A Study on HITS Technologies –the Latest Trends in Cable TV Communication

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Abstract – According to various industry estimates there are 71 million cable and satellite (C&S) homes in India. Most of these C&S homes are being served by analog cable which is non addressable and has severe capacity constraints. World over there is a migration from analog to digital technology. Digitization enables carriage of more number of channels in the same bandwidth, better reception quality, and delivery of various interactive and value added services such as video on demand, Internet, gaming, and EPG to the consumers. Over the last few years the number of channels being offered on cable television has rapidly multiplied. Although the capacity of the cable networks has been significantly enhanced over time, increasingly, they are not able to scope up with the demand for space from new channels. At many locations it is reported that the number of channels being offered are far more than the maximum that can be carried with the existing analogue systems. During the process of consultation on issues relating to Broadcasting and Distribution of TV channels last year, broadcasters had raised issues relating to the problem of lack of capacity on cable TV Networks and the associated issue of increasing carriage charges. As an underlying technology digitalisation is a growth driver. Digital transmission offers a number of advantages over analogue broadcasting. These include better reception quality, increased channel carrying capacity, new features such as programme guides, multi view and interactive services as well as potential to provide triple play: voice, video and data. Much of the television production and some distribution already use digital technology. The DTH (Direct to Home) service, which is essentially perceived as a competing platform to cable is in digital format. The Broadband based IPTV, which is also digital in format, is expected to give an enhanced level of competition to other platforms of delivery. Satellite TV channels are also beamed using digital technology. But the customer has to pay more prices to see digital quality TV channel in every medium. Headend-in-the-sky (HITS) is one such mode which confers benefits of wider reach even in far-flung and rural areas and also ensures digital delivery in most effective and economical manner. With HITS technology, the digitization and addressability can be achieved throughout the country in one stroke and with an investment far lower than what is needed to establish terrestrial digital headend in each city. This process can able to make India digitize in low cost.

Keywords - Cable Control Room, DTH, Headend, HITS.

I. INTRODUCTION

The history of community Antenna Television is very interesting. Johan Wilson was the man who introduces the CATV first time in 1948.Wilson has a sale store of TV sets in Mahanoy City, Pennsylvania where his sale the TV sets. This is a hilly area where reception of TV signals was poor. So he was facing a lot of problem regarding the sale of TV set. One day he installs an Antenna on a mountain near the city and lays a coaxial cable from antenna to his shop. Now he got good picture on his TV set. That day, in June 1948 was first CATV setup displayed on the shop of Johan Wilson. He also laid a cable from shop to the home of his customer to satisfy about reception of TV set. To provide good quality reception of TV signal to his customer he added an amplifier in cable and charged 100$ for installation and 2$ per month.

Television in India started with the experimental telecast starting in Delhi on 15 September 1959 (official launch date) with a small transmitter and a makeshift studio. The regular daily transmission started in 1965 as a part of All India Radio. In 1991, the Indian government led by P. V. Narasimha Rao started a series of economic reforms including the liberalisation of the broadcasting industry, opening it up to cable television. This led to an explosion in the Indian cable TV industry. As of 2014, the country has a collection of free and subscription services over a variety of distribution media, through which there are over 823 channels of which 184 are pay channels.

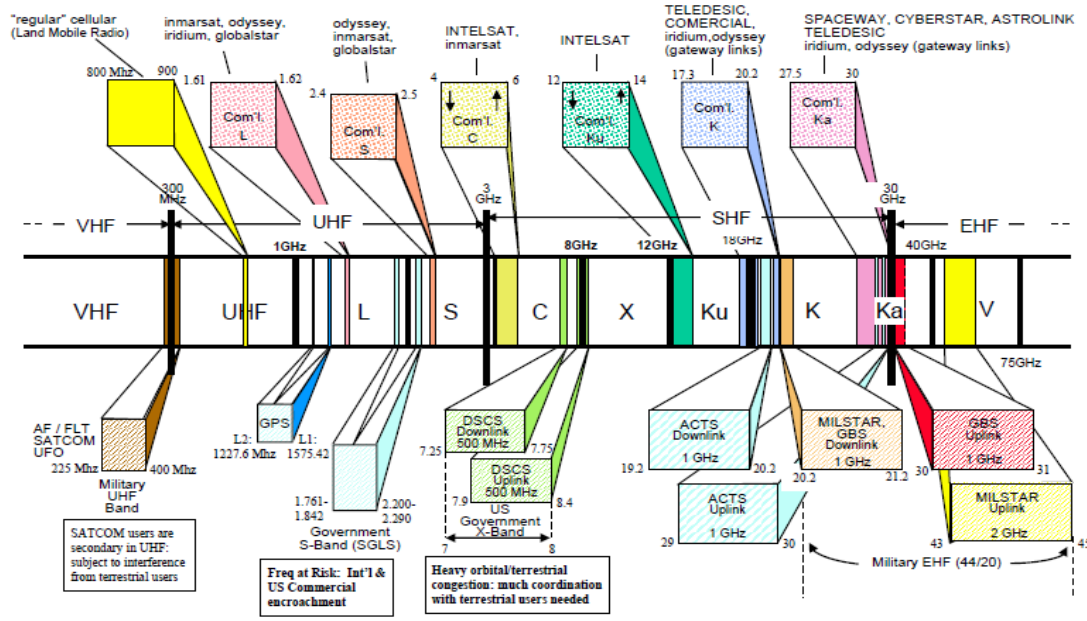

Fig. 1: Frequency Spectrum of KU & L Band

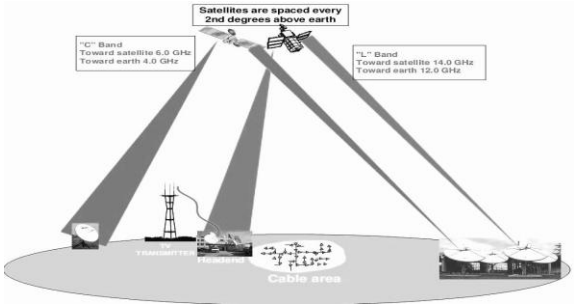

Fig. 2: Basic structure of Cable Network

So the question is that how to reach digital quality signal to the consumer in chief rate. Solution that had come up during the process of experimental research is the need for a policy framework for HITS which is an alternative means of delivery. Although one license was issued for HITS this service is not functional. Even so there is need for a clear policy framework for HITS, which could be on the lines of the permission already given by the Government to one operator (Jain HITS). Operators can then choose whether they would like to use this facility or the conventional one of a terrestrial headend. In this paper we want to describe the basic structured of present existing system and the HITS structure.

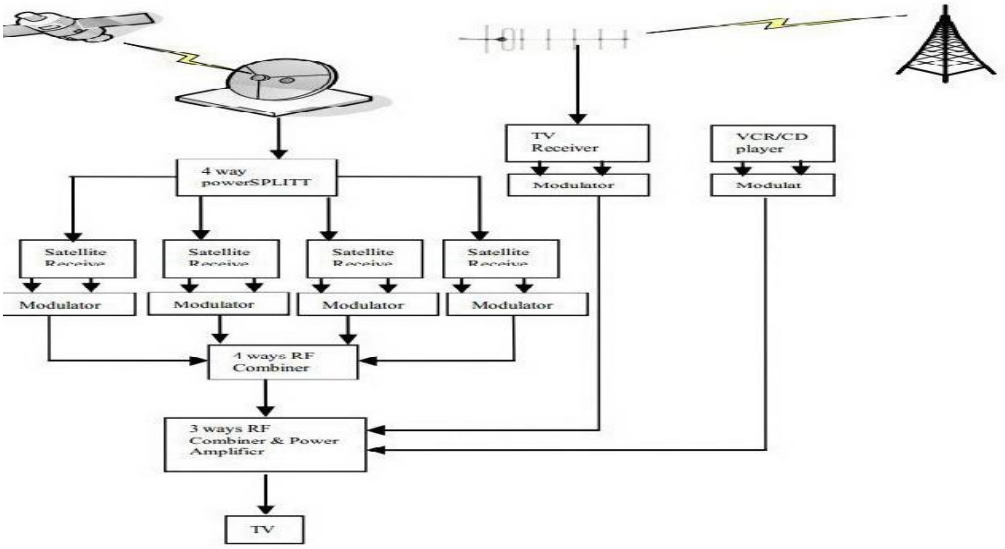

Fig. 3 : Basic Structure of Analog CATV network

II. ANALOG CATV NETWORK

In this network (Figure 3**)** operators obtain the channels from different sources like satellite TV, Terrestrial TV and from CD/DVD VCR player in form of AV signal. The signal receive from one satellite (INSAT 4A) are the combination of many channel frequency range. So

by receiving one satellite signal we can able to produce many channels. For that reason this signal is then given to the 4way/8way power splitter. Splitter split the receive signal and feed this individual signal to the respective receiver. Then the received signal is given to the Modulators. Modulator provides RF modulated signal at its output. The RF output of all Modulators is combined in RF mixer. At the same time the FTA signal and the local the program are also given to the modulator and combine it by using combiner. At the end of all combining signal it is given to the headend processor. Headend is a UHF/VHF processor. The combined and amplified signal is then given to the optical transmitter. By using optical fiber the MSO then send the signal to the operator house. Operator then Convert the optical signal to RF signal by using node. Then this signal is transmitted to the customer house on a coaxial cable. This is a very simple type of network. This network can expend within a limited area. If the expansion of network is increased the quality will be low and cost will be increase. The main problem of this network is maintenance of quality and the number of channel.

III. DIGITAL CATV NETWORK

In digital CATV network (Figure 4) all setup is same like in analog CATV setup. The block diagram is shown. The operator collects programs from different sources like Satellite Channels live local TV channels, or CD/DVD player. They achieve the signals through Digital satellite Receiver or cameras or CD/DVD player in Audio Video form. This AV signal is then provided to the MPEG-Encoders which convert these signals in MPEG-2 format; these encoders are also Called MPEG encoders. All encoder's outputs are combined in a MUX, this multiplexer single Output is provided to Modulator and then one amplifier/converter is used to transmit this signal on optical fiber. All these encoders Multiplexer and Modulators are controlled and monitored through a NMS (Network Management System). At the end of all combining signal it is given to the headend processor. Headend is a UHF/VHF processor. The combined and amplified signal is then given to the optical transmitter. By using optical fiber MSO then send the signal to the operator house. Operator then Convert the optical signal to RF signal by using node. Then this signal is transmitted to the customer house on a coaxial cable. At user end a set top box is used to convert this signal in RF form to view the signal on television set. This set top box has some important functions like online recording video games and request for VOD. Main problem in this system is the installation cost in MSO control room, for that reason monthly charge is too much high.

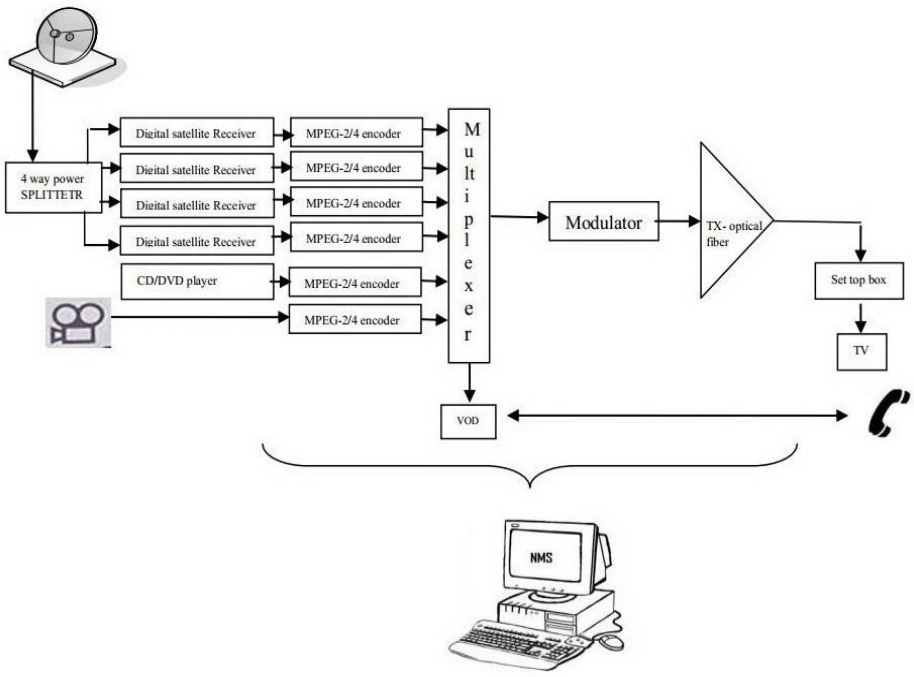

Fig. 4 : Basic Structure of Digital CATV network

IV. DTH NETWORK

The DTH service (Figure 5) provider collects the TV programs from different sources for example: satellite News, entertainment and sport channels or terrestrial channels, combine these channels to make a Package and transmits this channel package to their user via satellite link. This transmission is Digital and encrypted so user receives encrypt video result. This is a conditional access Transmission. There is another option for user and that is video on demand. The main difference in this setup is Program monitoring system. This is system where contents of programs, coming from different sources are checked according to policy of that organization. This transmission is DVB-S transmission in MPEG-2/4 compression format so user can get a DVD quality video. The service provider takes the

satellite transponder on lease for different type of packages. The uplinks station is like DVB-S earth station. The NMS is used for monitoring, network controlling, encryption and link management purpose. At user end a small dish antenna and set top box is used to receive the signal. This set top box has some important functions like online recording video games and request for VOD. The main problem is the cost of installation and package of TV program which is too much high for all type of subscribers.

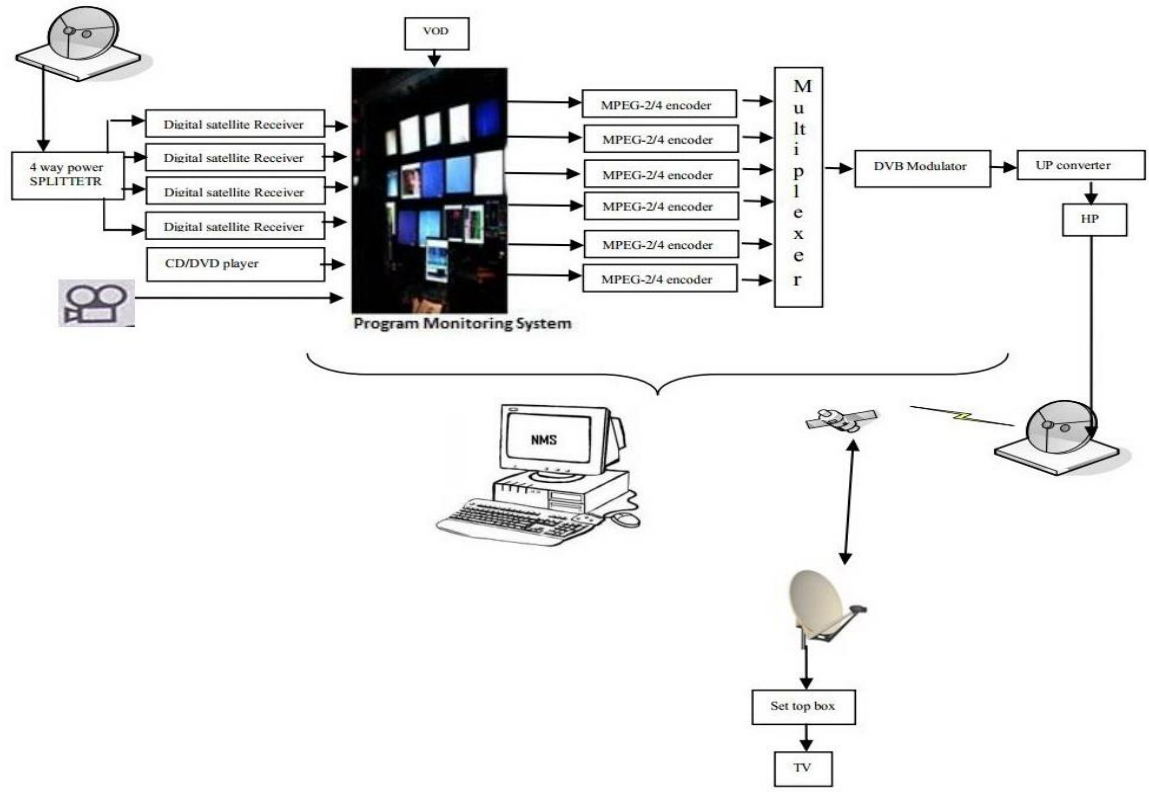

Fig. 5 : Basic Structure of DTH network

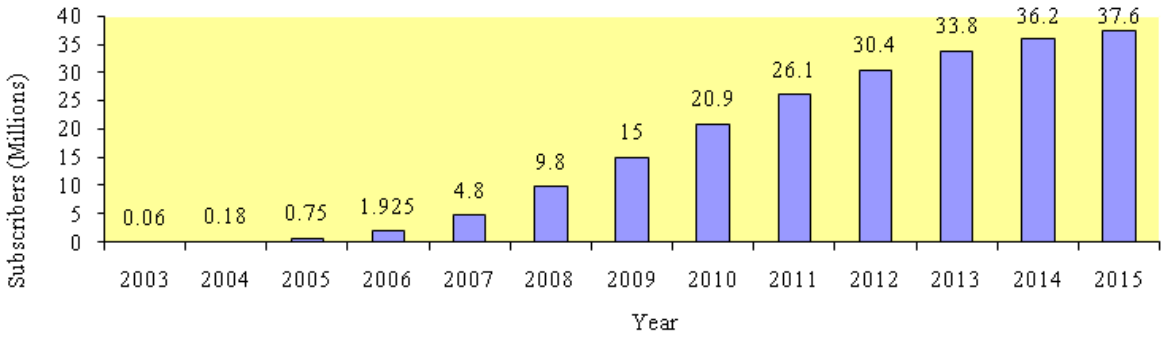

Fig. 6 : Growth rate of DTH network

V. HITS NETWORK

In the HITS system, (Figure 7) pay channels are received from their respective satellites at one centralized location. The pay channels are decoded, combined and re-encrypted with a common encryption and thereafter the signals are again uplinked to a satellite in "C" Band frequency. These signals are then down linked by individual MSOs/cable operators at their headend (control room). Cable operators need only one transmodulator per transponder (presently carrying 12-14 TV channels per transponder) for further re-transmission through cable to individual subscribers having the facility of set top box for exercising their choice of receiving the signals of those channels that are to be viewed by individual subscribers. Analog free to air channels can be received by the subscribers even without decoder and mixed for sending to the subscribers' homes in analog format. The cable operator can receive digital free to air channels with digital stream. The digital free to air channels are made available to the subscribers without going through de-encryption system of the set top box, whereas the analog channels are passed through the set top box. A subscriber can exercise his choice of channels and the same are activated through subscriber management

system (SMS) maintained at a centralized facility. Existing system of distribution of channels in cable (analog mode) under the existing system of cable distribution there are several headends all over the country which are engaged in the distribution of signals/channels to cable operators, which are ultimately delivered to the household viewers through the cable connection. In the current method of distribution, the pay channels and FTA channels are combined in a bundle by the cable operator which is made available to a consumer for a lump sum price. The MSOs and independent cable operators have set up headends to receive and transmit TV signals, which comprise essentially satellite dishes, receivers, integrated receivers, and decoders (IRDs), modulators, and fiber transmission equipment. The satellites dishes are used to downlink and receive the channels in both free to air (FTA) channel or pay channel mode. The signals received from the dishes are fed into the receivers for FTA channels and IRDs for the pay channels. The output from the receivers and IRDs is modulated and fed into fiber/coaxial cables and amplified at various places throughout the length of the cable to bring signals to the customer's premises. In a typical analog distribution platform, 65-70 channels can be delivered to the consumers.

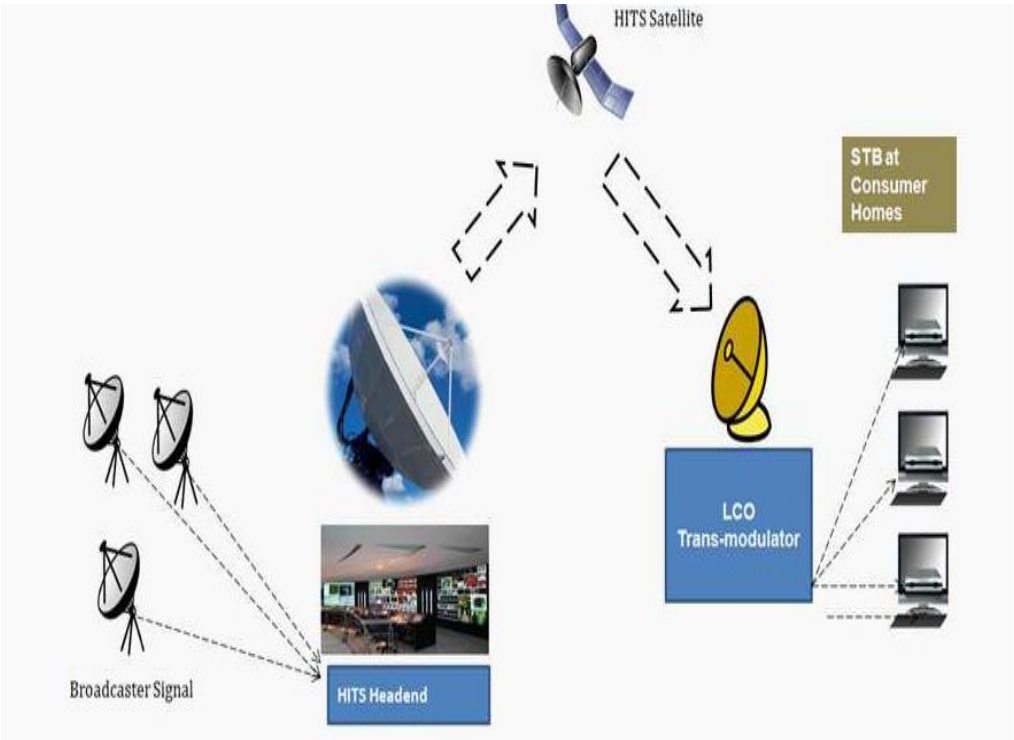

Fig.7: Basic Structure of HITS network

The existing system of un-addressable analog cable distribution is characterized by the following:

- The analog cable networks have severe capacity constraints. Typically these analog cable networks can carry only about 65-70 channels in all out of which only about 35-40 channels can be carried on a viewable band while rest of the channels are carried on hyper band (upper frequency) which have very little picture clarity. It is pertinent to mention that at present there are about 300 channels available over Indian sky.

- The present analog system does not provide any choice to the consumers. Who are forced to take all the channels that are being supplied by the broadcasters to the MSOs and cable operators. There is no mechanism or methodology in an analog environment to deliver the channels, only as per consumer's choice. A consumer is by default forced to have the entire bouquet of channels irrespective of the fact whether he wants them or not.

- There is no prevalent technological mechanism to determine the actual number of subscribers receiving a particular channel in non-CAS analog environment leading to various disputes and litigations in the sector. Although the entire value chain in cable distribution is working on the basis of "negotiated subscriber base", the broadcasters allege "under declaration" of number of subscribers by MSOs and cable operators.

- There is no distribution margin for MSOs and cable operators for distributing and delivering the pay channels to the end subscribers.

- Revenue loss to the government because of less than 100 percent declaration as there is non-compliance of service tax and entertainment tax liabilities.

- Absence of uniform pricing with prices fluctuating across geographies and consumer segments.

HITS technology tackles/addresses all the above-mentioned drawbacks of the analog system. All the stakeholders in the broadcasting sector have always acknowledged and accepted that all the above mentioned issues including the issue of number of subscribers/declarations, and capacity constraints are to be resolved by all possible legal means while also ensuring effective consumer choice. HITS technology is a complete answer for a voluntary implementation of an addressable system in non-CAS areas, which is completely in accordance with law and without requiring the issuance of notification for declaring the existing non-CAS areas as CAS areas for achieving addressability. Methods of implementing digitization and addressability. The digitization and addressability in cable distribution can be implemented in two ways:

- By establishing digital infrastructure at each individual headend (control room) of MSOs/independent cable operators.
- By establishing the digital infrastructure at a centralized facility

The establishment of digitization and addressability at each headend requires decoding infrastructure to decode signals received from pay channel broadcasters and encryption infrastructure to re-encrypt pay channel signals for distribution to customers through cable operators under CAS. Subscriber management system (SMS) has to take care of subscription/channel choice of the consumer, billing based on services subscribed, details of the payments received, mechanism to record and effect the request of change in the subscribed service - mainly addition and deletion. The Telecom Regulatory Authority of India (TRAI) analyzed the strength of HITS as a method of implementing digitization and addressability.

Advantage of HITS system:-

A. Cost of digitization through conventional cable system for the entire country:

This would essentially require converting the existing 7000 analog headends into digital headends. The cost of a digital headend including CAS and SMS ranges from Rs. 2 crore to Rs. 8 crore or more depending upon number of channels and sophistication of CAS and SMS. Thus, even at the lowest cost, the total amount required for 7000 digital headends would be upwards of Rs. 15,000 crore.

B. Cost of digitization through HITS for the entire country:

Earth station of HITS operator would cost Rs. 15 crore, and transmodulators of cable operators would cost Rs. 1200 crore (Rs. 2 lac per operator for 60,000 operators). The total capex would be around Rs. 1215 crore. Cost of hiring 10 transponders would be Rs. 50 crore per annum for HITS satellite (Rs. 5 crore per annum per transponder on recurring basis). Thus, HITS could, theoretically, digitize the cable transmission in the whole country with a capex of Rs. 1215 crore and a recurring cost of Rs 50 crore per annum, as against the capex of more than Rs 15,000 crore for conventional terrestrial digitization. These cost comparisons do not include the cost of upgrading the last mile cable network and the cost of set top boxes, because these are common to both HITS and conventional digitization.

C. Gain to subscriber:

The biggest advantage to the subscribers is that high quality digital transmission with value added services will become available to the subscribers throughout the country at one go. Since the reach of HITS service operator increases manifold, the cost of set-top box will come down due to economy of scale. The subscriber will not have to change the set top box if he shifts anywhere else within the country, so long as the cable operator in the new locality is affiliated to the HITS operator. The viewers will continue to watch the free to air channels in analog mode bypassing the set top box or even without a set top box if they do not want to subscribe to the pay channels.

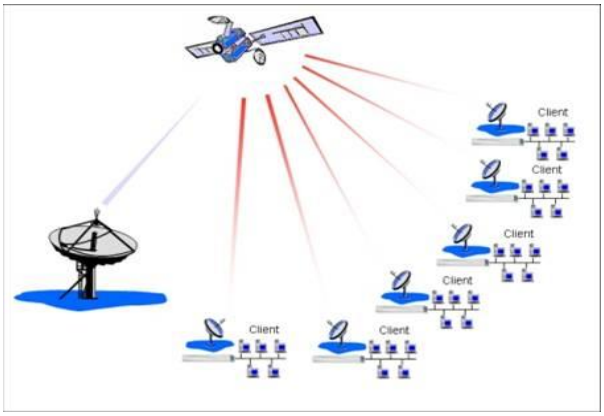

Fig. 8 : Working of HITS network

The digital transmission will enable operators to show many more channels to the consumers thus offering them a wide variety of choices. The implementation of CAS through HITS will bring down the cost of distribution etc. which may lead to a consequent reduction in subscription rates.

D. Benefits to cable operators:

The cable operators will get access to digital quality transmission throughout the country, which will help them in competing with other forms of digital delivery such as DTH and IPTV. The cable operator will have the flexibility to take feed from MSO and giving feed through terrestrial mode or from the HITS operator. If there are more than one MSO using the passive HITS platform for transmission, then the cable operator's choice of MSOs will increase. In stand alone CAS implementation, operator will have to invest on the SMS. In HITS model he will not be required to have an independent SMS of his own. With growing number of channels, cable operator will have to upgrade his network capacity from present 550 Mhz to 850 Mhz in

conventional analog mode. In HITS model he will be saved of this capital expenditure because by having digital transmission, he can carry more channels in existing network. The disputes among cable operators, MSOs and broadcasters, mainly related to number of subscribers, will be minimal because of addressability in HITS.

E. Benefits to the government:

With the implementation of digitization through HITS, the incidence of under-declaration of the subscribers by the cable operator will be reduced and, therefore, the substantial loss that is caused to the government by way of evasion of taxes will be prevented. The implementation of CAS through HITS will ensure a centralized mechanism for distribution of signals for various pay channels which will in turn make the monitoring/regulation of the industry by the government much more convenient and effective. The task of policy and of planning for this sector will become easier as all the information regarding the number of subscribers, their opted services, the payments made for such subscribed services, etc would be available at a single centralized location, as opposed to the digital implementation through thousand of individual headends wherein such information would be scattered and difficult to monitor. However, on the balance, it cannot be denied that HITS operation will certainly lead to better and more economical digital services to the public, thus ensuring assured revenue based on the actual number of subscribers availing their services, in addition to centralized data of subscribers for effectively realizing taxes by the government through HITS. It however needs to be stated that even other existing digital addressable systems (DTH, CAS, cable) have many of these advantages, but what is relevant is that there are certain areas where HITS has a distinct advantage. More importantly, the value of HITS as an alternative or additional platform for delivery having a potential to increase the competition cannot be over emphasized.

VI. CONCLUSION

Selecting HITS based delivery technology the way for uniform delivery of signals to the country wide with high flexibility and low cost per headend. It also provides for easy migration of customers from city to city as well as protection of investment in Customer Premises Equipment (CPE). Thus, in the existing scenario, HITS is the best and the cheapest way to implement addressability and digitization in cable distribution. HITS can able to make India digitize in a single stoke.

VII. ACKNOWLEDGMENT

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