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Telemedicine Video Conferencing Using VSAT and Optical Fiber

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Abstract: ***Communication links are the lifelines for telemedicine practice. Various terrestrial and satellite media can be used, however, each has its own plus and minus side. Current study was designed to evaluate two types of telecommunication media used for telemedicine video conference at a Telemedicine program over a period of fifteen months. The evaluation was based on analysis of technical parameters recorded in a prescribed perform Designed for the study purpose maintained prospectively after completion of each event. Only technical issues were focused. At the end of the study period analysis of data revealed that leased Line based terrestrial IP (Internet Protocol) is better than Sky IP.***

Keywords: VSAT; Optical Fiber

1. Introduction

Telecommunication technologies are one of the key player in the telemedicine process. Various terrestrial and satellite communication media are used for connectivity [3]. Video conference is one of the vital components in telemedicine enabled real time interaction between the participants. Quality of video conference is dependent on several factors out of which type of connectivity and bandwidth attributes to successful outcome. Video conferencing is a process of interactive synchronous visual communication. Video conferencing is similar to a telephone call except that there is a video picture from the other end as well as audio. The equipment for video conferencing consists of a video camera and microphone, a display medium, and a codec at each end with broadband telecommunication media. The minimum bandwidth for video conferencing is 128 kilobits per second. At this bandwidth a compression ratio of 600: 1 is required. A higher quality can be achieved by using a higher bandwidth such as 256 or 384 kilobits per second. The advantages of videoconferencing as opposed to the telephone are that people form a better rapport and communicate better when they can see the other person. A doctor can take a better medical history from the patient and physical signs and symptoms can be visually demonstrated or inspected [4].

2. Optical Fiber Cables

Technical Aspects The basic elements of a optical fiber cable (FOC) are as follows:

Core: This is the light transmission area of the fiber either made of glass or plastic. The usual range of cores is 8 um for single mode and 50, 62.5, and 100 um for multi mode.

Cladding: The function of cladding is to provide lower refractive index than the core in order to cause reflection within the core so that light waves are transmitted through the fiber. The range of cladding is generally 125 m.

Coating: These are usually multi-layers of plastic applied to preserve fiber strength, absorb shock, and provide extra fiber protection. Normally, buffer coatings range from 250 m to 900 m.

Advantages

The advantages of optical fiber as a communication medium are manifold. Fiber optic cables (FOCs) doesn't emit radiation, which is ideally suited for computer applications and environment where high voltages and electrical substations are present. Due to the electrical isolation the problem of cross talk is also not present with FOCs. Their immunity to outside electrical interference is also very important as it ensures that network synergies with power grids can be exploited.

FOCs have low loss, high bandwidth properties and can be used over greater distances than copper cables. The high bandwidth available in FOCs allows the transfer of multimedia data. Because of low attenuation rates (In data networks repeaters are only required after every 2km or so.), fiber is ideally suited for broadcast and telecommunications use for longer distances.

Being lightweight and small in size they are ideal for applications where running copper cables would be impractical. Using multiplexers is one fiber could replace hundreds of copper cables. FOCs also offer higher security of data transfer/communication as compared to co-axial cables. An optical fiber has to be broken to tap the signal leading to loss of signal, alerting the user immediately.

3. Very Small Aperture Terminals (VSATs)

Technical Aspects A VSAT is a small, software driven station with an antenna (typically 0.9-1.8 meters) used for the transmission of data, video or voice via a communication satellite. The VSAT equipment simply plugs into a PC or a phone. The equipment supports the common Ethernet and TCP/IP protocols. The VSAT equipment consists of two parts:

One part is placed outside to take care for a line-of-sight communication path to the satellite. It consists of a small antenna and electronics for signal reception and transmission. The other part is placed indoors to interface with the users PC or phone. This indoor unit may be as small

as a modem card. These two parts are connected via cabling. The antenna is directed to a communication satellite and in general the Ku band and C-Band are used. When the Ku band is used small antennae's can be applied (typically 0.9-1.8 meters). When the C-Band (4-8 GHz) is used, antennae between 1.8m and 10m in size are required.

Prices depend on several factors, but as a rule of thumb, the range lies between US $500 (for a very simple VSAT installation) to US $15000 (for a very sophisticated VSAT (C band)). VSAT overhead is in general minimal and installation is done in less than a day.

A VSAT can transmit and receive signals via its antennae to a satellite. It typically provides a capacity towards a satellite (the uplink) of about 19.2 KBPS. The downlink capacity is usually more; e.g. 512 KBPS.

Depending on the needs, receiving/transmitting of ordinary data, video, voice or a mix of different signals is possible. Data and voice are transmitted in a digital format, while video may be analogue or digital.

Advantages

Access: VSAT networks can reach areas, which are difficult to access or where landlines are expensive, not available or of good quality. Hence VSATs are suitable for sparsely populated areas or geographically remote areas.

Availability: A point that is often misunderstood is that VSAT circuits are more reliable than terrestrial circuits. Lease lines offer at best 99.5% availability (almost two days down time per year). VSAT circuits can offer 99.9% to 99.95%, depending on the requirements (99.9% = less than 9 hours down time per year).

Price: The cost of a VSAT network today will run roughly one half to one third the price of an equivalent Frame Relay network. Transmission costs are not distance dependent, and are also not a function of time on line or volume of data transmitted, unlike terrestrial networks.

Flexibility and Scalability: A VSAT network can be scaled up easily according to requirements. A new site can be added to the network by installing a remote VSAT unit.

Reliability: A VSAT has only one piece of equipment at the far end. Mean time between failure (MTBF) for some of the equipment used is measured in years. ***Security:*** Satellite networks offer excellent security against unauthorized access. All transmissions in VSAT systems are scrambled in digital format. Gaining access to a VSAT system is virtually impossible without authorization. Every remote VSAT earth station is controlled and monitored. Due to these reasons, banks and financial institutions predominantly use VSAT system to carry critical and sensitive financial transactions.

4. Material and Method

In proposed model, all the telemedicine activities under various projects were held inregular schedule manner. A log book is maintained for daily record of the events. This paper dedicated to carry out a prospective study of the technical parameters of video conference as part of telemedicine process carried out over a period of fifteen months using two types of telecommunication media. Various technical parameters of videoconference carried out over the study period between September 2013 till December 2014 was recorded during each event and entered in a preform designed specifically for the study. The technical parameters used for evaluation were successful connectivity, assured bandwidth, pinging time, audio transfer and receive rate, video transfer &receive rate, frame transfer and receive rate.

5. Result and Discussion

A total number of 852 telemedicine sessions were conducted during the study period of 15 months. Break up of communication link used for telemedicine sessions were; terrestrial IP (n=462)and sky IP (n=180) At the end of study period the data was analyzed. From the performance log, beside the two telecommunication media comparison which is listed in (table 1) , we conclude that when using to over IP network to measure the latency period, . The pinging time over 32 bytes of data through sky IP is 492-5 millisecond whereas in terrestrial IP using optical fiber it is only 2-3 milliseconds (Table 1).

Table 1: Result of Analysis of Technical Parameters

Specification	Satellite IP		Terrestrial IP	
No of Sessions	180		462	
No of Interruption	10		18	
Assured bandwidth(kbps)	384		384	
Available bandwidth(kbps)	256		384	
	Transmit	Receive	Transmit	Receive
Audio Rate(k)	32	32	64	64
Video rate	217K	223K	175-181K	224K
Video frame rate	25FPS	25FPS	25FPS	12.6FPS
Video packets lost	17PPS	35-39PPS	0	0
Pinging Time(ms)	4.92-5	-	2-3	0

6. Conclusion

After analyzing the technical data of these two different telecommunication media we reached on the conclusion, video-conference over terrestrial IP fared better than satellite IP.

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