

Optical Fiber Cables (Review Paper)

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ABSTRACT

Modern development, communication has become an important part of human life and cannot be dispensed with, the communication process involves information generation, transmission, reception and interpretation. Wide bandwidth for signal transmission with low delay is a key requirement in present-day applications. Fiber optics is now the transmission medium of data for long distance and it has high data rate transmission for Telecommunication networks. This paper gave an overview of fiber optic communication systems including the concept of wire communication, characteristic, architecture, optical fiber system (link budget design) and application of fiber optic.

Keywords: Fiber optics; link budget; Cables.

I. INTRODUCTION

Wired communication refers to based communication technology where data transmission over a wire for example twisted pair in low and high frequency and the optical fiber is very high and ultra-high frequencies. Also, telephone networks, television, internet Access and communication. Also, waveguide, used for high-Power applications and is considered as wired line [1]. Wireless communication include the transferring of information over a range without cable or wire or any Optical fiber is a cylindrical dielectric made of Silica glass. There is a central core in which the light is guided, included in an outer Cladding of a little bit of lower refractive index [2].

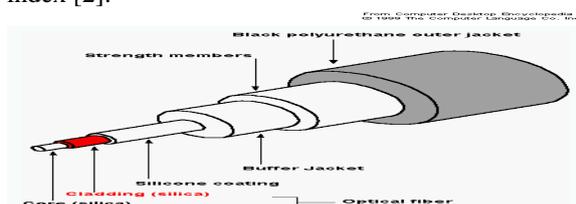


Figure (1) structure of fiber optics cable

Communication indicates transmit information from one point to another when it is needful. To transmit information such as image, speech, or data over a range, one generally. Uses the concept of carrier wave communication.[3].

Optical fiber Communication System uses light wave mechanism to Transfer the data over a fiber by changing electronic signals into light.[4]. Other shapes of electrical conductors. The distance travelled can be anyplace between a few meters (such as a TV remote control) and thousands of kilometers (such as radio communication) [5].

II. PREVIOUS STUDIES

Ritesh published in fiber optic communication and application they took a detailed look at the technological advantages of a fiber optic telecommunication Network and its applications.[6]. Similarly, Zheng, authorized method for dispersion on optical fiber communication with long distances, he focuses on his paper on dispersion on optical fiber communication [7]. Also, Hawar published research entitled Simulation of Single Mode of Fiber Optics and Optical Communication Components Using VC++, presented simulation methods on a single mode optical fiber link system, using VC++ [8]. Correspondingly, Fiber Optic Communications: An Over view, Deals with communication using optical fibers [9].

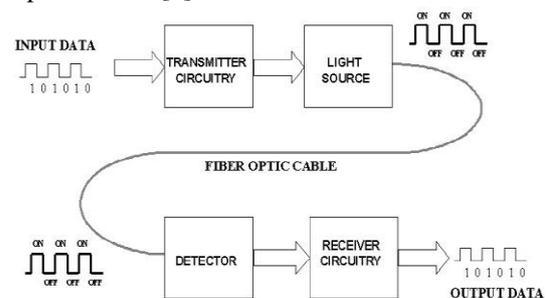


Figure (2) Transferring data by using optical fiber

Characteristic of optical fiber ; Fiber optics is a pioneer building block in the telecommunication

infrastructure. Its high bandwidth efficiency and low attenuation features make it ideal for large transmission and beyond [10].

Optical-fiber systems have many advantages over mineral-based communication systems. These advantages include Attenuation, interference and bandwidth characteristics. Furthermore, the comparatively smaller cross section of fiber-optic cables let room for enormous growth of the capacity in existing tubes. Fiber-optic features can be categorized as linear and nonlinear. Nonlinear characteristics are affected by parameters such as power level, channel spacing, and bit rate[11].

Interference: Fiber optic cables doesn't affected by electromagnetic interference. It can also be immune to electrical noise in the noisy environment [12].

Linear characteristic: Linear characteristics include attenuation, chromatic dispersion (CD), polarization mode dispersion (PMD), and optical signal-to-noise ratio (OSNR).

Attenuation: Right works of an optical data link rely on modulated light arrived the receiver with enough power to be demodulated rightly.

Attenuation is the decreasing in power of the light signal as it is transferred. Attenuation occurred because of passive media ingredients, for example, cables, cable paste, and conductors. Although attenuation is huge scale down for optical fiber than for other media, it still happens in both multimode and single-mode send. An effective optical data link must have sufficed light obtainable to defeat attenuation [13].

Chromatic dispersion : It is the outcome of the different wavelength or colours in a light beam arriving at their destination at partially different times. The result is a dispersion of the on-off light pulses that transmit digital information. Special treatment must be considered to compensate for this Dispersion so that the optical fiber reaches its maximum capacity [14].

*The optical signal to noise ratio:*OSNR is very substantial parameters on a Physical layer of optical fiber system sending, pending fiber sending, Amplified Spontaneous emission (ASE) fuss is generated. It is a non-reversible

The influence that cannot be offset in optical domain immediately [15].

Nonlinear characteristic: Increased an optical intensity in optical fiber leads to adjustment of refractive index, the wave propagation becomes a function of optical power. On the other hand, in linear fiber optics where the propagation constant is a function of fiber and the wavelength only the

propagation constant becomes a function of optical power in addition to other parameters [16].

Application of optical fiber : Demand for optical fiber application has increased recently, because of increasing number of applications. Telecommunication applications are spread widely, start with universal networks and end with desktop computers. These involve the sending of data, sound, or video over distances between a meters to hundreds of kilometers, utilize one of a few typical fiber designs in one of several cable designs [17]. CATV (cable television) services are provided by fiber optic network to an optical node, which transforms and distributes the electrical signal to subscribers via a coaxial cable connection [18].

III. ARCHITECTURES

Fiber-optic communication systems can be categorized into three broad categories – point-to-point links, distribution networks, and local-area networks.

Point-to-Point Links: Point-to-point links considered as the simplest form of optical fiber communication systems. Their essential role is to transmit information in digital bit form from one place to another with high accuracy. The length of the link depends on the required application.

A regenerator involves a receiver then a transmitter. When the link length skips a certain value, reparations will be required rely on the operating Wavelength to forbid the signal from coming too weak to be detected in an effective way [19].

Distribution Networks: The optical devices and physical fiber that distribute signals to users in telecommunications networks.

*Local-Area Network :*When a computer network covers a small area called LAN, for example, one site or building, such as a collage [20].

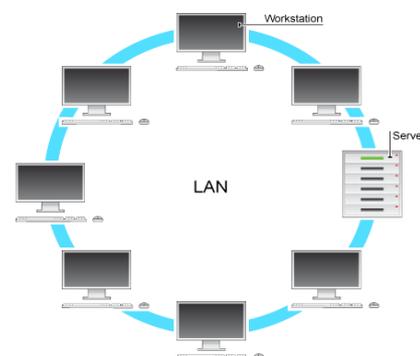


Figure (3) LAN- Local Area Network

Wide area network: Wide area network covers a geographically large area and called (WAN). WAN consisting of two or more local area networks (LAN) or metro area networks (MAN) and is

simply a scattered communication network for transmission of data, image, video, voice [21].

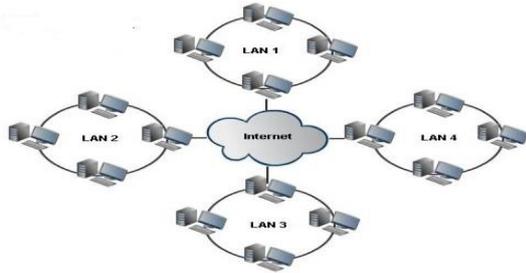


Figure (4) Wide Area Network

Optical fiber system (link budget design)

The main goal of power budget is to provide enough power to reach the receiver to maintain reliable performance during the entire system lifetime. The receiver sensitivity is a minimum average power required by the receiver. The average launch power is mostly specified for each transmitter with optical powers expressed in dB [22].

Fiber-optic connections must have enough power for correct operation, and for doing that, power budget must be calculated, which is the maximum amount of power it can be sent.

The bad case is used to find out the power budget analysis to supply an error margin, although all the parts of an actual system do not function at the worst-case levels.

IV. CONCLUSION

This paper presented a detailed look at the communication concept for wire, in particular, the characteristic and application of fiber optic also focused on the architecture and optical fiber system (link budget design). There are a huge amount of development can be made by making more research's and work on the optical fiber. Correspondingly, faster and more reliable infrastructure which would be the prime demand of the ever growing population of tomorrow.

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