7. Advantages Of Fiber Optics

7.1 Immunity to Electromagnetic Interference
7.2 Data Security
7.3 Non Conductive Cables
7.4 Eliminating Spark Hazards
7.5 Ease Of Installation
7.6 High Bandwidth Over Long Distances

7.1 Immunity to Electromagnetic Interference

Although fiber optics can solve data communications problems, they are not needed everywhere. Most computer data goes over ordinary wires. Most data is sent over short distances at low speed. In ordinary environments, it is not practical to use fiber optics to transmit data between personal computers and printers as it's too costly. Electromagnetic Interference is a common type of noise that originates with one of the basic properties of electromagnetism. Magnetic field lines generate an electrical current as they cut across conductors. The flow of electrons in a conductor generates a magnetic field that changes with the current flow. Electromagnetic Interference does occur in coaxial cables, since current does cut across the conductor. Fiber optics are immune to this EMI since signals are transmitted as light instead of current. Thus, they can carry signals through places where EMI would block transmission.

7.2 Data Security

Magnetic fields and current induction work in two ways. They don't just generate noise in signal carrying conductors; they also let the information on the conductor to be leaked out. Fluctuations in the induced magnetic field outside a conductor carry the same information as the current passing through the conductor. Shielding the wire, as in coaxial cables can reduce the problem, but sometimes shielding can allow enough signal leak to allow tapping, which is exactly what we wouldn't want.

There are no radiated magnetic fields around optical fibers; the electromagnetic fields are confined within the fiber. That makes it impossible to tap the signal being transmitted through a fiber without cutting into the fiber. Since fiber optics do not radiate electromagnetic energy, emissions cannot be intercepted and physically tapping the fiber takes great skill to do undetected. Thus, the fiber is the most secure medium available for carrying sensitive data.

7.3 Non Conductive Cables

Metal cables can encounter other signal transmission problems because of subtle variations in electrical potential. Electronic designers assume that ground is a uniform potential. That is reasonable if ground is a single metal chassis, and it's not too bad if ground is a good conductor that extends through a small building. However, the nominal ground potential can differ by several volts if cables run between different buildings or sometimes even different parts of the same building.

Signal levels in semiconductor circuits are just a few volts, creating a problem known as ground loop. When the difference in ground potential at two ends of a wire gets comparable to the signal level, stray currents begin to cause noise. If the differences grow large enough, they can even damage components. Electric utilities have the biggest problems because their switching stations and power plants may have large potential differences.

A serious concern with outdoor cables in certain computer networks is that they can be hit by lightning, causing destruction to wires and other cables that are involved in the network. Certain computer companies are aware of this problem and trying to solve it by having protective devices for wire circuits to block current and voltage surges.

Any conductive cables can carry power surges or ground loops. Fiber optic cables can be made non-conductive by avoiding metal in their design. These kinds of cables are economical and standard for many indoor applications. Outdoor versions are more expensive since they require special strength members, but they can still be valuable in eliminating ground loops and protecting electronic equipment from surge damage.

7.4 Eliminating Spark Hazards

In some cases, transmitting signals electrically can be extremely dangerous. Most electric potentials create small sparks. The sparks ordinarily pose no danger, but can be really bad in a chemical plant or oil refinery where the air is contaminated with potentially explosive vapours. One tiny spark can create a big explosion. potential spark hazards seriously hinder data and communication in such facilities. Fiber optic cables do not produce sparks since they do not carry current.

7.5 Ease Of Installation

Increasing transmission capacity of wire cables generally makes them thicker and more rigid. Such thick cables can be difficult to install in existing buildings where they must go through walls and cable ducts. Fiber cables are easier to install since they are smaller and more flexible. They can also run along the same routes as electric cables without picking up excessive noise.

One way to simplify installation in existing buildings is to run cables through ventilation ducts. However, fire codes require that such plenum cables be made of costly fire retardant materials that emit little smoke. The advantage of fiber types is that they are smaller and hence require less of the costly fire retardant materials. The small size, lightweight and flexibility of fiber optic cables also make them easier to be used in temporary or portable installations.

7.6 High Bandwidth Over Long Distances

Fiber optics have a large capacity to carry high speed signals over longer distances without repeaters than other types of cables. The information carrying capacity increases with frequency. This however, doesn't mean that optical fiber has infinit bandwidth, but it's certainly greater than coaxial cables. Generally, coaxial cables have a bandwidth parameter of a few MHz/km, where else the fiber optic cable has a bandwidth of 400MHz/km. *(These figures are just approximations and do vary from cable to cable!)* This is an important factor that leads to the choice of fiber for data communications. Fiber can be added to a wire network so it can reach terminals outside its normal range.
