Optical fibers: advantages and disadvantages.

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This article is about advantages and disadvantages of optical fibers in comparison to conventional metal wires and cables.

An optical fiber is a glass or plastic fiber that carries light along its length. Its main use is in fiber-optic communication, but it has many other uses as well (i.e. sensors, fiber lasers etc.). Optical fibers allow signals to be transmitted over long distances with almost no data loss. They are also immune to most types of interference.

Optical fibers keep light inside of its core by total internal reflection, basically acting as a wave guide. There are two types of optical fibers Multi and Single mode fibers. Multi-mode fibers have a larger core diameter and are used for short distance communications, where high power must be transmitted. Single-mode fibers are used for long distance communications (longer than 550 meters).

Optical fiber communication.

Optical fiber can be used as a way of telecommunication and networking because it is flexible, reliable and can be bundled as cables. It is especially advantageous for long-distance communications, because light travels through the fiber with little optical data loss, compared to electrical cables. This allows long distances to be spanned with few repeaters. Additionally, the per-channel light signals traveling in the fiber have been modulated at rate as high as 111 Gb/s (gigabits per second). The fiber can carry many independent channels, each using a different wavelength of light. The current laboratory of fiber optic data rate record, held by Bell Labs in Villarceaux, France, is multiplexing 155 channels, each carrying 100 Gb/s over a 7000 km fiber.

For short distance applications, creating a network within an office building, fiber-optic cabling can be used to save space in cable ducts. This is because a single fiber can often carry much more data than many electrical cables, such as 4 pair Cat-5 Ethernet cabling. Fiber is also immune to electrical interference; there is no cross-talk between signals in different cables and no pickup of environmental noise.

Non-armored fiber cables do not conduct electricity. It makes fiber a good solution for protecting communication equipment located in high voltage environment (power generation facilities), or metal communication structures prone to lightning strikes. They can also be used in environments where explosive fumes are present, without danger of ignition. Wiretapping is more difficult compared to electrical connections, and there are concentric dual core fibers that are said to be tap-proof. Although it would seem that optical fibers are perfect, they do have several drawbacks.

But even though these drawbacks exist, they can mostly be bypassed or ignored in a longer run, making optical fibers a much better solution, compared to metal wires.

Disadvantages:

- High investment cost and a lot more expensive equipment.
- Difficult to interconnect.
- Do not carry electrical power for the end-user device.

Advantages:

- Lower cost in the longer run.
- Low data loss and almost complete interference immunity.
- Large carrying capacity
- No crosstalk between cables no sparks.

Bibliography:

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