

## Fiber Optic Media vs Copper Media

Fiber-optic technology is getting more and more popular nowadays in the professional networking world. “Why?” – one may ask. “Is it the distances that signal can travel without a repeater? Or is it the passive components that require no energy to operate?” Both statements are true, however main reasons are potentially unlimited bandwidth (limited only by the speed of light) and immunity to external factors.

Data in the optic-fiber is transmitted by a LED or a laser, and received by an optical detector. Data in single optical cable can travel simultaneously in multiple wavelengths. However that would require multiple lasers transmitting signal, and multiple receivers to accept data at the same time.

Difference in wavelengths is measured in nm (nanometers). Typical data transmission wavelengths are between 850nm and 1550nm.

As it was mentioned before, optical-fiber is more advanced type of cable than copper cable, due to multiple reasons. External factors (electromagnetic interference) cannot affect the signal in the fiber, since it is a light, not the electricity based transmission. All of the electric cables generate EMI at some level, which will affect other cables in the range. That will result in crosstalk inside the cable, especially if it is of a significant length. Not being able to produce magnetic field, and not being affected by one makes optical cable ideal candidate if the cable should be deployed through elevator shaft, industrial machinery, or electrical transformers.

Fiber optical cable is not only being able to transmit high bandwidth signal over longer distances, but it is also extremely secure. If the copper cable can be easily tapped, physically penetrating the shell of the cable and connecting to the core in order to “steal” data, fiber optic cable cannot be accessed that easy. Advanced systems use EMI in order to access data from the copper cable, which is also impossible to do with the data transmitted “at the speed of light”.

Why we still use copper over optical fiber, one may ask. There are two main reasons for that. First one is the cost. If you check the cost for the optical fiber, you may see it is not much more expensive than the high-end UTP cable. Sometimes it is even cheaper than some advanced copper cables. So where does the expenses problem comes from. Optical fiber requires specialized equipment, including switches, hubs, routers, network cards, and it comes for a price. In fact, it might be over four times more expensive than the UTP equipment with the same functionality. However optical fiber offers option for unique topologies, that can save some of the expenses.

Second reason for limiting optical installations, is the... installation. Compared to the copper network installation, where anyone can do it with proper tools, following online tutorial, optical fiber is much more difficult to install. Since you are dealing with glass material, the connection cannot be anything but perfect, otherwise it will result in huge signal loss (if it would work at all). Multiple special tools require advanced training to be able to work with them.

In any case, one always can consider fiber optic media converters for easy conversion between fiber optic and copper media.