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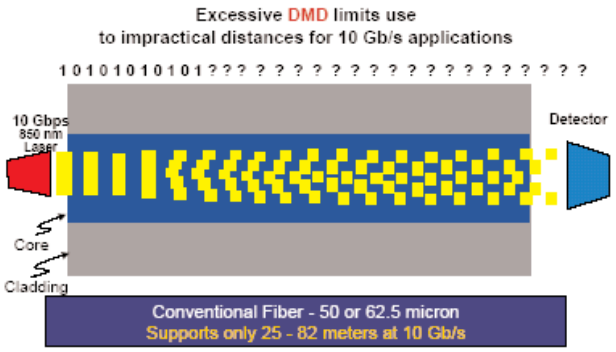
Leading Optical Innovations

Inter-Symbol Interference (ISI)



Inter-symbol interference (ISI) is an impairment of data communications systems that limits the reach and bandwidth (capacity to carry information) of the network. Ethernet and Fibre Channel systems transmit information using digital transmission (*0*s and *1*s). When the transmission laser is on, a digital *1* is transmitted; when it is off, the signal is for a digital *0*. For example, the pattern *1010100* is the letter *T*. If the transmitter transmits *1010100* and the receiver detects the same pattern, then *T* is successfully transmitted. A digital laser transmitter is like a flashlight that is turned on and off very quickly to send these bit patterns - up to 10 billion times per second for 10 Gigabit Ethernet transmitters! But if the laser pulses spread as they travel down the fiber, the *1*s and *0*s can smear together, and *1010100* becomes *???????* at the receiver, resulting in errors and system failure.

The causes of ISI

The “pulse spreading” that causes ISI is a result of differential model delay, or DMD. Multimode fiber is so named because it has hundreds if light pathways, or modes, in which light can travel along the core of the fiber. If the speed of the light in each mode is equal, then all modes arrive at the transceiver at the same time; in other words, the fiber will have zero DMD. But imperfections in fiber manufacturing and design can result in large differences in modal speed, causing DMD to increase. If the Laser transmits a *1* (laser pulse) into a fiber with DMD, different parts of the laser pulse will travel along the fiber at different speeds. As a result, some parts of the *1* may spread into the adjacent bit slots, causing the system to fail, as illustrated above.

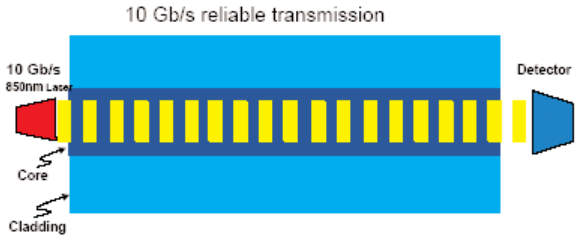
ISI is the primary impairment to Gigabit and 10 Gigabit system performance. By minimizing ISI, the reach of such systems can be increased by up to 12 times. Looked at another way, minimizing ISI allows an increase from Gigabit to 10 Gigabit speeds at the same distance.

Inter-Symbol Interference

How reducing ISI increases bandwidth

Controlling and minimizing DMD minimizes the ISI -- and therefore maximizes the bandwidth -- of a multimode fiber system. When the laser pulses are each contained within their respective time slots, they do not smear together with the adjacent pulses. Using a fiber with low DMD can dramatically improve system performance, as illustrated here.

Modern data communications systems operate at one, two, four, and now 10 Gigabits per second. Specifying and using a low-DMD fiber such as LaserWave ™ fibers from OFS will maximize the reach and data rate of your network while preserving the low cost benefits of multimode fiber based systems.



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