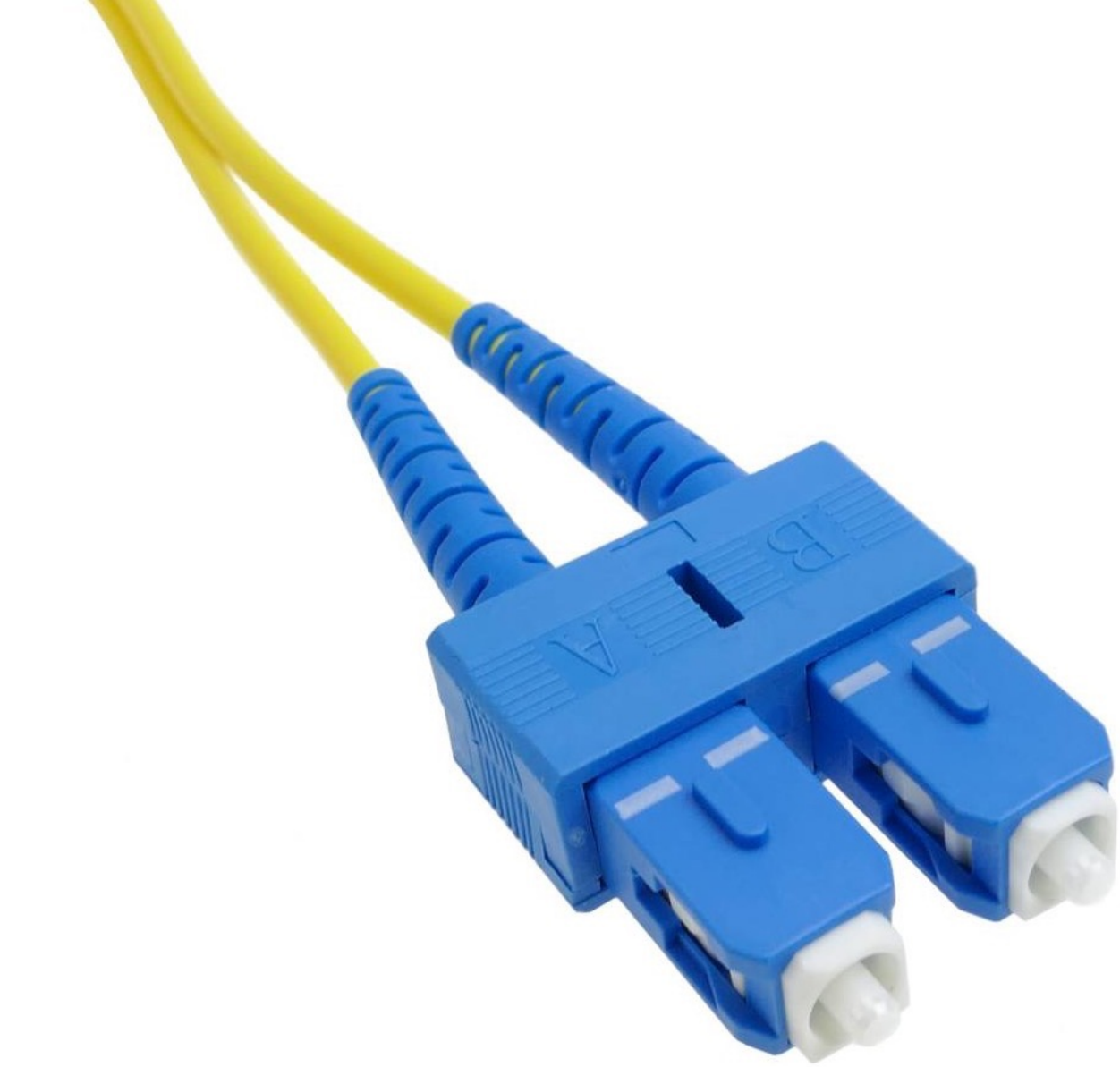


PENLINK

Which fiber should I choose: Explaining Fiber, Simplex, Duplex, Multiplexer and more!

When using fiber, it's important to know about the different options that are available to you. In this document we will go through the different types of fiber connections and explain their basic characteristics.

What is fiber and why is it so efficient?

Fiber is a cable with a glass core that can transfer signals with great results. It is made up from the glass core, layers of protective plastic, kevlar and cladding to keep it safe. But fiber is still very delicate and needs to be handled with great care.

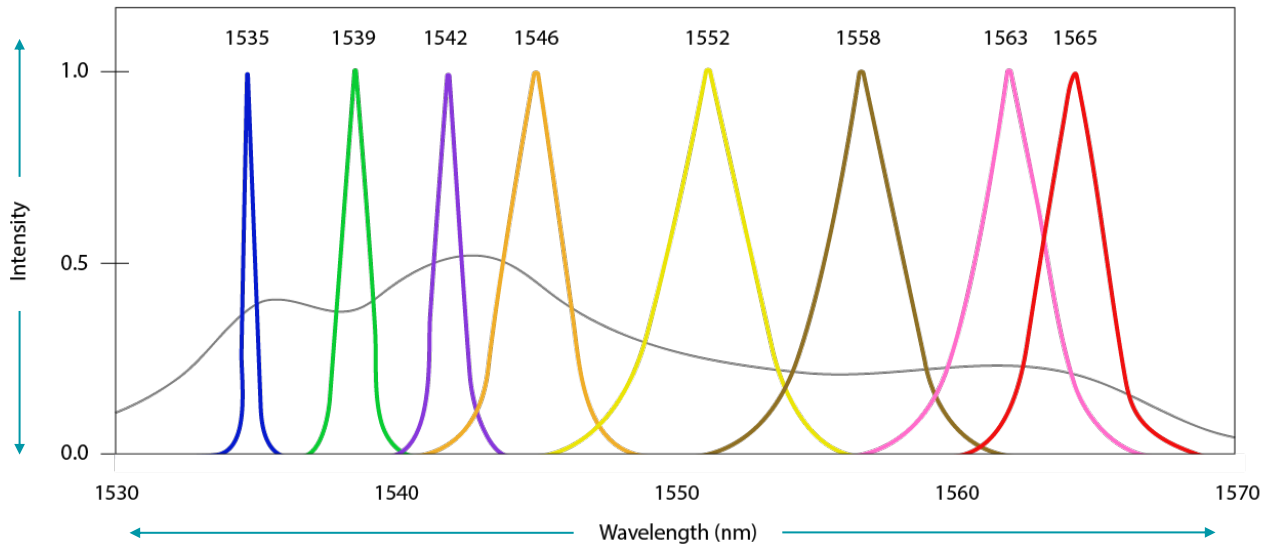
The bandwidth of a fiber cable is considered as limitless. This is on the other hand theoretical since the bandwidth of the fiber will be limited to the performance of the end equipment. A laser is needed to send light into the fiber core, and electronics need to decode the light. The laser can send the light through the cable in different wavelengths (colours), these wavelengths are independent from each other and increase the total capacity of the fiber. Instead of only sending on one wavelengths, up to 80 different wavelengths can be utilized.

In practise, it's not as simple since the equipment used in the application needs to work together. There are however different ways to optimize your equipment to archive a great infrastructure setup.

By choosing the correct media converter (converts analogue / digital signals, I/O to fiber) or off-the-shelfs converters that allow your application's need of data/control signals to be transferred into your system.

In this document, we hope to explain some of the challenges and choices that may help you.

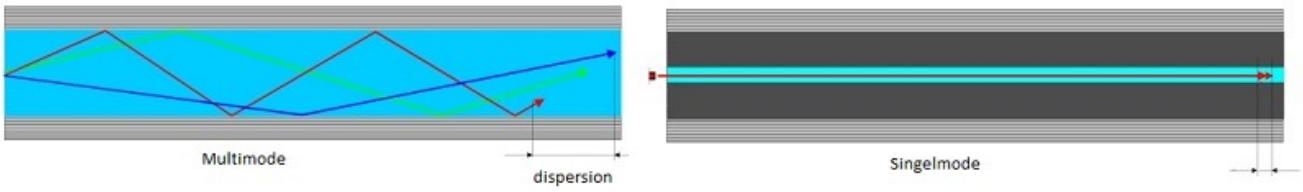
The image below illustrates how the wavelength's can be optimized, and 8 independent wavelengths can be sent thought the 1530-1570 area (normally for single-mode fiber 1300-1600 is available).



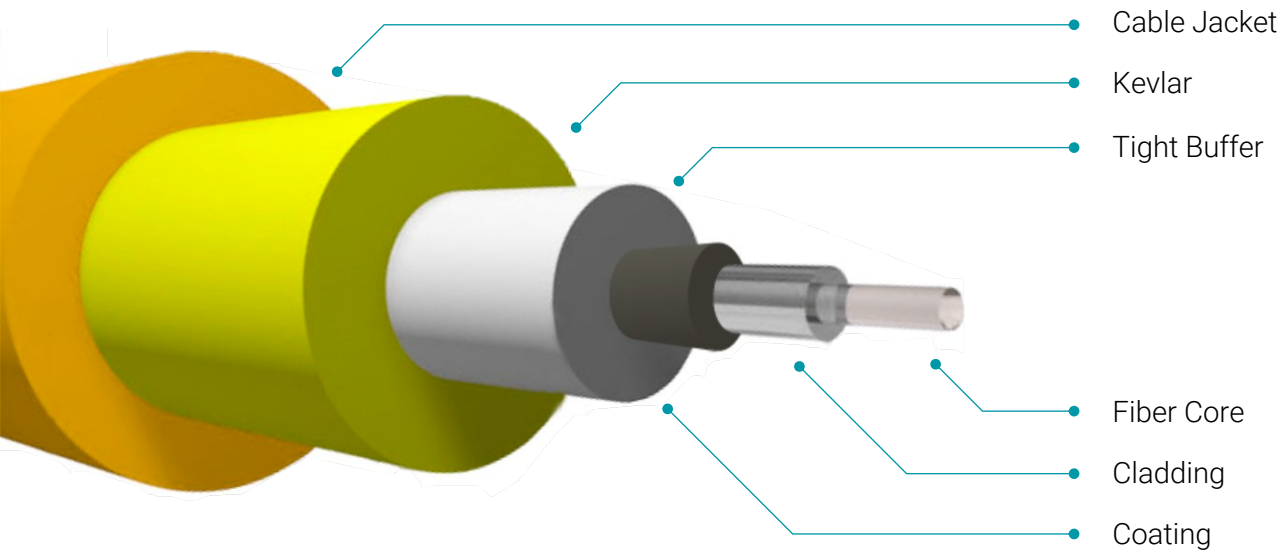
Multi-mode and Single-mode

The first step to decide is what the type of fiber that is needed. There are two types of modes to choose from, multi-mode (MM) or single-mode (SM). To define what type of fiber is needed we need to know which equipment is going to be used to send and receive the signals. If you need help understanding what you need, contact us and we can help you determine your fiber needs.

In the past multi-mode was used due it's low price in comparison to single-mode, but nowadays there is only a small difference between the two modes. Multi-mode has a larger fiber core, that makes the light scatter inside the cable, which reduce the distance and performance.



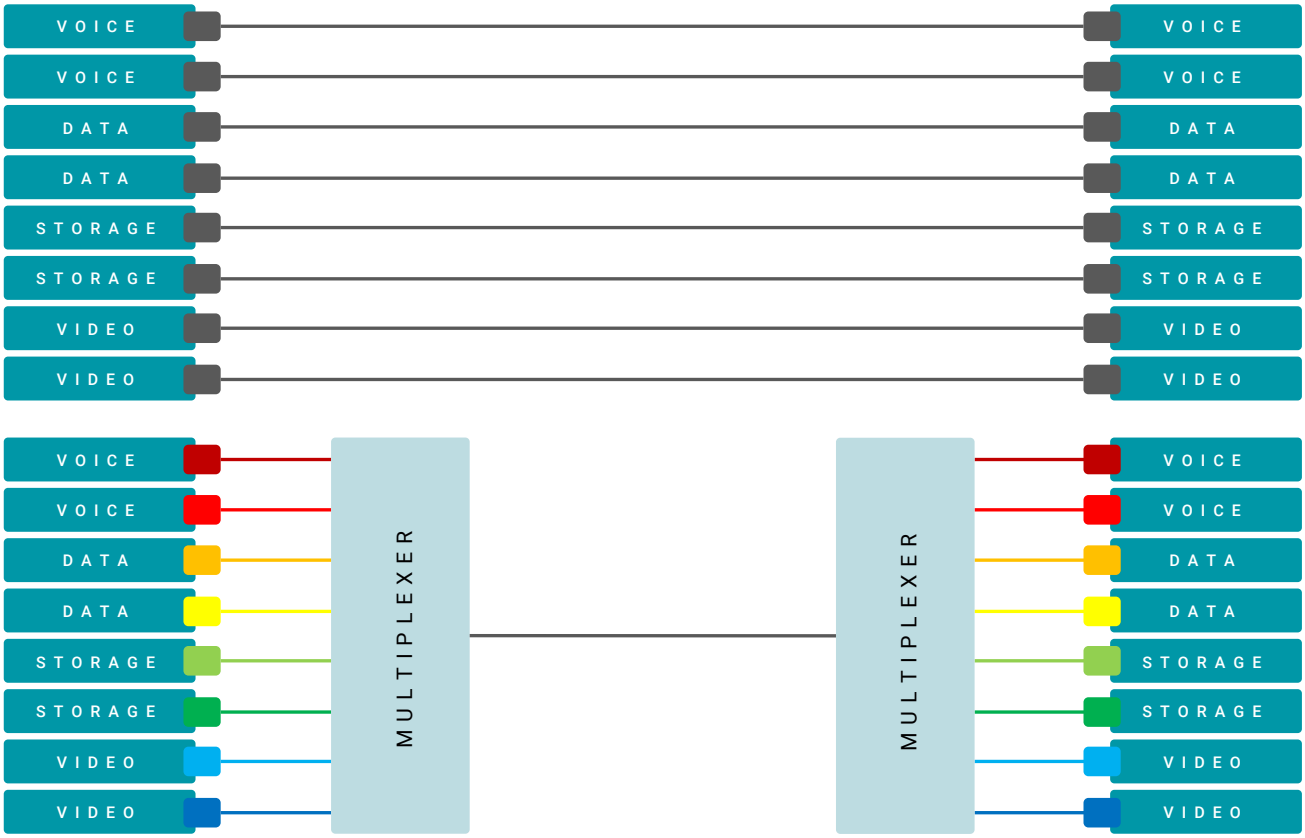
The single-mode fiber, which often has the same outer dimensions, is significantly thinner on the inside. This together with the very precise and more expensive laser in the transmitter gives the single mode fiber several advantages. The light is not scattered through reflectors, but travels straight through the glass core, which means that the light pulse from the transmitter retains its original properties and effect much longer. This allows us to regulate the distance by increasing or decreasing the amount of energy, with the result that the maximum transmission length is multiplied compared to multimode, with a bandwidth up to 100Gb/s.



Optimize the fiber with a Multiplexer

A multiplexer, or mux, is a device that joins several data signals together and enables them to be transmitted over a single fiber network. Conversely, a demultiplexer, or demux, splits them apart. These mux/demuxers maximize the use of the fiber and minimize operating costs when multiple channels need to be transported between several sites.

Many of our customers need to transfer different types of communication signals, and by optimizing the fiber usage, this can allow several different types of application signals to be sent with only one fiber.

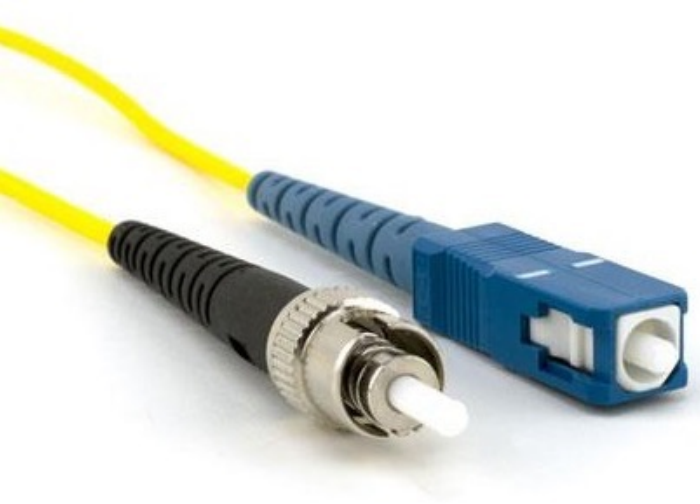


The example above show how several different applications (voice, data, storage and video) can be optimized with a multiplexer/de-multiplexer, du reduce from 8 to one fiber channel.

Standard acronyms for fiber connection: Simplex, BiDi, WDM and Duplex, Standard-SFP

There a two types of fiber connections but we have 7 different names for them, if not more. Let's break it down to which one is which!

It is enough to keep track of two different types of fiber connections. Those with one contact at the end and those with two contacts. If you have a fiber cable in your hand with only one connector at each end, then you belong to the BiDi single-fiber-simple-fiber-simplex-WDM team. If you have two connectors at each end, then you play in the standard SFP-duplex team. Have a look at the table below.



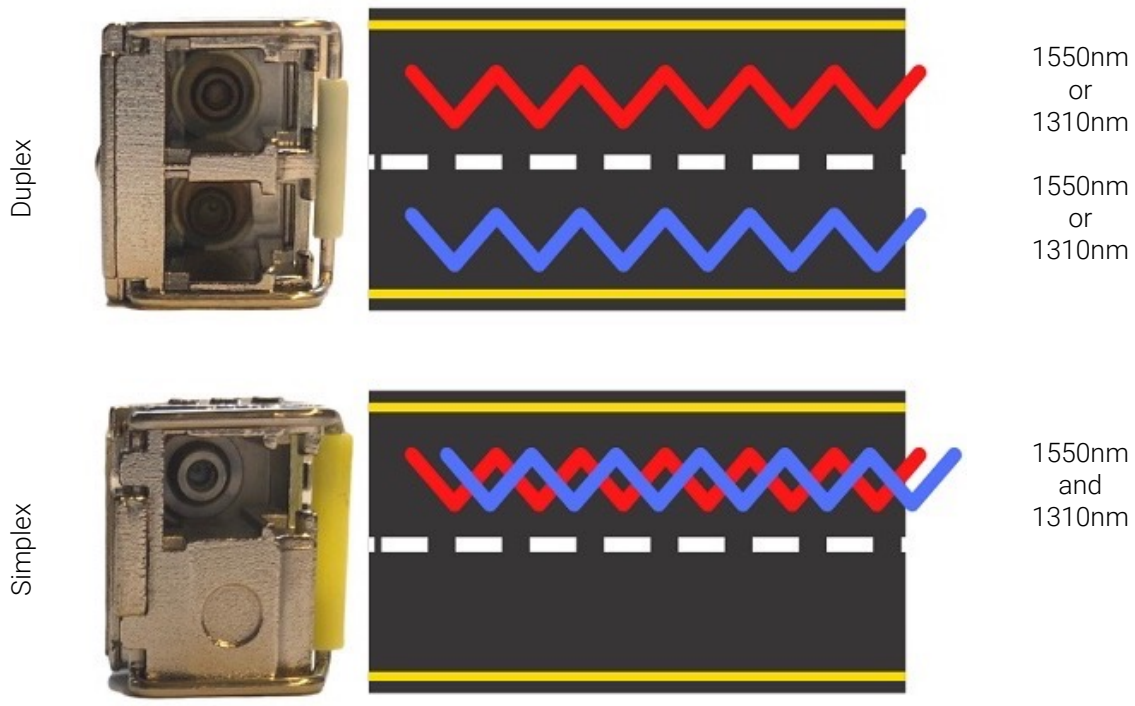
TYPE:	SINGLE CONNECTOR	DOUBLE CONNECTOR
Simplex	X	
WDM	X	
Singlefiber	X	
Simplefiber	X	
BiDi	X	
Duplex		X
Standard-SFP		X

The difference between Simplex/BiDi/WDM/Singlefiber and Duplex/Standard-SFP

To make it simple to understand what we are talking about, we are addressing the connections with simplex and duplex. What is the difference between these two then? Simplex uses only one connection that can send out several independent data channels. Because each channel has an exclusive wavelength, you can run data in both directions without colliding with each other. Whilst duplex need two cables to run data that sends and receives in independent channels.

How do you know which connection is needed? It all depends on the signals you are going to send to the receiver and how the sender and receiver is programmed to handle the wavelengths. In the image below you can see how it works in practice.

A very efficient technology for multiplying the possibility of an already installed fiber cable is WDM. WDM is not limited to only two channels but also occurs in the classes CWDM (coarse WDM) and DWDM (dense WDM) which describe the distance between the channels and therefore also determine the number of possible channels.



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