SmartOptics | WDM Multiplexers

Optimizing the Use of Fiber with Your Multiplexer

Harnessing the power of OSI-branded multiplexers and optical add/drop multiplexers (OADMS) to selectively add and drop wavelength channels gives you more flexibility in volume of traffic and type of data you can transmit

A WDM multiplexer, sometimes referred to as a mux, is the key to optimizing, or maximizing, the use of the fiber. The multiplexer lies at the heart of the operation, gathering all the data streams together to be transported simultaneously over a single fiber. It does this by taking multiple input signals and combining – multiplexing – them together on to a single, common line output. The multiplexed signal can now be transmitted on a single fiber or fiber pair over the optical network. At the other end of the fiber, the streams are demultiplexed, i.e. separated into different channels again.

Multiplexers allow you to split one single cable into multiple traffic channels and simultaneously transport multiple data channels over it – much like adding new lanes on an expressway to make traffic more efficient. You get more flexibility in terms of the volume of traffic and the type of data you want to transmit.

Since they're usually positioned at the end points in a network, multiplexers are often referred to as terminal muxes. When connecting two sites, a multiplexer is positioned at each site, creating a point-to-point connection.

Multiplexer: Combining channels to transmit multiple services via fiber

Because the multiplexing and demultiplexing are usually all done within the same type of module, they are commonly referred to as mux/demux modules. While some traditional system vendors incorporate mux/demux modules in their chassis-based systems as vertical plug-in cards, most mux/demuxes are horizontal 1U devices. Either way they are passive modules that take up little space and require no power, ideal for green data center interconnectivity.

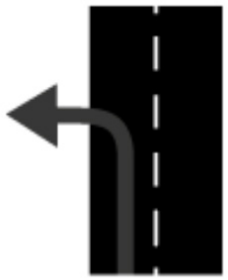
In our road analogy, the multiple input signals into the multiplexer can be considered as the lines on the road that separate out the different lanes of traffic.

Early WDM systems were able to transport two bi-directional channels over a pair of fibers. The technology has evolved rapidly and both the number of channels and the amount of data per channel transported has increased. Today, up to 80 channels can be simultaneously transmitted down a dark fiber pair at any one time.

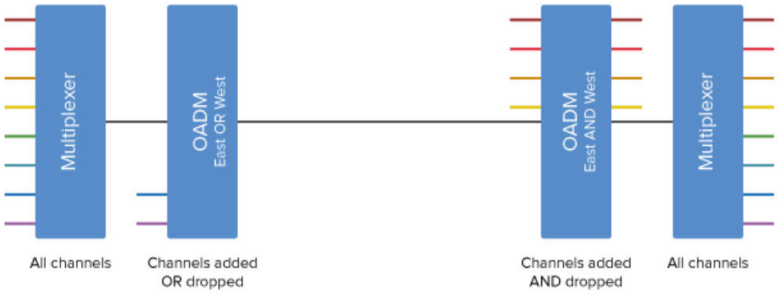
Optical add-drop multiplexers

In the same way that traffic needs to enter and leave a highway at specific junctions, traffic needs to enter and leave a network at specific junctions, too. CWDM or DWDM multiplexers are often referred to as terminal muxes because they tend to be positioned at the end points in a network. Therefore, if only two sites need to be connected, a multiplexer is positioned at each site, creating a point-to-point connection between the two sites. Quite often networks have additional sites where connectivity is required of some, but not all the traffic.

For such networks, another type of passive module exists: an optical add-drop multiplexer (OADM). An OADM extracts the desired wavelengths and bypasses the rest of the traffic that doesn't need to be accessed at that particular site along the route. With these building blocks even more versatile ring, distribution and access networks can be built.



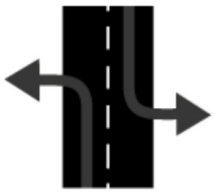
As an example, when a network has three elements, such as: Two end points (sites A and C) and a midpoint (site B). Now let's say that only some of the traffic is required at site B. This is where an OADM is used.



Point-to-point network with two interim OADM sites. East only at interim site 1, and east and west (often referred to as drop and continue) at interim site 2.

OADMs are available for CWDM and DWDM and for single fiber or dual fiber networks. They add extra flexibility when networks that aren't point-to-point are required. They can create point-to-point networks with add-drop functionality and ring networks. OADMs typically tend to be for 1, 2, 4 or 8 channels. With any more channels than this, it's more effective to build a series of point-to-point networks using terminating multiplexers.

Using our road as an analogy, OADMs have two fundamental functions:



End Terminal OADM

Sometimes called an East or West OADM. Traffic is added and dropped at one side of the network only. Depending on the configuration of the OADMs and muxes, this generally creates a point-to-point connection between that point and the point next to it or one of the mux/demuxes.

Drop and Continue OADM

Sometimes called an East and West OADM. Traffic is dropped at that particular site and maybe regenerated if it is a part of a ring network, or the signal needs to simply carry to the next point in the network.

Technical Overview

Multiplexer (or mux)
A multiplexer, or mux, is a device that joins several data signals together and enables them to be transmitted them over a single dark fiber network. Conversely, a demultiplexer, or demux, splits them apart. These mux/demuxers maximize the use of the dark fiber and minimize operating costs when multiple traffic channels need to be transported between several sites.
Optical networks quite often require some, but not all, of the channels to be accessed at various points throughout a network. To enable this, optical add-drop multiplexers (OADMs) are used.

An OADM is a device used in WDM-systems for multiplexing and routing different channels of light into or out of a single-mode fiber. "Add" means that the device is able to add one or more new wavelength channels to an existing multi-wavelength WDM signal. "Drop" means that it can remove one or more channels and pass those signals to another network path.

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