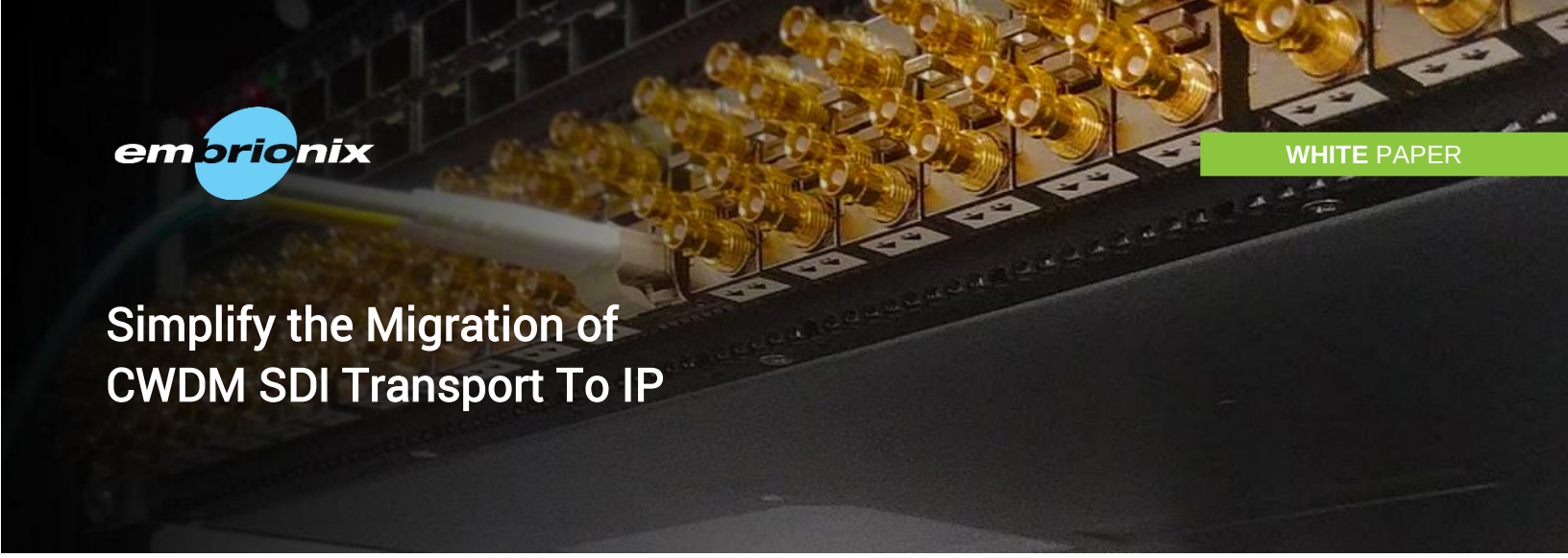


WHITE PAPER

# Simplify the Migration of CWDM SDI Transport To IP

**Authors** :

Francois Gagnon
Roy Folkman
Renaud Lavoie

## INTRODUCTION

*Broadcasters have been using dark fiber to carry SDI video signals for a long time via CWDM (course wavelength division multiplexing) technology. The principle of CWDM is simple (although the technology is very advanced): dark fiber (in fact any fiber) passes light through cables without regard for wavelengths, except on the water peak, (see below)). The fiber can be compared to a multiple-lane highway where, in the case of CWDM, there are 18 lanes. With DWDM (Dense WDM) there are up to160 lanes! This paper will discuss the methods and benefits of migrating CWDM SDI transport to IP.*

## THIS PAPER EXPLORES:

- CWDM & DWDM Overview
- CWDM & Mux/Demux
- Migration from SDI to IP
- Mux/Demux removal
- Utilizing Mux & Demux

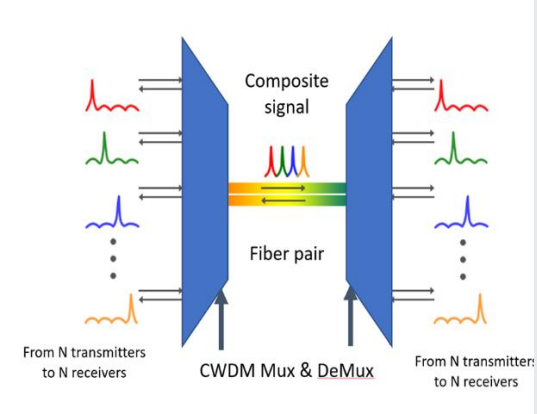



Figure 1.0 CWDM Mux & DeMux

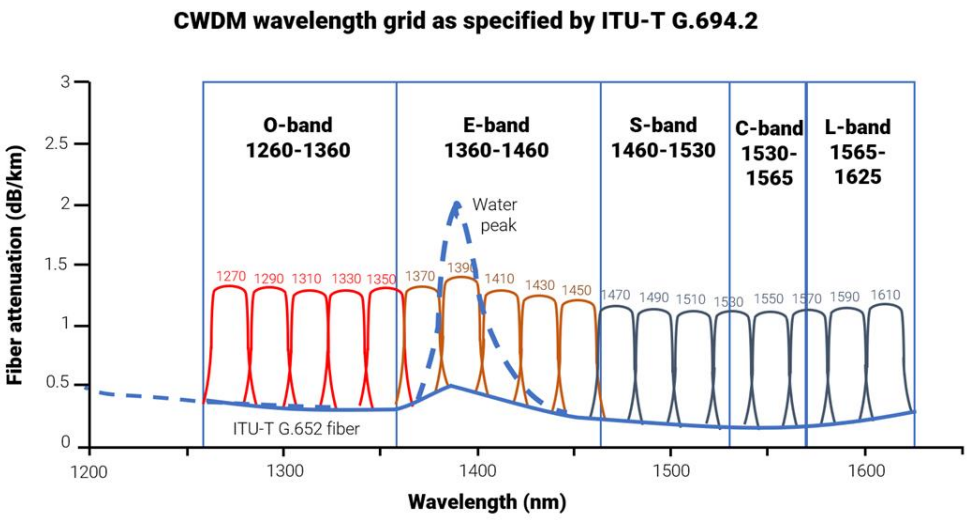



Figure 2.0 CWDM Wavelength Grid

## CWDM AND DWDM EXPLAINED

The following images illustrate basic DWDM and CWDM behavior. In wavelength division multiplexing, deploying different wavelengths of visible laser light enables a multiplexer/demultiplexer to combine several optical carrier signals onto a single fiber and remove unwanted light.

CWDM in detail

CWDM, is cost effective and broadcasters generally select it over DWDM. CWDM lasers do not need to be temperature controlled making the overall cost of the system more affordable. DWDM, on the other hand, offers more channels per fiber but this density comes with a higher price and is complex to build. DWDM wavelength lasers need thermoelectric coolers to keep their output stable, the price of such lasers is higher since it was intended for long haul use with reduced fiber strain.

The next image shows CWDM bands and attenuations relative to 18x bands. As you can see on the image, the 1390nm and 1410nm are located in the water peak. This attenuation peak is created by the water molecule excitation when wavelengths travel through fiber

NOTE That the water peak is a reaction between the fiber and the light at a specific wavelength creating more attenuations. Recent advances in fiber are drastically reducing the attenuation (ITU-T G.652 fiber) caused by water molecules.

## CWDM AND MUX, DEMUX FEATURES

CWDM mux and demux are key to making the highway of light navigable. Mux and demux are critical for:

-Filtering on the receive end, all except essential wavelengths. The optical receivers are wide receivers, they received all wavelengths from O-band to L-band.

-Combining wavelengths on the fiber.

-CWDM and DWDM muxes and de-muxes are signal agnostic and built with fully passive components. Any type of signal (Ethernet, MPLS, SDI, SONET, SDH, etc.) can pass without being affected by other wavelengths.

-CWDM muxes can support 4x/8x or 16x wavelengths. Keep in mind that the 16x wavelength is usually a combination of 2x 8 wavelengths.

-Good CWDM muxes will have a tap or expansion port, a pure fiber optic port used to cascade muxes or to add an IP port in your current CWDM network.

# SIMPLY MIGRATE FROM SDI TO IP

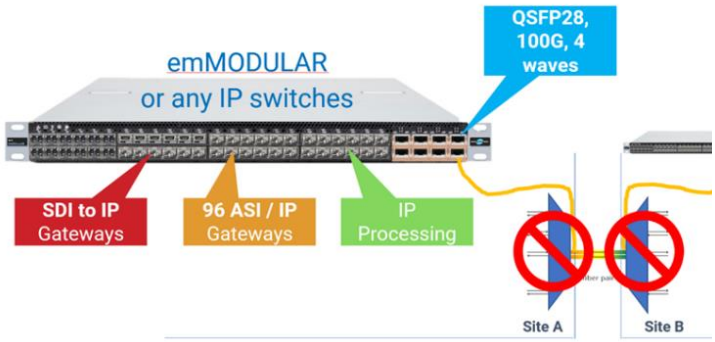
There are multiple ways to migrate to IP in a CWDM system. This document will explore some solutions to do the migration with the intent of helping the reader choose a suitable method. The Embrionix team believes that more than one solution presented in this paper is feasible. Let's explore mux and demux removal. Benefits of an IP system over a traditional CWDM solution include inherent routing capability and ease of future expansion.

A simple but drastic solution is to remove the CWDM mux & demux

### Solution 1: Mux and demux removal

This simple, but most drastic solution, is to remove the CWDM mux and demux and then re-attach the IP connection to the dark fiber. The following image illustrates an example of this procedure

Figure 3.0 Mux and Demux Removal




Some advantages/disadvantages of this scenario:
-Possible costs related to removing the mux and adding a connector that fits on the QSFP28 (quad small-form pluggable 4x28Gbits).

- -The QSFP28 LR4 optical transceiver uses the following wavelengths: 1296, 1300, 1304, 1309. Consequently, only ONE can be connected to the fiber as the QSFP always uses the same wavelengths. (At the time of writing this paper, the available speed is 100G. 200G (QSFP56) is on the horizon).
- -The QSFP28, LR4 could drive up to a 10x km distance.
- -No redundancy can be deployed with only one pair of fiber cables.
- ROUTING IS NOW POSSIBLE, and no longer point-to-point

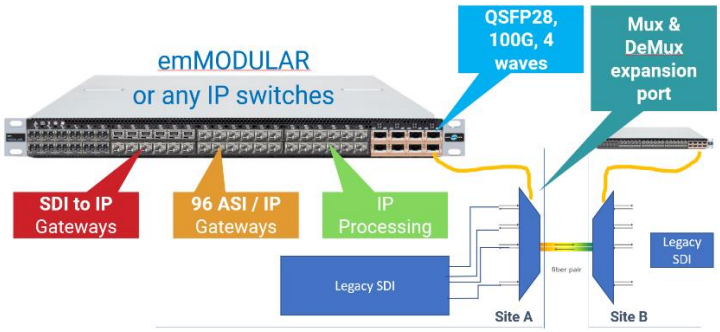
Removing the CWDM mux/demux is still a good solution for transport connection, but it does restrict the bandwidth and distance. Of course, one could argue that it is possible to add a transponder and DWDM waves, which can carry some serious bandwidth. Of course, this would increase system cost.

### Solution 2: Going around the mux and demux

Yes, it may sound strange but it could make for a great migration path from SDI to IP. Furthermore, this would enable the continued use of the CWDM mux and demux.

This solution is only possible if you do not use the lower band on your existing CWDM system, ie the same that the QSFP28 LR4 uses. If we explore the CWDM Mux and DeMux a little deeper, we realize that the 16 or 18 channels constitutes a cascade of 2 x 8 or 9 x CWDM Mux and DeMux. Now, if you use the band E, S, C or you can use the expansion port to connect the QSFP28 LR4. You then have your old system still working when you install the new media over IP connections. The following picture shows how this can be done.

Figure 4.0 Around The Mux



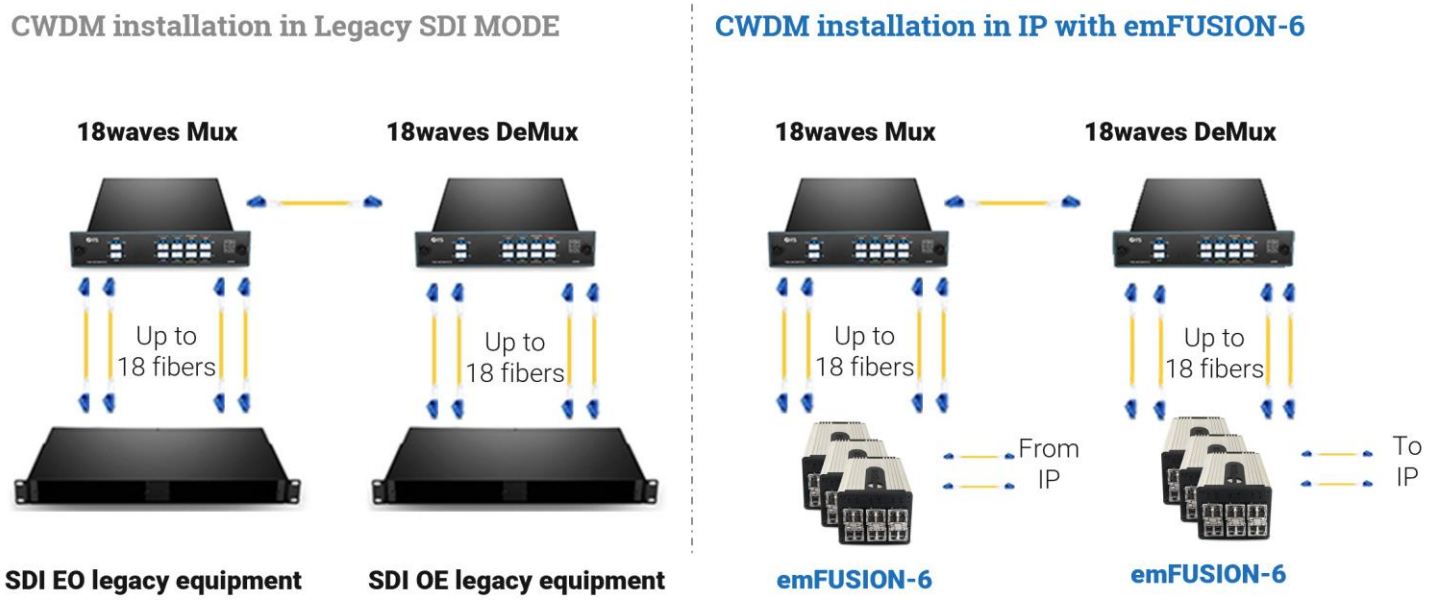



Figure 5.0 The emFUSION-6 eliminates the need for OE and EO equipment and Simplifies the connection to IP with 25GE (redundant)

## CONCLUSION

In conclusion, the migration from a CWDM SDI transport system to an IP system is simple and could be achieved quickly by removing the mux and connecting the dark fiber directly to an IP switch. It can also be done in a build as you grow system, where you can decide to keep the Mux and Demux and build a more flexible system. Whichever option you select, the Embrionix team will help you successfully deploy your new IP system.

A final point: By moving your system to IP, routing becomes simple and of course, it is free in IP!