

## Increasing Fiber Capacity with CWDM

Fiber-optics has become a widely used transport for transmitting data for carrier networks, enterprise campus networks, and Local Area Network (LAN) extensions. Although the cost of fiber has significantly been reduced, the cost of installing it can still be high. Therefore after the fiber is installed, its efficient use is key to keep the overall costs down.

Capital and operational costs are greatly reduced by collapsing legacy services from low speed serial to high speed Ethernet traffic for transport over Ethernet, ATM, or IP/MPLS. GDC's Xedge MSPx offers aggregation of legacy services combined with CWDM capability, allowing network operators to roll out more cost-effective and scalable networks. CWDM provides further cost savings through the sharing of the fiber optic infrastructure without growing the overlaying networks.

### Xedge MultiService Packet Platform

GDC's powerful MSPx platform enables multiservices (Frame Relay, TDM, Ethernet, ATM, and IP) over MPLS, ATM, or Ethernet trunk interfaces. The technology allows service providers and private network operators to offer converged solutions while reducing capital and operational expenditures (Figure 1). GDC's network manager, ProSphere, facilitates the provisioning of virtual private wire services (VPWS) using pseudowire emulation.

The MSPx can support up to 112 OC3s and up to 28 OC12s in a 16 slot shelf; and up to 28 DS3s (E3s). Up to 224 DS1/E1 ports in the large chassis can be bonded into subgroups. Each subgroup can be 2, 4 or 8 DS1s/E1s.

The 16 slot shelf also provides for up to 70 FE ports and 14 Gigabit Ethernet ports all of which can be used for which can be used for subscribe or NNI links. Smaller shelves in the Xedge family can be used to scale according to specific site application requirements.

GDC strives to reduce the cost of ownership for WAN operators by designing, integrating and supporting hybrid network solutions that deliver significant return on investment. With the introduction of the Xedge MSPx, service providers can lower costs by eliminating multiple private lines and/or overlay networks. A flatter network requires less hardware for overall maintenance.

### Xedge in a CWDM Network

When the capacity of optical terminating equipment is reached, network operators must decide if they want to overhaul their terminating equipment or add more fiber. Overhauling the terminating equipment can be costly if when going from an SONET OC-3 to OC-12 or to OC-48.

Wave Division Multiplexing (WDM) can be a cost effective solution to get more bandwidth out of that single pair of fibers. The Xedge MSPx combines aggregation of legacy services with CWDM capability, allow network operators to rollout cost-effective, scalable networks.

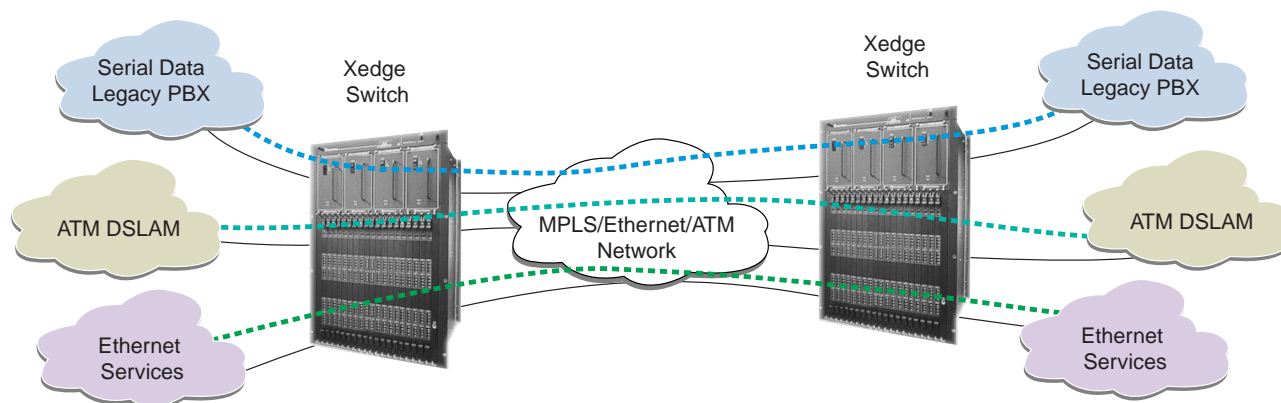


Figure 1: Xedge in a CWDM Network

### Wave Division Multiplexing

WDM technology multiplexes multiple wavelengths coming in from separate fibers onto a single fiber, then demultiplexes the aggregate at the receiving end by their respective wavelengths. Coarse Wavelength Division Multiplexing (CWDM) uses a spectrum of wavelengths (also known as Lambdas) that are separated by 20nm as defined in ITU-T G.694.2 and allows for multiplexing up to 18 wavelengths or channels over a single fiber (*Figure 3*).

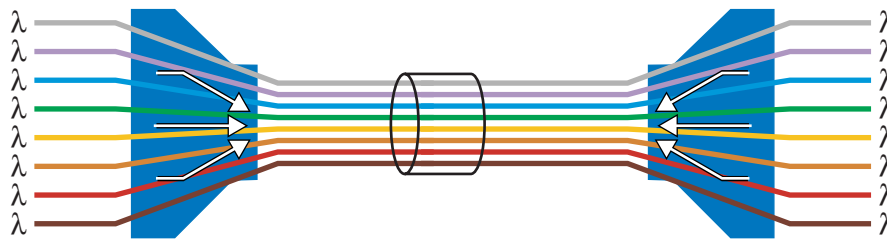
*Figure 3* conceptualizes an eight CWDM channel system. The Xedge MSPx participates with this topology by utilizing "colored" optic transceivers with the appropriate wavelength attached to the correct channel on the multiplexer. The signal is then extracted at the far end demultiplexer.

The MSPx uses Small Form-factor Pluggable (SFP) optic modules that are available in "colored" wavelengths on the OC-N and the Gigabit Ethernet interfaces for the Packet Cell switch (PCx) controllers.

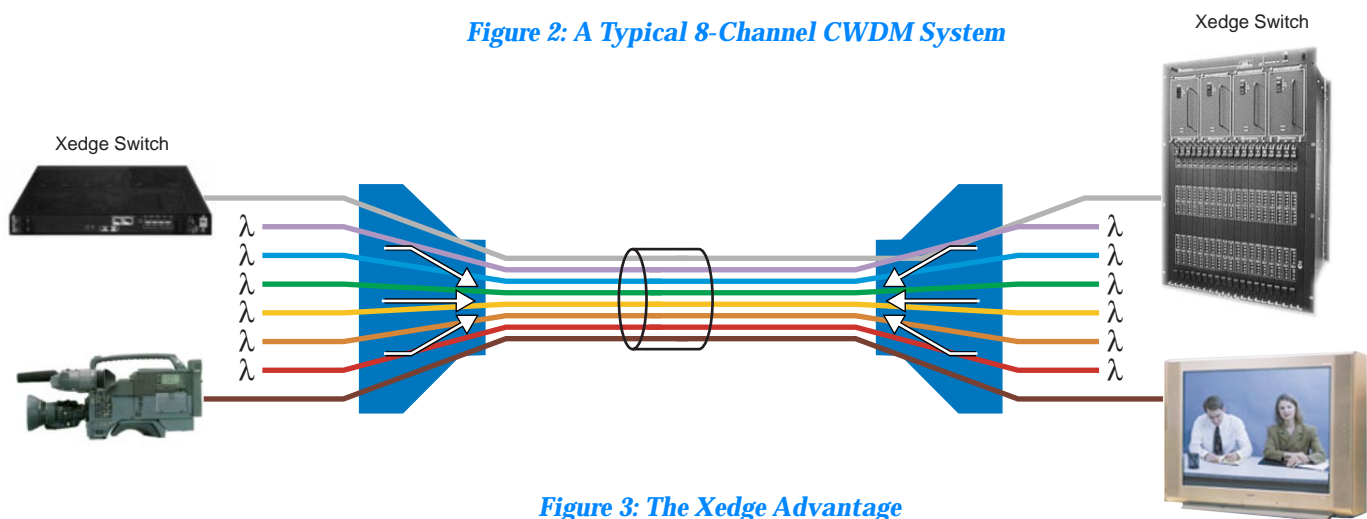
The table below shows a typical allocation of wavelengths for an eight channel CWDM system from the ITU-T along with industry standard "color" assignments.

Wavelength	Standard Color Code
1471	GRAY
1481	VIOLET
1511	BLUE
1531	GREEN
1551	YELLOW
1571	ORANGE
1591	RED
1611	BROWN

**Table 1: Typical Wavelength Allocation**



**Figure 2: A Typical 8-Channel CWDM System**



**Figure 3: The Xedge Advantage**

## Adding ROADM

Not only does CWDM allow for efficient fiber use in a linear system, but with the use of Reconfigurable Optical Add Drop Multiplexers (ROADM), the same concept can be used in a ring topology as well.

The ROADM takes the wavelength transmitted by the Xedge and switches it onto the ring. It then peels the wavelength out at the appropriate multiplexer providing efficient use of the spectrum on the fiber resources. (Figure 4)

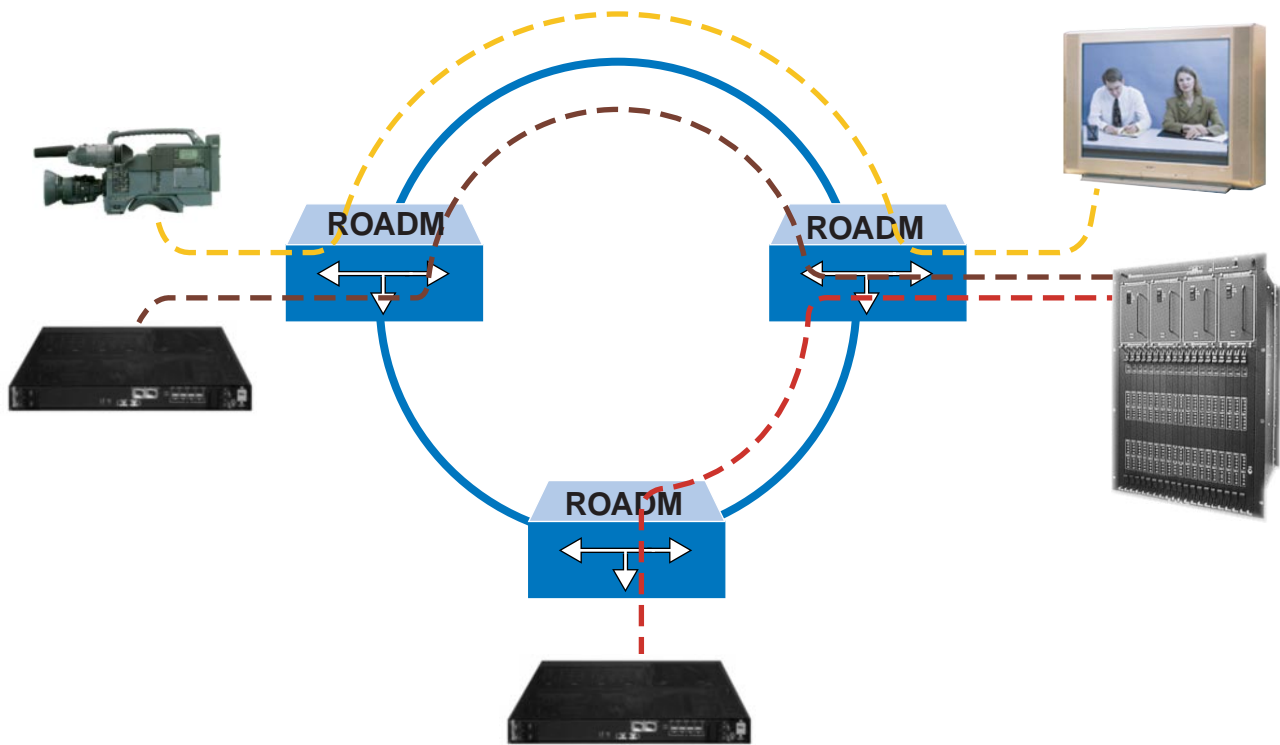


Figure 4: Xedge with CWDM and ROADM

