CWDM Applications from Telco Systems

Telco Systems
A BATM Company

Maximizing Fiber Capacity

www.telco.com

Note: Transmission distance is directly affected by a number of factors and in some instances a full 80km may not be achieved. These factors include quality of fiber, number of splices, number of connectors, etc. In order to estimate the supported distance, the optical power budget must be calculated. Real time measurement of optical power on each wavelength makes management of the link much easier.

As fiber moves closer to the end user, optical telecommunication carriers require technologies that promise high-end networks for low-end cost. One of the most popular of these technologies is Coarse Wave Division Multiplexing, or CWDM.

Telco Systems brings a full range of management and high availability solutions to CWDM for carriers deploying mission-critical networks. Flexible and scalable, Telco Systems' CWDM solutions support DS3, Ethernet, fibre-channel, SONET/SDH protocols as well as line protection and restoration. CWDM provides a low cost, high bandwidth solution for bringing the benefits of fiber-optic technology to the curb, business, and home.

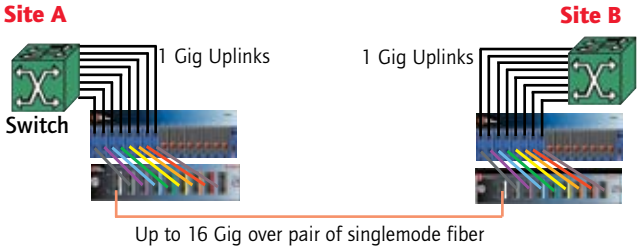
Optimizing your Fiber

The CWDM network provides a cost-effective "no new fiber upgrade" solution for adding new broadband services or customers to existing singlemode fiber.

CWDM offers up to an 18X pair-gain on existing ITU-T G.652 and G.653 (DSF) fiber infrastructure. At a conservative 20 percent yearly growth rate, providers could see another 10 years of life out of the installed fiber base. At a very optimistic 50 percent yearly growth rate, this equates to another five years of fiber life. Furthermore, for situations where fiber is widely deployed, CWDM enables a much greater return on investment of this fiber infrastructure than was previously thought possible.

The Metrobility® CWDM solutions by Telco Systems allow users to increase the capacity of existing fiber by utilizing widely spaced, separate wavelengths – between 1310nm and 1610nm – within the same fiber pair. Up to 16 different channels can be combined on a single fiber pair.

Point-to-Point Network Supporting 16Gbps over SM Fiber



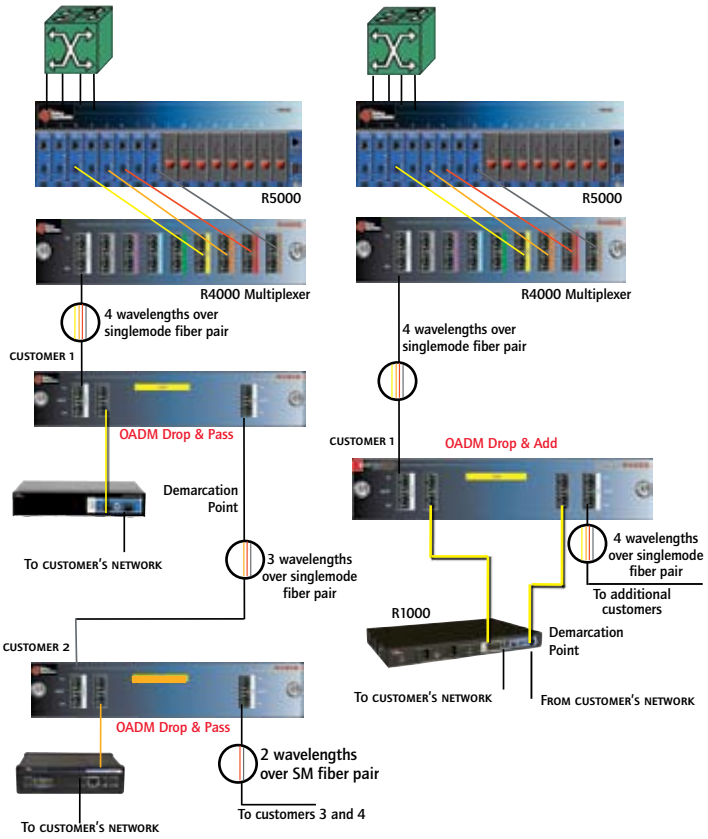
Extending your Network

A CWDM network starts with multiplexing multiple connections on a fiber pair. Each connection represents a unique wavelength, or lambda. Using the ITU-grid CWDM standard, these wavelengths are broadly spaced using 20nm between supported lambdas. The Metrobility CWDM solution from Telco Systems supports 16 wavelengths ranging from 1310nm to 1610nm.

'Drop & Add' and 'Drop & Pass' modules provide the ability to terminate ('Drop') one or more of the wavelengths from the fiber locally and allows the other wavelengths to continue ('Pass') to other nodes. Similarly, the 'Drop and Add' ability allows a wavelength to be added from a local fiber interface and allows the other wavelengths to continue ('Pass') to other nodes.

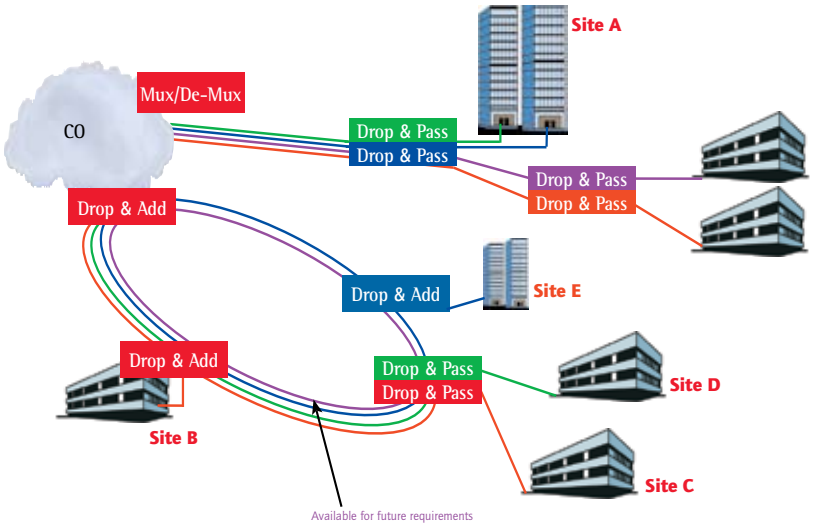
Supported transmission distance is 80km between the point of origin to the delivery of the wavelength. In the 'Drop & Pass' scenario, total distance for all wavelengths would be 80km from the central office to the final customer in the network. In the 'Drop & Add' scenario, each added wavelength could be transmitted 80km from the point at which the wavelength was inserted.

Multiple Customers over Singlemode Fiber utilizing Drop-and-Pass and Drop-and-Add



Configuring your Network: Ring or Point-to-Multipoint

- Site A has 4 point to point connections from the Central Office to a high rise office building. In this case two wavelengths are dropped at the office building and the remaining two continue to two other locations.
- Site B is on a fiber ring with a red wavelength that connects to the Central Office and a point to point connection between Site B and Site C.
- Site D is connected to the Central Office on the green wavelength.
- Site E is connected to the Central Office on both the East and West side of the ring on the blue wavelength.
- In the ring configuration, the violet wavelength is not used. If a new point to point or ring application is being added in the local area, new local equipment is installed and an available CWDM wavelength, in this case violet, is then used to provide the service.



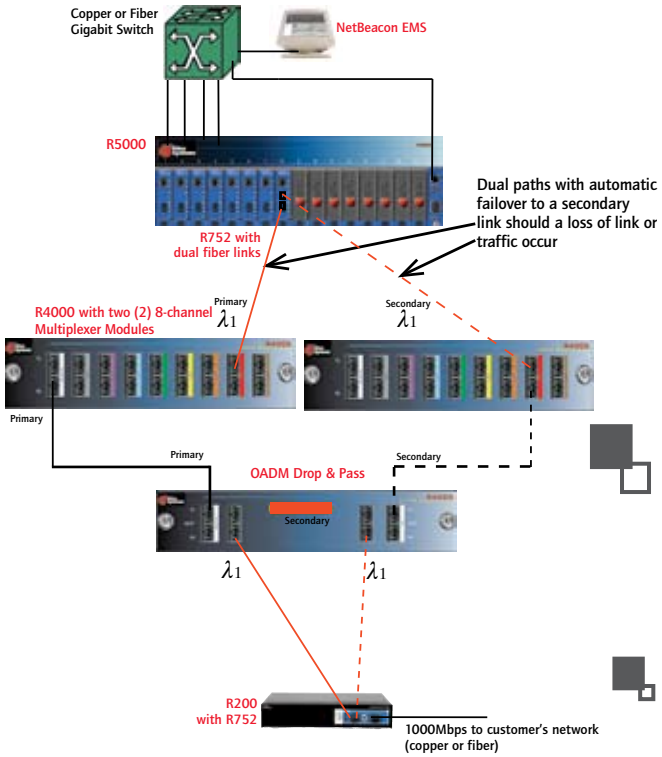
Ensuring High Availability through Line Protection and Restoration (LPR)

Because more wavelengths mean more customers on a single fiber link, the ability to safeguard link traffic becomes more critical and makes redundancy a key component of any CWDM network.

Telco Systems offers a patent-pending solution for creating resiliency for Ethernet CWDM networks at the physical layer. Dual gigabit links provide fast failover (672 nanoseconds) for loss or link or loss of traffic (e.g. switch failure).

This physical layer solution is able to isolate failures with a faster recovery time and is simpler to implement when compared to using Spanning Tree or Fast Spanning Tree protocols.

High-speed Ethernet line protection and restoration is critical to service providers offering very high service levels to mission-critical businesses. Telco Systems LPR solution creates a faster-than-SONET failover scheme to ensure very high availability in the event of a cut fiber or switch failure.



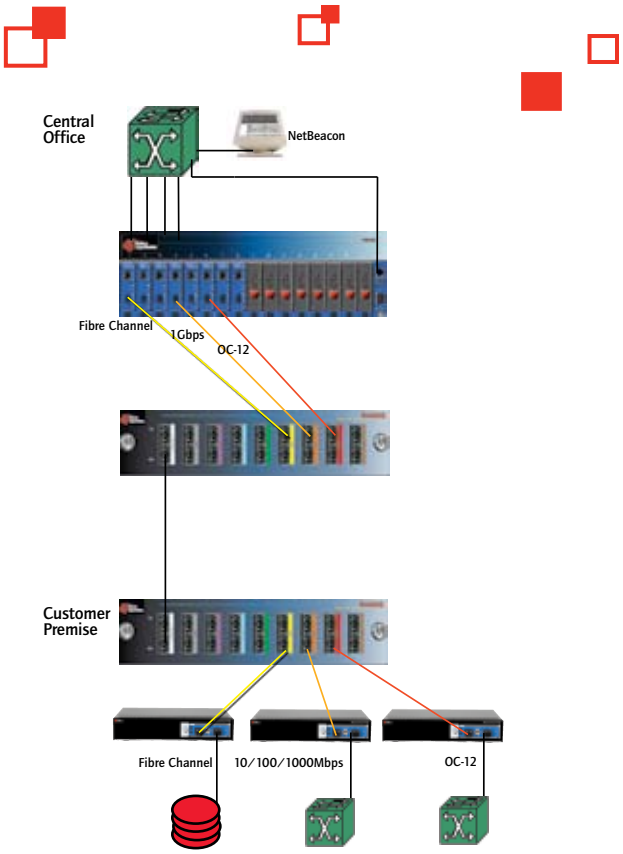
Deploying Multiple Services

When configured with wavelength-specific CWDM optics, the Metrobility Multi-rate Line Card (MRLC) from Telco Systems enables service providers to leverage existing fiber infrastructure to provision and manage multiple services over a single fiber pair by utilizing different CWDM lambdas.

The R380 MRLC provides a transparent interface for CWDM across a wide range of protocols with data rates ranging from 45Mbps to 2.7Gbps and supports DS3, Ethernet, SONET/SDH, fibre channel, and ESCON protocols. The MRLC utilizes small form-factor pluggable optics (SFP) for maximum flexibility. Because they are hot-swappable, SFP optics enable service providers to change optics on-the-fly for significant time savings with no effect on existing services.

The R380 Multi-rate Line Card operates at data rate ranging from 45Mbps to 2.7Gbps and supports Ethernet, SONET/SDH, fibre channel, and ESCON protocols. Data rate is determined by the DIP switch setting on the card, or by software auto-detection or manual settings in NetBeacon® or WebBeacon™ element management software.

The line card performs re-amplification, reshaping and re-timing on all **known** data rates and re-amplification and reshaping for **protocol transparent** data rates. Re-amplification ensures the maximum distance support across singlemode fiber.

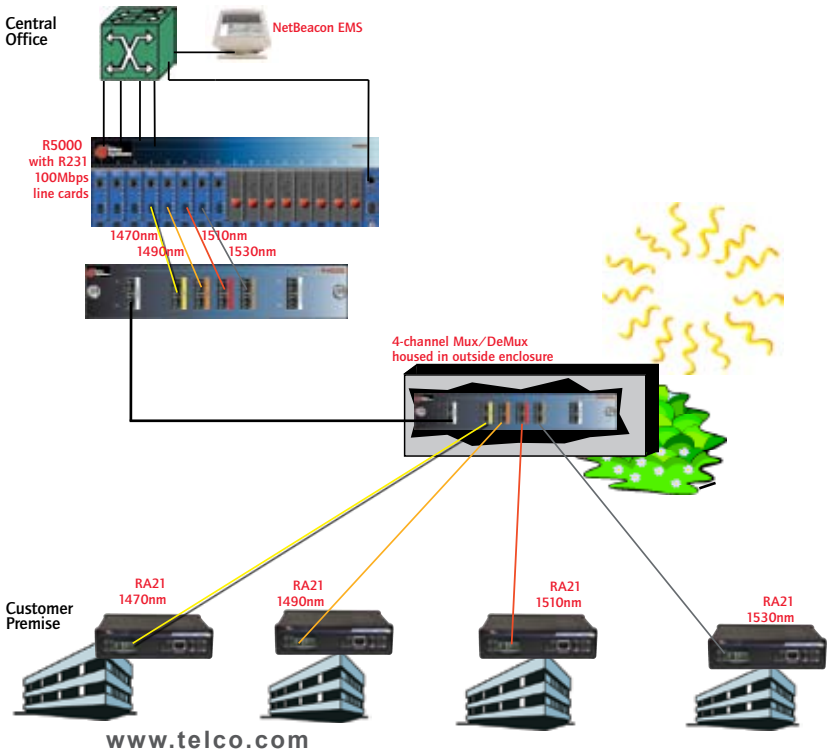


Weathering the Elements

For installations where extremes of temperature are common, Telco Systems offers optional extended temperature optics in all of its 4-channel multiplexers. These units have been tested from -40oC to -80oC and provide reliable operations regardless of temperature extremes.

The R4000 CWDM utilizes passive optical networking (PON) components, and requires no power, thereby reducing overall costs.

For applications requiring installation in outdoor locations or other harsh environments, the R4000 modules can be housed in an appropriate NEMA enclosure.



Managing your Network

It is critical for service providers and network administrators to have some method of monitoring every link against problems such as poor connections, wavelength degradation, equipment failure, and even physical breaks in the fiber. Without inline electrical conversion, mechanisms for alerting service providers to any potential problem that could degrade or even bring down the network are extremely difficult.

By utilizing optics in optical-to-electrical-to-optical (OEO) line cards or devices which support the MSA SFF-8472 standard, the optical link can be monitored end-to-end using real time digital measurements of transmitted and received optical power levels and internal temperature. Should one of these parameters fall outside normal range, management software will generate an alarm.

A managed R5000 chassis can monitor up to 16 links using any of the following management interfaces:

-NetBeacon Element Manager (workstation-based, GUI interface)
-WebBeacon (browser-based interface)
-Command Line Interface (CLI)
-SNMP-based manager such as HP Open View

Additional information such as card type, date of service, and configuration, plus analog measurement of power, temperature and voltage may also be managed.

Line cards in the R5000 chassis provides the OEO interface to the R4000 multiplexer.

A CWDM device view also provides inventory information on wavelengths used.

Optical power receive and transmit levels and temperature are easily viewed with NetBeacon's GUI interface.

Remote Site Management

Because CWDM utilizes passive optical components, end-to-end management becomes enormously difficult. To ensure a network is providing quality of service to customers, Telco Systems offers the highest level of element management providing the ability to monitor and manage the remote site - without expensive and time consuming truck rolls.

Telco Systems remote site solutions are simple to install, minimize inventory requirements, and accommodate management requirements to ensure that service providers can meet SLA's and end-user QoS expectations.

Management options for the remote site include both path fault management using SNMP and PING, and link fault management. Link fault management features eliminate the requirement for an IP address at the customer site, providing additional security from hackers and denial of service attacks. Additional mangement options include in-service (non-intrusive) loopbacks, Dying Gasp, RMON Group 1 statistics, errored symbol and frame events, and real-time analog information for power and temperature, and histograms to track trends for power, temperature, voltage, bandwidth, etc.

Addressing your Requirements

The Metrobility R5000 by Telco Systems is a 17-slot, 2-U, rackmounted NEBS Level 3 certified chassis that may be configured with dual, load-sharing AC or DC power supplies for high-availability applications. The chassis supports one (1) management card to enable an SNMP-based element manager.

Line cards in the R5000 are equipped with ITU-grid CWDM optics which, in most cases, are small form-factor pluggable (SFP). SFP optics makes this solution extremely flexible, allowing the quick replacement or exchange of optics as the customer's needs change. Service providers can mix and match line cards which support data rates ranging from 45Mbps to 2.7Gbps.

The R5000 resides at the central office where it serves as the optical-electrical-optical (OEO) interface between the service provider's switch and Telco Systems' R4000 CWDM Multiplexer.

The R4000 supports 2 CWDM modules. Modules may be either 4 or 8-channel multiplexers. By using an expansion port on the 4-channel multiplexer, up to 16 wavelengths may be multiplexed over a singlemode fiber pair.

A second R4000 at the customer premise is equipped with optical add/drop multiplexer (OADM) modules for add/drop capabilities.

The OEO interface at the customer site is either a line card housed in one of the Metrobility family chassis (R1000 or R200) or the RA21 standalone optical network unit (ONU) which supports the ITU-grid CWDM optics. The R1000, a 2-slot rackmounted chassis, the R200, a single-slot standalone unit, and the RA21 provide the connection to the customer's switch.

Central Office

R5000
17-slot Interface Chassis

- Connects to existing copper or fiber switch
- Provides OEO interface and enables management capabilities
- Supports up to 16 channels utilizing standard ITU Grid optics

R4000
CWDM Chassis

- Multiplexes wavelengths from R5000 onto a single fiber pair
- Passive optics require no power
- Supports 8-channel and 4-channel multiplexer modules (2 per chassis)
- Expansion port on 4-channel multiplexer

Customer Premise

R1000
2-slot Interface
Rack-mounted Chassis

RA21
Optical Network Unit

R200
Single-slot Interface
Standalone Chassis

- Connects to customer's existing copper or fiber switch
- Provides secure demarcation point between the provider's network and the customer's network

R4000
CWDM Chassis

- Supports 2 modules
- Passive optics require no power
- OADM modules allow drop & pass or drop & add options
- Connects to chassis or Optical Network Unit

Access and Services Line Cards
(with remote management)

Access Line Card
(fixed optics)

Services Line Cards
(SFP optics)

Transport Interface Line Cards

Multi-Rate Line Card
(SFP optics)

Gigabit Line Card
(SFP optics)

Line Protection
and Restoration
Line Card (SFP optics)

Product Options

CWDM Passive Components

R4000 Chassis

- 2-slots supports 2 passive optic modules
- NEBS Certified
- No power required

R4000 Modules

- 4-channel multiplexer module with expansion port
- 8-channel multiplexer module
- 4-channel multiplexer module with extended temperature optics
- Drop & Pass modules
- Drop & Add modules

CWDM Active Components

R5000 Chassis

- Rugged 2-U chassis with optional redundant AC or DC power
- 17-slots supports multiple types of line cards
- Optional management card
- NEBS Level 3 certified with DC power

R1000 Chassis

- Rugged 1-U chassis with AC or DC redundant power
- 2-slots supports multiple types of line cards or one (1) line card and one (1) management card
- NEBS Level 3 certified with DC power

R200 Chassis

- Standalone chassis with internal AC power
- Single slot supports one (1) line card

Line Cards

- 100Mbps Access Line Card (R231)
- 10/100Mbps Service Line Card (R821)[1]
- 10/100/1000Gbps Service Line Card (R851)[1]
- 1Gbps Interface Line Card (R153)[1]
- 1Gbps LPR Line Card (R752)[1]
- Multi-Rate Interface Line Card (R380)[1]

RA21 Optical Network Unit

- 10/100Mbps Standalone

[1] SFP optics

Supported Wavelengths

Mux/DeMux	1310	1330	1350	1370	1390	1410	1430	1450	1470	1490	1510	1530	1550	1570	1590	1610
R416-A4-A*													•	•	•	•
R416-A4-B*									•	•	•	•				
R416-A4-C*					•	•	•	•								
R416-A4-D*	•	•	•	•												
R416-B4									•	•	•	•	•	•	•	•

* Also available with extended temperature optics

Line Cards	1310	1330	1350	1370	1390	1410	1430	1450	1470	1490	1510	1530	1550	1570	1590	1610
1Gbps	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
100Mbps									•	•	•	•	•	•	•	•
Multi-Rate	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
1Gbps LPR	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Standalone	1310	1330	1350	1370	1390	1410	1430	1450	1470	1490	1510	1530	1550	1570	1590	1610
10/100Mbps									•	•	•	•	•	•	•	•

Supported Features

Feature	R231	RA21	R821	R851	R153	R752	R380
Speed	100Mbps	10/100Mbps	10/100Mbps	10/100/ 1000Mbps	1Gbps	1Gbps	45Mbps - 2.7Gbps
SFP Optics			•	•	•	•	•
Copper-to-fiber conversion	•	•	•	•	•	•	
MM-to-SM fiber conversion	•		•	•	•	•	•
Optical Power Measurement	•	•	•	•	•	•	•
Remote Loopback	•	•	•	•			•
Link Loss Carry Forward	•	•	•	•	•	•	•
Link Loss Return	•	•	•	•	•		•
Far End Fault	•	•	•	•			
Rate Limiting	•		•				
LPR						•	
3 R's			•	•	•	•	•
Remote Site Management	NetBeacon WebBeacon	NetBeacon WebBeacon	SNMP Secure IP 802.3ah NetBeacon	SNMP Secure IP 802.3ah NetBeacon			

For more information on Metrobility CWDM solutions by Telco Systems, contact Telco Systems at sales@telco.com or call us at 1.781.551.0300, or toll-free in the US at 1.800.221.2849.

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