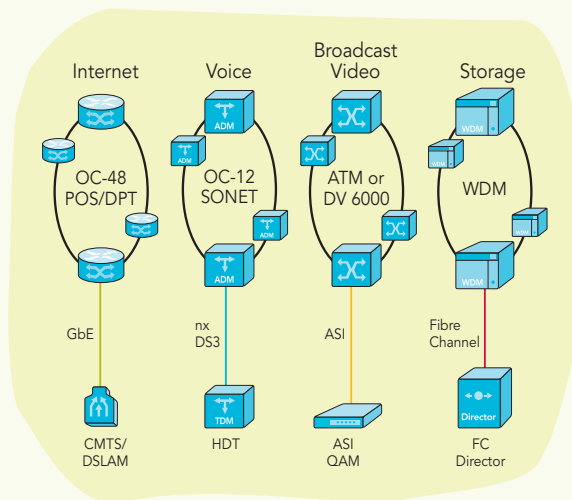


# Converged Transport Networks

**ARE YOU A DECISION MAKER FOR YOUR ORGANIZATION'S METRO/REGIONAL TRANSPORT NETWORKING NEEDS?** If the answer is yes, then you will likely need to consider the following questions when making decisions about how to handle the inevitable migration from circuit switched Time Division Multiplexing (TDM) networks to IP-based packet switched networks:

- » Are you operating multiple overlay networks including ATM, POS and DPT/RPR for legacy high-speed data; Gigabit Ethernet (GbE) for Video On Demand and recent data growth; SONET/SDH for circuit voice Host Digital Terminals (HDTs); and, if you're a cable operator, ASI/DV6000 for broadcast video?
- » Are you running out of fiber capacity for Triple-Play growth?
- » Are you looking for cost-effective means to transport GbE/10GbE for Converged Triple-Play services?
  - » But are you worried about investing in a new transport infrastructure that does not support legacy connectivity, or requires replacement of SONET/SDH line cards with GbE/10 GbE cards within the next two years?
- » Are you considering deploying Reconfigurable Optical Add/Drop Multiplexers (ROADMs) without understanding the business case?
- » If you are a cable operator, are you considering offering business services to compete directly with traditional telcos, but are uncertain about what services and protocols customers are asking for, and where—all of which would drive up Operational Expense (OPEX) and Capital Expense (CAPEX)?
- » Does your current network look like the diagram below?

Service providers and cable operators worldwide need to converge their networks in order to consolidate infrastructure and operations and in the process reduce OPEX. But, several problems exist in today's business model for convergence. For example, many network operators are also in the middle of massive TDM-to-IP/Ethernet transitions, and many of the line cards being purchased today will have to be replaced and written off in the near



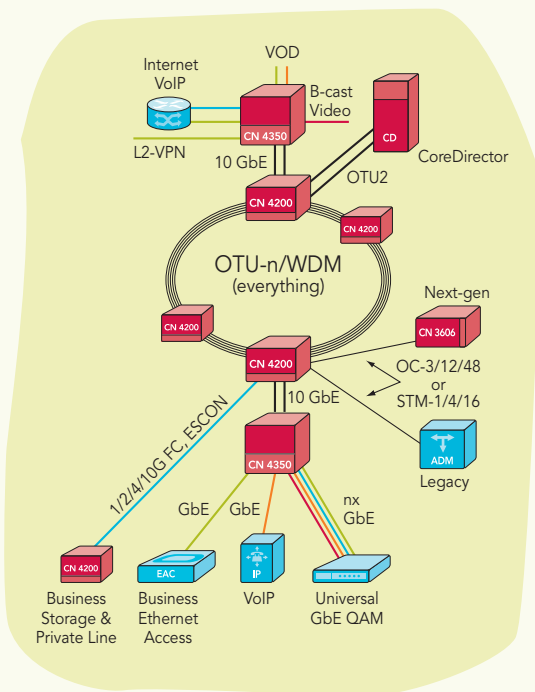
The network overlay approach results in multiple networks specific to a service or protocol. These multiple networks are expensive to deploy and maintain and difficult to manage.

## FEATURES & BENEFITS

- » FlexiPort modules are completely programmable as either a transponder, muxponder, ADM or cross-connect
- » Unprecedented network flexibility using FlexiPort provides the ability to change and upgrade services on existing ports—allowing you to efficiently migrate your infrastructure as the service environment changes
- » Comprehensive SONET/SDH-like performance monitoring to support even the most stringent SLA's
- » Considerable OPEX and CAPEX savings driven by reduced sparring requirements, reduced time and resources required to provision services and improved wavelength efficiency
- » Guaranteed investment protection—all modules are reusable for new protocols and services; support for future services requires only simple software/firmware downloads
- » Eliminates stranded capacity through efficient grooming of sub-wavelength services
- » 10G capability—including tunable DWDM

future. In addition, the network churn during this transition presents a real challenge for network planning impacting both CAPEX and OPEX in a significant way.

**CIENA'S CONVERGED NETWORK SOLUTION IS A MULTI-PLATFORM SET.** Ciena's CN 4200™ FlexSelect Advanced Services Platform is the metro cornerstone of Ciena's FlexSelect architecture. It is the industry's first truly multiservice system capable of supporting virtually any service type at any speed from 10 Mb/s to 10 Gb/s in the same shelf using only two module types. Each interface is fully programmable to support any protocol so that services can be provisioned, upgraded and changed in-service along the entire path from a remote location. It can support any combination of OC-3/12/48, STM-1/4/16, ESCON™, FICON®, Fibre Channel (FC) 100/200/400, GbE, 1000BaseT, OTU-1 and GDPS services on a single module and any 10G service including OC-192/STM-64, 10GbE LAN/WAN, FC1200 or OTU-2 on a second module—that's it. And, it also supports CWDM, DWDM—or even a combination of both—for maximum flexibility and scalability.



The CN 4200 can switch/aggregate multiple services onto a single fiber and drop it at any location on the network.

Operational advantages of the CN 4200 architecture include:

- » **Up to 66% fewer spares than conventional MSPPs or next-gen SONET/SDH platforms**—Fewer spares required because there are only two module types.
- » **Up to 78% improved wavelength efficiency**—Improvement allows you to map any service to any wavelength that has enough capacity and directs services to any port—on any line module, at any location.
- » **Improved provisioning times of up to 95%**—Combining capabilities with the remote software configurability means there is substantially less up-front network planning.
- » **Highest density**—Up to 24 client/network ports in a 4-rack unit (4RU) shelf.
- » **Carrier-grade availability and security features**—Features include Ciena-standard 6 nines (99.999%) availability; hitless software upgrades using separated control and data planes; secure software and management to protect network from unauthorized personnel and intruders; optional protection on a per-service or per wavelength basis; SONET/SDH-like fault detection and isolation for any service type.

**THE CN 4350™ ETHERNET SERVICES PROVISIONING SWITCH**

is currently the only switch on the market designed specifically to guarantee delivery of video and voice packets, with bounded sub-10 microsecond delay and jitter even under fully loaded or oversubscribed conditions. Because CN 4350 10GbE interfaces can be equipped with transport-grade tunable 10G OTU2 interfaces, significant further cost savings are possible by eliminating a 10GbE transponder on the CN 4200.

**THE CIENA COREDIRECTOR®** can also provide high density Ethernet aggregation on the new PALM (Packet Aware Line Module) line card and provide OTU2 handoffs to the CN 4200 for transport. The CN 3606 is a next-gen SONET/SDH multiplexer providing a cost-effective solution for high density T1/E1 and T3/E3 aggregation on to higher speed uplinks.

Other products in the portfolio using the FlexiPort technology include the CN 2000™ and DN 7000™ Series. The CN 2000 allows seamless migration from ESCON to FC and GbE interfaces when WDM transport is paired with storage extension applications, all without requiring any new equipment. In addition, because of the Adaptive WAN technology, the bandwidth mix can be adaptively assigned over the course of a day (e.g., ESCON, FC, and GbE). In the case of the DN 7000 Series, the dual ATM/FR and IP/MPLS

functionality and control plane allows an operator to move traffic over from the legacy ATM infrastructure to a new IP/MPLS infrastructure, without having to change out customer equipment or maintain parallel networks.

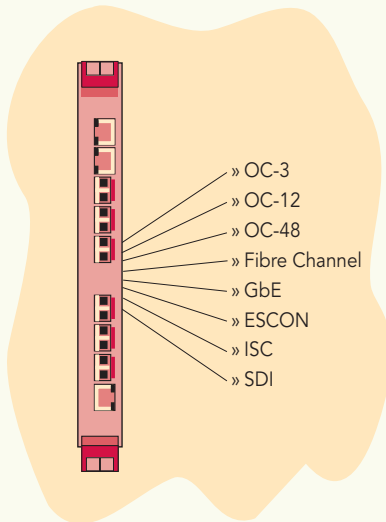
**MULTISERVICE TRANSPORT USING DIGITAL WRAPPER TECHNOLOGY**

The CN 4200 is a multiservice switching, aggregation, and transport platform that allows carriers to groom lower-speed TDM and data signals, such as OC3/STM-1 and Gigabit Ethernet into a higher-speed OTU-1 (2.7Gb/s) transport stream,

while maintaining true transparency for each client signal. Using the CN 4200's innovative timeslot technology, service providers are free to aggregate both like and unlike services into a consolidated OTU-1 signal that can be dissembled at various downstream ADM sites as desired.

The CN 4200 uses ITU G.709 OTU-1 Digital

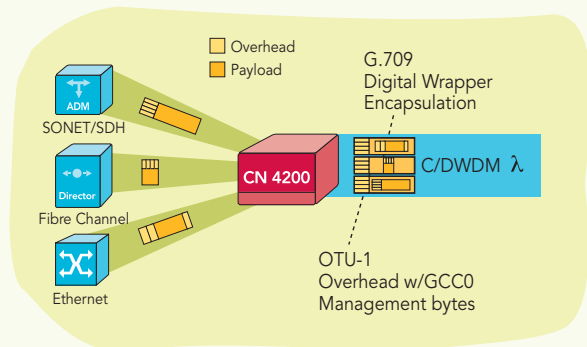
Wrapper Technology as the unifying basis of its multiservice transport functionality. Digital Wrapper provides a standardized frame-based encapsulation mechanism for transponding OC-48/STM-16 signals through an Optical Transport Network (OTN). Equally important however, the OTU-1 frame offers a convenient means of aggregating two or more like or unlike services into one unified frame that can be demultiplexed in part or whole at downstream CN 4200 nodes as desired.



M6S FlexiPort Module

The CN 4200 has both AC and DC power options so that it can be located either in the corporate office or in the data center. The M6S Module has six interface ports that can accept any client signal on any port including SONET/SDH, GbE, ESCON, FICON, FC100 and FC200.

With the CN 4200, OTU-1 transport is done at the wavelength level. Through TDM techniques, the OTU-1 signal may comprise one or more lower-rate sub-wavelength or client signals such as FC or Gigabit Ethernet. When networking multiple wavelengths over common fibers, OTU-1 services are managed in the optical domain using optical filters, but the client services within a wavelength are networked electronically using the switch fabric. This combination of optical muxing at the transport layer, coupled with the service aggregation at the client layer, gives operators unparalleled opportunities for satisfying true multiservice transport over a common network infrastructure.



G.709 Digital Wrapper encapsulates other protocols for transparent transport on a common optical channel.



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