

G-Series Gigabit Ethernet Card (G1K-4) for Cisco ONS 15454 SONET/SDH MSPP

The G-Series Gigabit Ethernet card for the ONS 15454 platform enables the delivery of carrier-class, private line Ethernet services. The ONS 15454 enables service providers and enterprise customers to seamlessly migrate their networks, from offering/transporting TDM services, or Ethernet/ATM over TDM, to Ethernet services over a single network, eliminating the operation of multiple overlay networks to support currently deployed services. Gigabit Ethernet Networking Flexibility in the Optical Metro Network.

The Cisco ONS 15454 is the industry's leading metro optical transport platform, with over 1000 customers and 30,000 systems deployed worldwide. The ONS 15454 combines supercharged SONET/SDH transport, integrated optical networking including ITU Grid Wavelengths and DWDM, unprecedented multiservice interfaces on demand including Ethernet and TDM to deliver radical economic benefits to service providers. The ONS 15454 provides the functions of multiple network elements in a single platform. As part of Cisco's unrivaled IP+Optical product line, the ONS 15454 combines the capacity of optical transport with the intelligence of IP to cost-effectively deliver next generation voice and data services.

Cisco's metro optical transport leadership also extends to Ethernet service capability. The ONS 15454 began offering Ethernet service capabilities in early 1999. Service providers want to provide Ethernet to their customers due to its lower cost, ubiquitous service, and bandwidth scalability. A key differentiator for service providers is their ability to offer TDM, Ethernet, and IP based services to their customers.

With the introduction of a new four-port Gigabit Ethernet (GigE) card, model G1K-4, for the ONS 15454 Optical Transport Platform, service providers can now deliver Gigabit media flexibility without building an overlay network or redesigning their existing SONET infrastructure. The unprecedented TDM capabilities of the ONS 15454, combined with high density DWDM optics and the evolutionary four-port GigE card, enables service providers to deliver on the key market differentiators needed to ensure their success.

Figure 1
Cisco G-Series Gigabit
Ethernet Card.



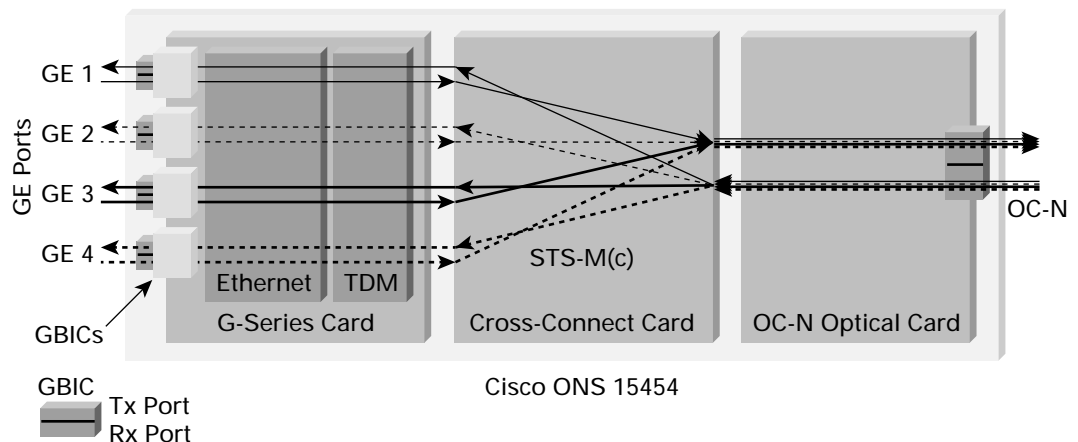


Product Overview

The Cisco ONS 15454 G-Series Gigabit Ethernet card is a four-port, 1000 Mbps Ethernet module using pluggable Gigabit Ethernet interface converter (GBIC) optical modules for the flexible interface support to multiple types of client equipment. The G-Series card has four “virtual” SONET/SDH interfaces that can be mapped to optical transport cards via the cross-connect cards within the ONS 15454 chassis. These virtual ports are scalable in size from STS-1 (~50 Mbps) to STS-24c/VC-4-8c (~1.25 Gbps), or an aggregate of 2.5 Gbps total virtual port bandwidth per card.

There are two operating modes for the G-Series card, cross-connected and transponder. In cross-connected mode, the Gigabit Ethernet client interfaces each get encapsulated into a SONET/SDH payload and exits the G-Series card through the virtual ports for cross-connection to the optical interfaces, outlined in Figure 2.

Figure 2
G-Series Cross-Connected Operating Mode

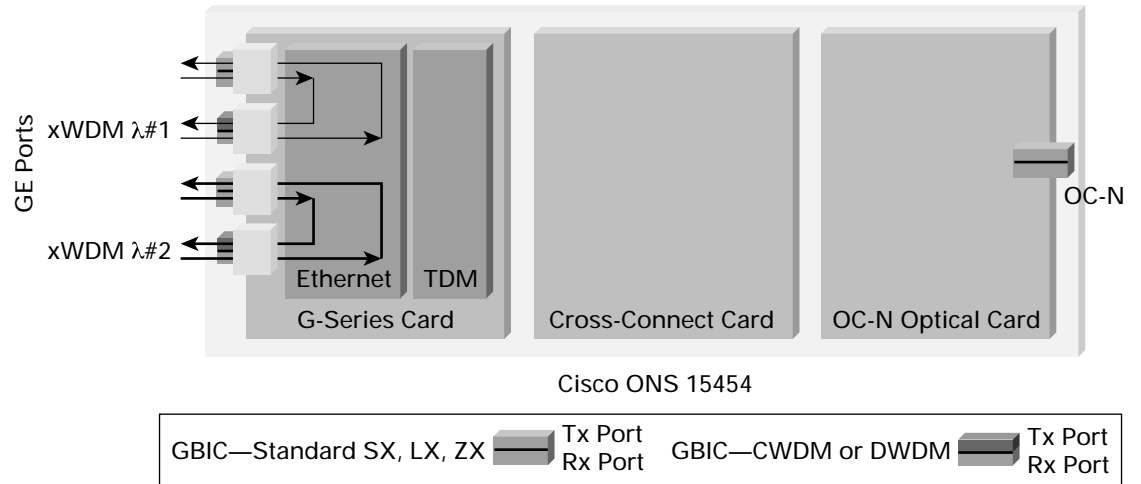


The G-Series payloads can be transported over protected circuits (UPSR, path protected mesh network (PPMN), BLSR, and 1+1) or unprotected circuits, providing the level of resiliency specified by the network administrator or available bandwidth.



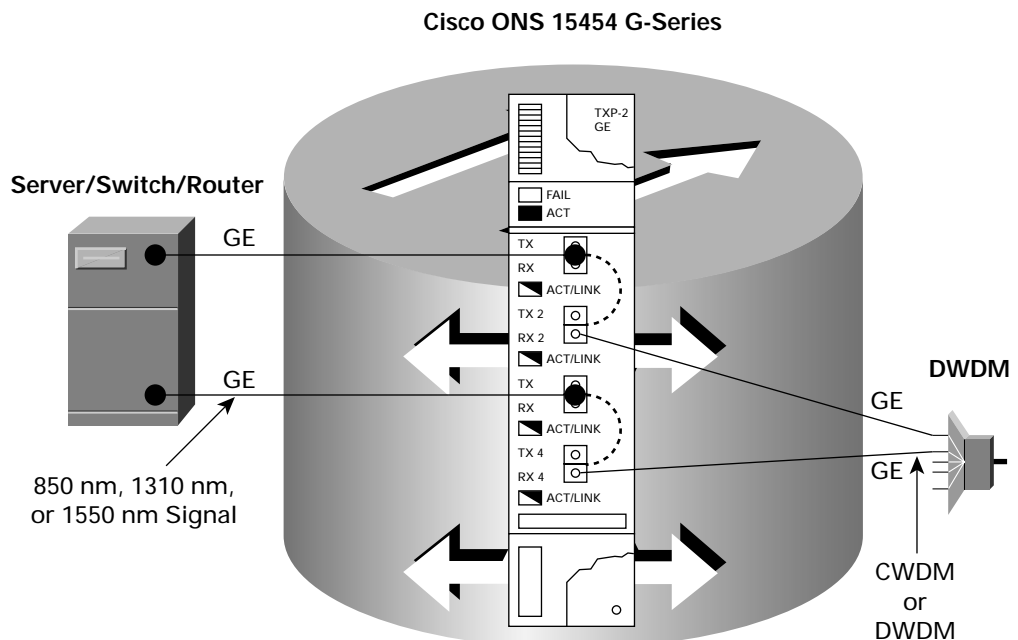
In transponder operating mode, the Gigabit Ethernet client interfaces each get directed, within the G-Series card, to another Gigabit Ethernet client interface on the same G-series card, never accessing the SONET/SDH encapsulation process or the virtual ports, as detailed in Figure 3.

Figure 3
G-Series Transponder Operating Mode



This enables a wideband optical signal from a switch/router/server to be converted to a CWDM or a DWDM wavelength to deliver a scalable transport solution for Gigabit Ethernet based services (see Figure 4).

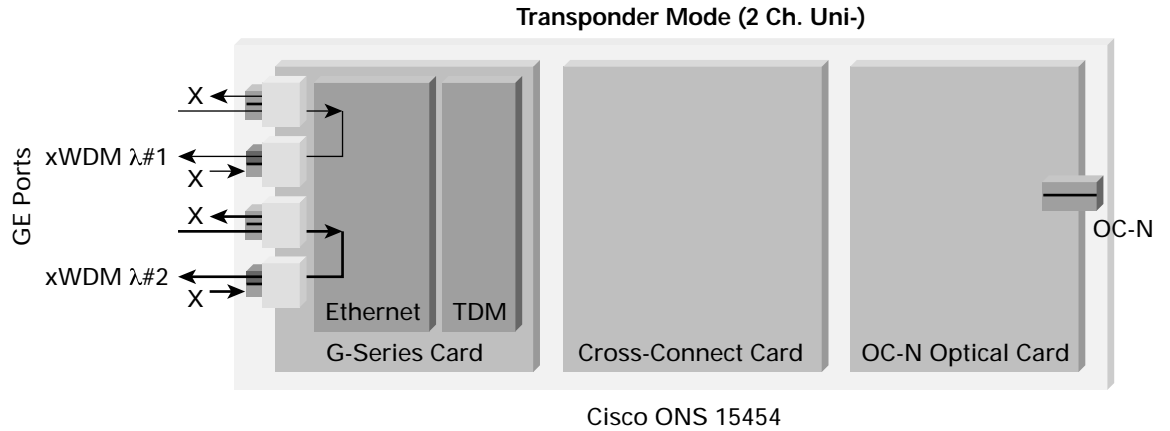
Figure 4
G-Series Transponder Application



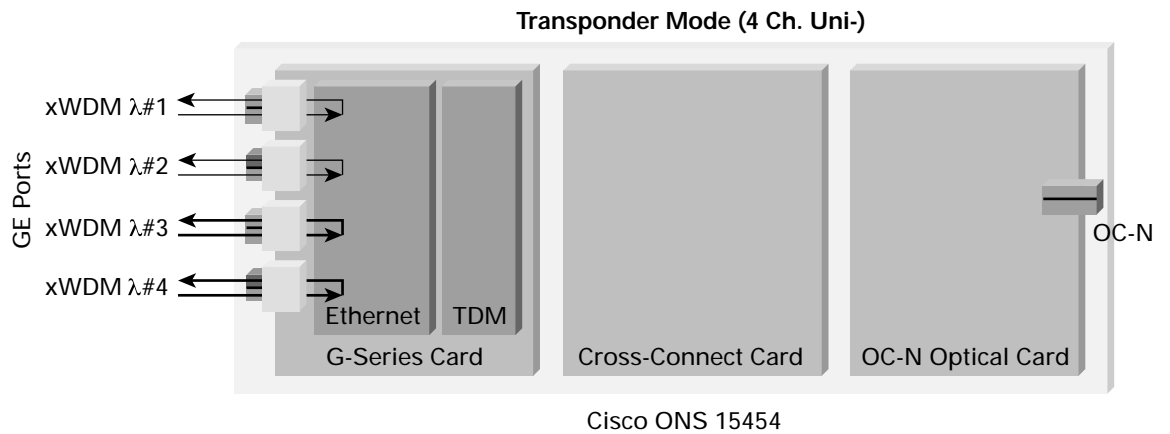


The transponder mode will support both bidirectional and unidirectional Gigabit Ethernet signals, enabling servicing of different application types (Figures 5).

Figure 5
G-Series Unidirectional Transponder Modes



GBIC—Standard SX, LX, ZX		Tx Port	Note: This Configuration Must be Used When the Client Terminal's Optical Signal is Multimode, 850 nm.
		Rx Port	
GBIC—CWDM or DWDM		Tx Port	
		Rx Port	
Unused Port	X		



GBIC—Standard SX, LX, ZX		Tx Port	Note: This Configuration Can be Used When the Client Terminal's Optical Signal is Single mode, 1310 nm, 1550 nm, or 15xx.xx nm.
		Rx Port	
GBIC—CWDM or DWDM		Tx Port	
		Rx Port	



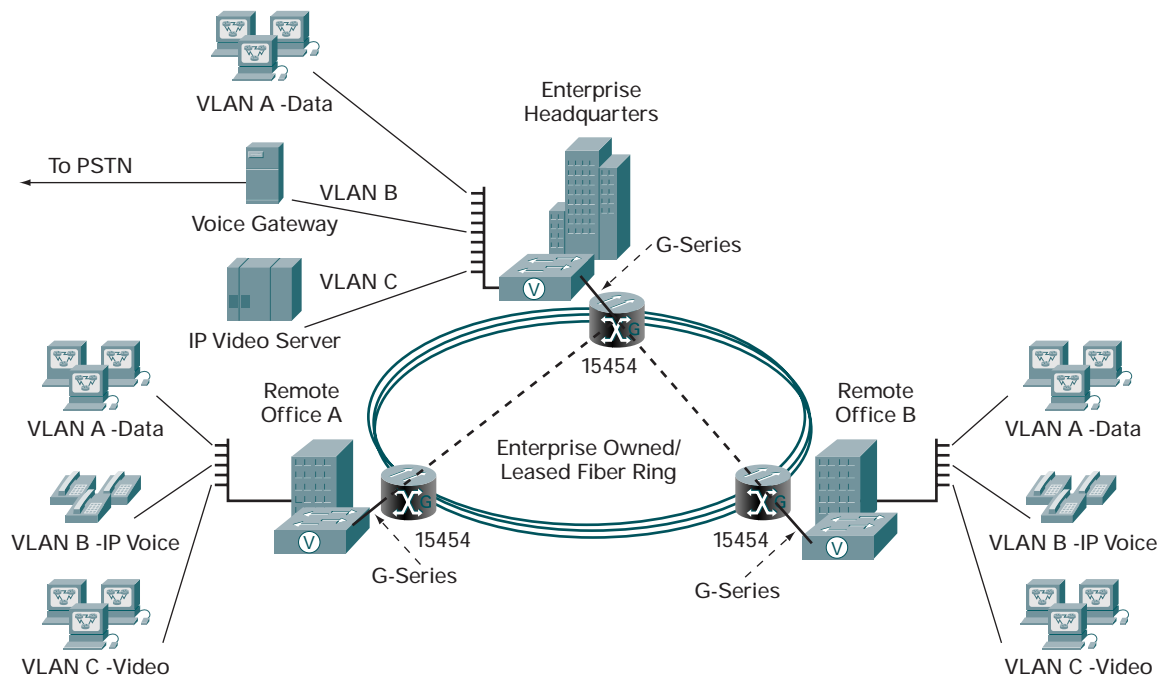
Applications

The Cisco ONS 15454 G-Series product provides the flexibility to meet the demands of a wide variety of network applications found within many customer networks. The following diagrams outline a few of the applications that can be met using the G-Series cards.

Reliable Enterprise Networking

The ONS 15454 equipped with the G-series card allows the enterprise user to build a highly reliable, multiservice network to support their video, voice, and data network (see Figure 6). Additionally, the ONS 15454 based network provides the flexibility to support traditional TDM based services along with Ethernet services, enabling a evolutionary network growth versus a revolutionary, risky implementation. The ONS 15454 provides transport scalability from 155 Mbps (OC-3/STM-1) up to 320 Gbps (32 wavelength of 10 Gbps), positioning the enterprise network for future growth.

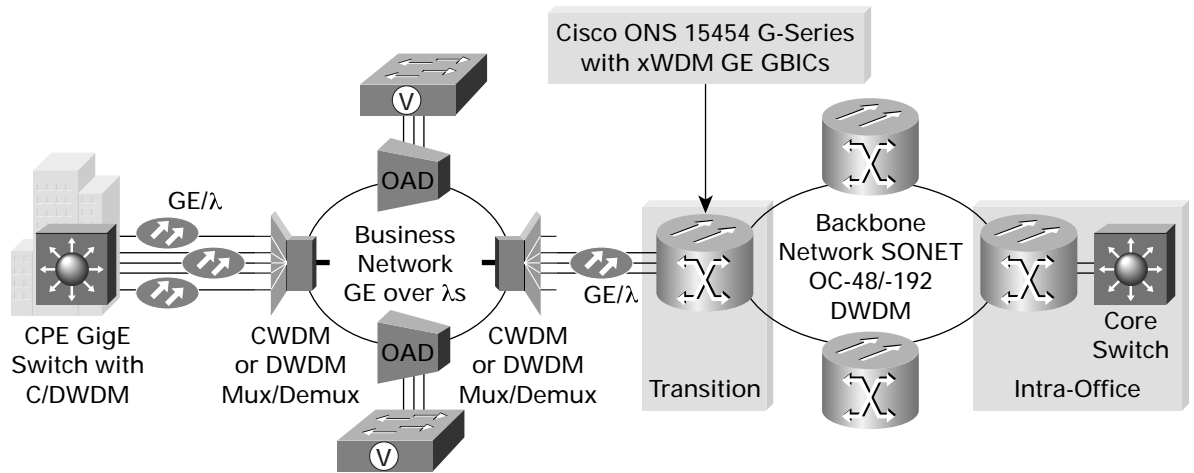
Figure 6
Reliable Enterprise Networking





Service providers can also leverage CWDM and DWDM GBICs in the G-Series card to allow for a scalable access network, as shown in Figure 7.

Figure 7
Service Provider Scalable Access Network Using Gigabit Ethernet Wavelengths

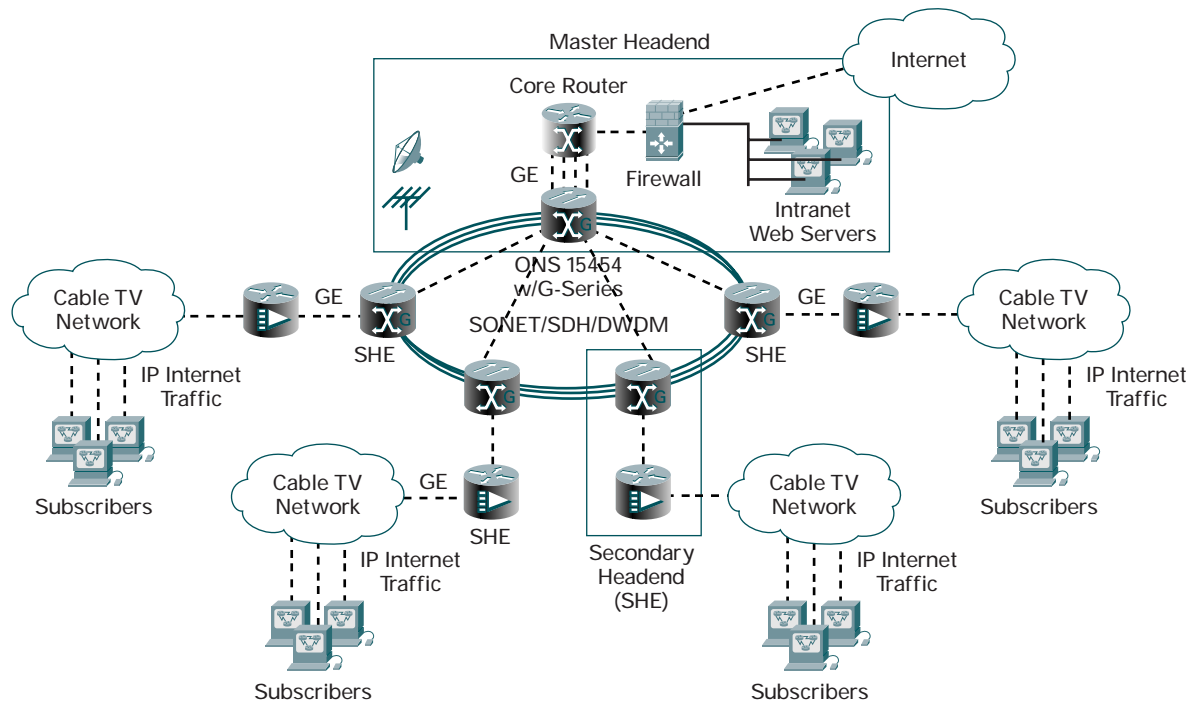


Private Line Gigabit Ethernet

Metropolitan networks deliver services to end user customers. As such, a metropolitan network that supports a wide range of service capabilities will allow the service provider to offer a tariff mix to meet the customer's needs. The Cisco ONS 15454 provides the foundation for building an advanced multiservice network over an extremely reliable SONET/SDH infrastructure (see Figure 8). The G-Series Gigabit Ethernet card enables the delivery of data services, such as transparent LAN services (TLS) or Internet access, over a carrier-class optical infrastructure supporting traditional TDM services. The G-Series solution enables the service provider to offer a wide variety of Ethernet service-level agreements (SLA), using the scalable transport capability and network protection via SONET UPSR, BLSR, Linear 1+1, or unprotected transport capabilities offered by the platform. It is also very important for the network to be manageable and usable by the service provider's technicians. The provisioning of an Ethernet circuit over a G-Series equipped network is easy by leveraging the ONS 15454's embedded A-Z circuit provisioning wizard for network level circuit creation. The G-Series card also supports TL-1 based provisioning to simplify integration with many embedded service provider management systems.



Figure 9
Cable Television Data Networking



The above are just a few of the applications that can be cost-effectively deployed leveraging the ONS 15454 with the G-Series modules.

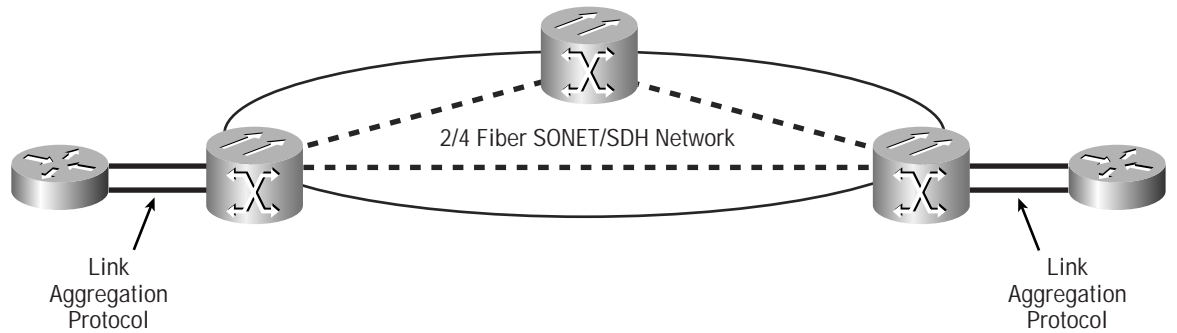
Flexible Gigabit Networking

The ONS 15454 coupled with the G-series gigabit Ethernet card, provides the following capabilities:

- No Overlay Networks
- Carrier Class Ethernet
 - 50 ms via SONET/SDH Protection
 - Client Interface Protection Leveraging Gigabit Etherchannel/Link Aggregation on Connected Devices (see Figure 8)
 - Hitless Software Upgrades
- Integrated DWDM
- Seamless, Remote GE Circuit Bandwidth Upgrades via integrated Cisco Transport Controller (CTC)
- Efficient Gigabit Packing, up to 256-wire speed GE per METRO ring (OC-192/STM-16 ITU Optics @ 100 GHz)
- Multiple Management options with CTC, Cisco Transport Manager (CTM), TL1 (for SONET only), and SNMP



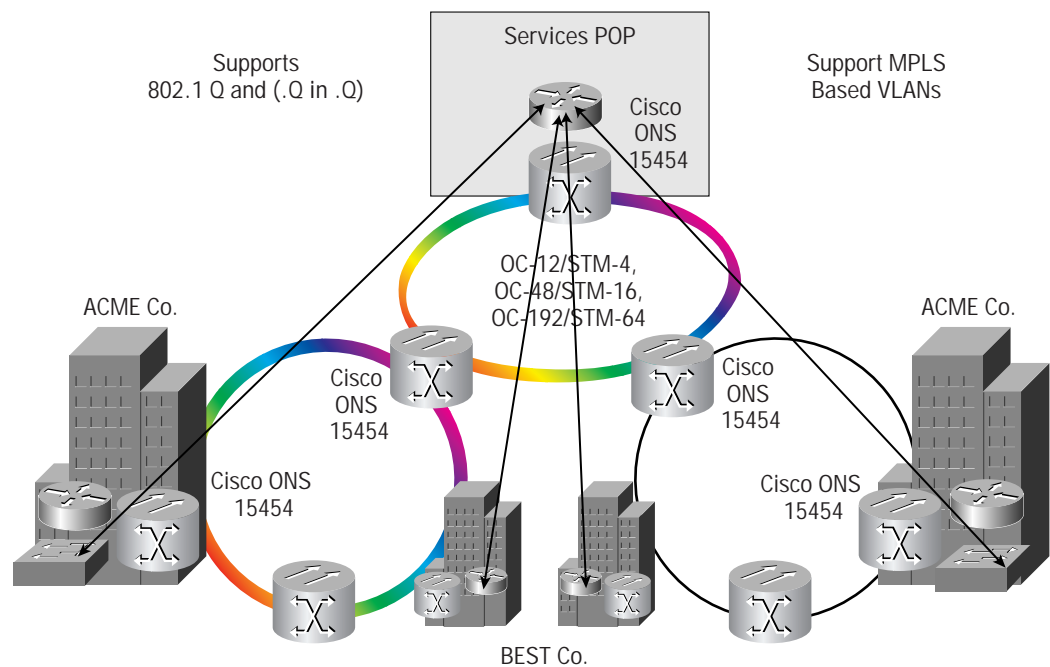
Figure 10
Carrier Class Ethernet



Managing the Optical Transport Platforms

Provisioning and managing an optical transport device with CTM's Java-based graphical user interface (GUI) is easier than ever. CTM is the carrier-class element management system (EMS) for the Cisco ONS 15000 series product line. CTM provides advanced capabilities in the functional management areas of configuration, faults, performance, and security for Cisco optical network elements, subnetworks, and networks. CTM is based on a client/server architecture that scales to support up to 1000 network elements and 100 simultaneous clients. CTM is a key enabler for automation of the OSS through the northbound interfaces to a network management system (NMS) or operations support system (OSS).

Figure 11
VPN Scalability





Cisco Transport Manager

- Scalable client/server element management system (EMS) for Cisco optical transport products
- Integrated element manager for Cisco 15xxx optical platforms
- Java-based client, Solaris-based server, Oracle database
- Full fault, configuration, performance, and security management
- Tree-based network explorer, topology map, graphical cross-connect map
- CORBA, TL1(for SONET only), SNMP northbound interfaces for OSS integration
- CTM support for 15454 SDH with CTM r3.1

Cisco Transport Controller

- Integrated Java-based node and sub-network control
- Consistent GUI for Cisco ONS 15454 and Cisco ONS 15327
- Full node control: provisioning, alarm, maintenance, performance
- Sub-net control: auto-discovery, topology map with drill-down, A-Z circuit provisioning, sub-net alarm control

TL-1 (for SONET)

- Support for fault, inventory, provisioning, and performance

SNMP

- Support for fault, inventory, and performance monitoring

Features and Specifications

Compact Design

- Single width card slot design for increased shelf flexibility and scalability
- Up to 12 G-Series cards per shelf assembly
- Up to 16 line-rate (or 32 sub line-rate) GE circuits per shelf over 2 protected 10 Gbps SONET/SDH DWDM wavelengths
- Up to 64 line-rate (or 128 sub line-rate) GE circuits per seven foot bay over 8 SONET/SDH DWDM wavelengths
- Up to 24/48 bidirectional/unidirectional transponder Gigabit Ethernet circuits per shelf assembly
- Up to 96/192 bidirectional/unidirectional transponder Gigabit Ethernet circuits per ANSI 7 foot bay

Data Architecture Options

- Point-to-point
- Hub and spoke via multiple circuits



Optical Transport Options

- UPSR/SNCP
- 2F- and 4F-BLSR/MS-SPR
- APS/SNC (1+1 uni- or bidirectional)
- Path Protected Mesh Networking (PPMN)
- Unprotected (0+1)

Regulatory Compliance¹

SONET/ANSI System

Countries

- Canada
- USA
- Mexico
- Korea
- Japan
- EU

EMC Emissions (Radiated, conducted)

- ICES-003
- GR-1089-CORE
- 47CFR15
- VCCI V-3/2000.04
- CISPR24

EMC Immunity

- GR-1089-CORE
- CISPR24
- EN50082-2

Safety

- CAN/CSA-C22.2 No. 60950-00 Third Ed., 12/1/2002
- GR-1089-CORE
- GR-63-CORE
- TS001

Environmental

- GR-63-CORE
- AT&T Network Equipment Design Specification (NEDs)

Structural Dynamics

- GR-63-CORE
- AT&T Network Equipment Design Specification (NEDs)

Power and Grounding

- SBC (TP76200MP)
- ETS 300-132-1 (DC power)

SDH/ETSI System

- EU
- Australia
- New Zealand
- Singapore
- China
- Mexico
- Hong Kong
- Korea

- EN 300 386-TC
- EN50081-1
- EN55022
- AS/NZS3548, Amendment 1 + 2 1995

- EN300-386-TC
- EN55024

- UL 60950 Third Ed., 12/1/2000
- EN60950 (to A4)
- IEC60950/EN60950, 3rd Ed.
- AS/NZS3260 Supplement 1,2,3,4, 1997

- ETS 300-019 (Class 3.1E) (Note 2)

- ETS 300-019 (Class 3.1E) (Note 2)

- ETS 300-253 (grounding)

1. Equipment homologation will occur in stages. Please contact your account manager to determine if country homologation has been completed.



Table 1 System Requirements

Component	ONS 15454 SONET	ONS 15454 SDH
Processor	TCC +, TCC2	TCCI, TCC2
Cross-connect	XC, XC-VT, XC-10G	XC-10G, XC-VXL-10G, XC-VXL-2.5G
Shelf Assembly	NEBS/NEBS3E/ANSI versions with appropriate fan tray assembly	ETSI version with SDH 48V fan tray assembly
System Software	R3.2.0 or greater ^{1, 2}	R3.3.0 or greater ²
Slot Compatibility	XC & XC-VT: slots 5, 6, 12, 13 XC-10G: slots 1 to 6, 12 to 17	XC-10G, XC-VXL-2.5G, XC-VXL-10G: slots 1 to 6, 12 to 17

1. Operation with XC or XC-VT cross-connect card requires G-1K-4 card and a minimum of Release 4.0 software.
 2. Transponder mode, CWDM and DWDM GBICs require R4.1.0 or greater software.

Table 2 Specifications

Attribute	G-1K-4 Specification
Client Interfaces	
Ports	<ul style="list-style-type: none"> • Card • Shelf (max 12 cards) • Rack (max 4 shelves)
Speed	1000 Mbps
Auto negotiation of duplex mode	Yes
Flow control - pause (802.x)	symmetric (asymmetric < R4.0)
SONET/SDH Virtual Interfaces	
Ports	4
Speed	<ul style="list-style-type: none"> • SONET: STS-1, -3c, -6c, -9c, -12c, -24c, -48c • SDH: VC-4, -4-2c, -4-3c, -4-4c, -4-8c, -4-16c
Maximum Card Bandwidth	<ul style="list-style-type: none"> • SONET: STS-48 • SDH: VC-4-16
Encapsulation	LAN Extension Protocol (LEX)
Circuit type	Point-to-point only (no shared packet ring)
Network Protection Types	<ul style="list-style-type: none"> • Ring - UPSR/SNCP, BLSR/MS-SPR (2-fiber and 4-fiber) • Linear - 1+1 APS/SNC • Mesh protection - Path protected mesh networking • Unprotected - 0 + 1



Table 2 Specifications

Attribute	G-1K-4 Specification
Ethernet	
VLAN	Transparent
Spanning tree	Transparent
MTU sizes	64 to 10,000 bytes
Link Aggregation	
• Client Interfaces	• Transparent
• Virtual Interfaces	• Transparent
Performance	
64 to 10,000 byte frames	Line rate (@ STS-24c/VC4-8c)
Statistics	
Ethernet Ports	Link status
• Receive	• Packets, bytes, total errors, giants, FCS errors, runts, jabbers, alignment errors, pause, packets dropped - internal congestion
• Transmit	• Packets, bytes, pause, packets dropped - internal congestion
Virtual ports (SONET/SDH)	HDLC errors
Management Interfaces	
Data	• Cisco transport controller (CTC) window • SNMP traps
Transport (SONET/SDH)	• CTC or TL-1 via Telnet or serial port • SNMP traps and TL-1 autonomous messages
Card LEDs	
• Failure (FAIL)	• Red
• Status (ACT)	• Green
Port LEDs (per port)	
• Link/Activity (LINK/ACT)	• Amber/Green (flash)
Performance Monitoring	
SONET (virtual ports)	Path termination device (PTE). The following SONET/SDH path alarms are supported: • Code violations (CV-P) • Errored seconds (ES-P) • Failure counts (FC-P) • Severely errored seconds (SES-P) • Unavailable seconds (UAS-P) Path trace (J1 byte) - Transmit and receive
SNMP Traps	• Spanning Tree Protocol traps: Bridge-MIB (RFC 1493) • Authentication trap: RFC 1157 • Link-up and Link-down traps for Ethernet ports: IF-MIB (RFC 1573) & SONET • SDH MIB (RFC 2558)



Table 2 Specifications

Attribute	G-1K-4 Specification
Power	
Card	63 watts (GBICs included)
Physical	
Size	<ul style="list-style-type: none"> • Single card slot • 32.13 H x 1.83 W x 22.86 D (cm) • 12.65 H x 0.72 W x 9.00 D (inches)
Weight	<ul style="list-style-type: none"> • 0.9 kg • 2.1 lb
Operating environment	
Temperature ¹	<ul style="list-style-type: none"> • -5 to +55 C • 23 to +131 F
Humidity	5 to 95%, non-condensing
Storage environment	
Temperature	<ul style="list-style-type: none"> • -40 to +85 C • -40 to +185 F
Humidity	5 to 95%, non-condensing

1. The ZX GBICs are only qualified in the temperature range from -5 to +50 Celsius. The operating temperature range with DWDM GBICs is -5 to +40 C and requires the latest G1K-4 card revision shipping at R4.1 FCS. See release notes for more details.

Table 3 Throughput Performance (as a percent of GE interface speed)

Frame Size Bytes	Transport Circuit Size						
	STS1 (SONET only)	STS3c/ VC-4	STS6c/ VC4-2c	STS9c/ VC4-3c	STS12c/ VC4-4c	STS24c/ VC-4-8c	STS48c/ VC-4-16c
64	5%	15%	30%	45%	60%	100%	100%
128	5%	15%	30%	45%	60%	100%	100%
256	5%	15%	30%	45%	60%	100%	100%
512	5%	15%	30%	45%	60%	100%	100%
1024	5%	15%	30%	45%	60%	100%	100%
1280	5%	15%	30%	45%	60%	100%	100%
1518	5%	15%	30%	45%	60%	100%	100%
10,000	5%	15%	30%	45%	60%	100%	100%

Table 4 Ordering Information

Part Number	Description
15454-G1K-4	1000 Mbps Ethernet card, 4 GBIC slots, L1 transport, SONET system
15454E-G1K-4	1000 Mbps Ethernet card, 4 GBIC slots, L1 transport, SDH system



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