ML-Series Card Overview

This chapter provides an overview of the ML1000-2, ML100T-12 and ML100X-8 cards for the ONS 15454 (SONET) and ONS 15454 SDH. It lists Ethernet and SONET/SDH capabilities and Cisco IOS and Cisco Transport Controller (CTC) software features, with brief descriptions of selected features.

This chapter contains the following major sections:

- ML-Series Card Description, page 1-1
- ML-Series Feature List, page 1-2
- Key ML-Series Features, page 1-5

ML-Series Card Description

The ML-Series cards are independent Gigabit Ethernet (ML1000-2) or Fast Ethernet (ML100T-12 and ML100X-8) Layer 3 switches that process up to 5.7 Mpps. The cards are integrated into the ONS 15454 SONET or the ONS 15454 SDH. An ONS 15454 SONET with a 10-Gigabit Cross-Connect (XC10G or XC-VXC-10G) card can host the card in any traffic card slot, but an ONS 15454 SONET with a Cross-Connect (XC) card or Cross Connect Virtual Tributary (XCVT) card can only host the ML-Series card in the four traffic slots. An ONS 15454 SDH can host the card in any traffic card slot with any cross-connect card.

The ML-Series card uses Cisco IOS Release 12.2(28)SV, and the Cisco IOS command-line interface (CLI) is the primary user interface for the ML-Series card. Most configuration for the card, such as Ethernet port, bridging, and VLAN, can be done only through the Cisco IOS CLI.

However, CTC, the ONS 15454 SONET/SDH graphical user interface (GUI), also supports the ML-Series card. SONET/SDH circuits cannot be provisioned through Cisco IOS, but must be configured through CTC or TL1. CTC offers ML-Series card status information, SONET/SDH alarm management, Cisco IOS Telnet session initialization, Cisco IOS configuration file management, provisioning, inventory, and other standard functions.

The ML100T-12 features twelve RJ-45 interfaces, and the ML100X-8 and ML1000-2 features two Small Form-factor Pluggable (SFP) slots supporting short wavelength (SX) and long wavelength (LX) optical modules. All three cards use the same hardware and software base and offer similar feature sets. For detailed card specifications, refer to the "Ethernet Cards" chapter of the *Cisco ONS 15454 Reference Manual* or the *Cisco ONS 15454 SDH Reference Manual*.

The ML-Series card features two virtual packet-over-SONET/SDH (POS) ports, which function in a manner similar to OC-N card ports. The SONET/SDH circuits are provisioned through CTC in the same manner as standard OC-N card circuits. The ML-Series POS ports support virtual concatenation (VCAT) of SONET/SDH circuits and a software link capacity adjustment scheme (SW-LCAS).

ML-Series Feature List

The ML-Series cards have the following features:

- Layer 1 data features:
    - 10/100BASE-TX half-duplex and full-duplex data transmission (ML100T-12)
    - 100BASE-FX full-duplex data transmission with Auto-MDIX (ML100X-8)
    - 1000BASE-SX, 1000BASE-LX full-duplex data transmission (ML1000-2)
    - IEEE 802.3z (Gigabit Ethernet) and 802.3x (Fast Ethernet) Flow Control
- SONET/SDH features:
    - High-level data link control (HDLC) or frame-mapped generic framing procedure (GFP-F) framing mechanism for POS
    - Two POS virtual ports
    - LEX, Cisco HDLC or Point-to-Point Protocol/Bridging Control Protocol (PPP/BCP) encapsulation for POS
    - VCAT with SW-LCAS
- Layer 2 bridging features:
    - Transparent bridging
    - MAC address learning, aging, and switching by hardware
    - Protocol tunneling
    - Multiple Spanning Tree (MST) protocol tunneling
    - 255 active bridge groups maximum
    - 60,000 MAC address maximum per card and 8,000 MAC address maximum per bridge group
    - Integrated routing and bridging (IRB)
    - IEEE 802.1P/Q-based VLAN trunking
    - IEEE 802.1Q VLAN tunneling
    - IEEE 802.1D Spanning Tree Protocol (STP) and IEEE 802.1W Rapid Spanning Tree Protocol (RSTP)
    - IEEE 802.1D STP instance per bridge group
    - Resilient packet ring (RPR)
    - Dual RPR Interconnect (DRPRI)
    - Ethernet over Multiprotocol Label Switching (EoMPLS)
    - VLAN-transparent and VLAN-specific services (Ethernet Relay Multipoint Service [ERMS])
- Fast EtherChannel (FEC) features (ML100T-12 and ML100X-8):
    - Bundling of up to four Fast Ethernet ports

- Load sharing based on source and destination IP addresses of unicast packets

- Load sharing for bridge traffic based on MAC addresses

- IRB

- IEEE 802.1Q trunking

- Active FEC port channels, maximum of 6 for the ML100T-12 and maximum of 4 for the ML100X-8

- Gigabit EtherChannel (GEC) features (ML1000-2):

  - Bundling the two Gigabit Ethernet ports

  - Load sharing for bridge traffic based on MAC addresses

  - IRB

  - IEEE 802.1Q trunking

- POS channel:

  - Bundling the two POS ports

  - LEX encapsulation only

  - IRB

  - IEEE 802.1Q trunking

- Layer 3 routing, switching, and forwarding:

  - Default routes

  - IP unicast and multicast forwarding

  - Simple IP access control lists (ACLs) (both Layer 2 and Layer 3 forwarding path)

  - Extended IP ACLs in software (control-plane only)

  - IP and IP multicast routing and switching between Ethernet ports

  - Reverse Path Forwarding (RPF) multicast (not RPF unicast)

  - Load balancing among equal cost paths based on source and destination IP addresses

  - Up to 18,000 IP routes

  - Up to 20,000 IP host entries

  - Up to 40 IP multicast groups

  - IRB routing mode support

- Supported routing protocols:

  - Virtual Private Network (VPN) Routing and Forwarding Lite (VRF Lite)

  - Intermediate System-to-Intermediate System (IS-IS) Protocol

  - Routing Information Protocol (RIP and RIP II)

  - Enhanced Interior Gateway Routing Protocol (EIGRP)

  - Open Shortest Path First (OSPF) Protocol

  - Protocol Independent Multicast (PIM)—Sparse, sparse-dense, and dense modes

  - Secondary addressing

  - Static routes

  - Local proxy ARP

- Border Gateway Protocol (BGP)
- Classless interdomain routing (CIDR)
- Quality of service (QoS) features:
  - Multicast priority queuing classes
  - Service level agreements (SLAs) with 1-Mbps granularity
  - Input policing
  - Guaranteed bandwidth (weighted round-robin [WDRR] plus strict priority scheduling)
  - Low latency queuing support for unicast Voice-over-IP (VoIP)
  - Class of service (CoS) based on Layer 2 priority, VLAN ID, Layer 3 Type of Service/DiffServ Code Point (TOS/DSCP), and port
  - CoS-based packet statistics
  - IP SLA network monitoring using Cisco IP SLA (formerly Cisco Service Assurance Agent)
- Security features
  - Cisco IOS login enhancements
  - Secure Shell connection (SSH Version 2)
  - Disabled console port
  - Authentication, Authorization, and Accounting/Remote Authentication Dial-In User Service (AAA/RADIUS) stand alone mode
  - AAA/RADIUS relay mode
- Additional protocols:
  - Cisco Discovery Protocol (CDP) support on Ethernet ports
  - Dynamic Host Configuration Protocol (DHCP) relay
  - Hot Standby Router Protocol (HSRP) over 10/100 Ethernet, Gigabit Ethernet, FEC, GEC, and Bridge Group Virtual Interface (BVI)
  - Internet Control Message Protocol (ICMP)
- Management features:
  - Cisco IOS
  - CTC
  - Remote monitoring (RMON)
  - Simple Network Management Protocol (SNMP)
  - Transaction Language 1 (TL1)
- System features:
  - Automatic field programmable gate array (FPGA) upgrade
  - Network Equipment Building Systems 3 (NEBS3) compliant
  - Multiple microcode images
- CTC features:
  - Framing Mode Provisioning
  - Standard STS/STM and VCAT circuit provisioning for POS virtual ports

- SONET/SDH alarm reporting for path alarms and other ML-Series card specific alarms
- Raw port statistics
- Standard inventory and card management functions
- J1 path trace
- Cisco IOS CLI sessions initiated through CTC
- Cisco IOS startup configuration file management from CTC

Key ML-Series Features

This section describes selected key features and their implementation on the ML-Series cards.

Cisco IOS

Cisco IOS controls the data functions of the ML-Series cards and comes preloaded on the ONS 15454 SONET/SDH Advanced Timing, Communications, and Control (TCC2) card and Advanced Timing, Communications, and Control Plus (TCC2P) card. Users cannot update the ML-Series Cisco IOS image in the same manner as the Cisco IOS system image on a Cisco Catalyst Series. An ML-Series Cisco IOS image upgrade is accomplished only through the ONS 15454 SONET/SDH CTC, and Cisco IOS images for the ML-Series cards are available only as part of an ONS 15454 SONET or SDH software release. This Cisco IOS image is included on the standard ONS 15454 SONET/SDH System Software CD under the package file name M_I.bin and full file name ons15454m-i7-mz. The images are not available for download or shipped separately.

DRPRI

The bridge-group protocol DRPRI is an RPR mechanism that interconnects rings for protection from ONS node failure. The protocol provides two parallel connections of the rings linked by a special instance of RSTP. One connection is the active node and the other is the standby node. During a failure of the active node, link, or card, a proprietary algorithm detects the failure and causes a switchover to the standby node. DRPRI provides a less than 200-msec recovery time for Layer 2 bridged traffic when the ML-Series cards use the enhanced microcode image. The Layer 2 recovery time is up to 12 seconds for other microcode images. The recovery time for Layer 3 unicast and multicast traffic also depends on the convergence time of the routing protocol implemented regardless of the microcode image used.

EoMPLS

EoMPLS provides a tunneling mechanism for Ethernet traffic through an MPLS-enabled Layer 3 core. It encapsulates Ethernet protocol data units (PDUs) inside MPLS packets and using label stacking forwards them across the MPLS network. EoMPLS is an Internet Engineering Task Force (IETF) standard-track protocol based on the Martini draft. EoMPLS allows service providers to offer customers a virtual Ethernet line service or VLAN service using the service provider's existing MPLS backbone.

GFP-F Framing

GFP defines a standard-based mapping of different types of services onto SONET/SDH. The ML-Series and CE-Series support frame-mapped GFP (GFP-F), which is the PDU-oriented client signal adaptation mode for GFP. GFP-F maps one variable length data packet onto one GFP packet.

GFP is composed of common functions and payload specific functions. Common functions are those shared by all payloads. Payload-specific functions are different depending on the payload type. GFP is detailed in the ITU recommendation G.7041.

Link Aggregation (FEC, GEC, and POS)

The ML-Series offers Fast EtherChannel, Gigabit EtherChannel, and POS channel link aggregation. Link aggregation groups multiple ports into a larger logical port and provides resiliency during the failure of any individual ports. The ML-Series supports a maximum of four Ethernet ports in Fast EtherChannel, two Ethernet ports in Gigabit EtherChannel, and two SONET/SDH virtual ports in POS channel. POS channel is only supported with LEX encapsulation.

Traffic flows map to individual ports based on MAC source address (SA)/destination address (DA) for bridged packets and IP SA/DA for routed packets. There is no support for policing or class-based packet priorities when link aggregation is configured.

RPR

RPR is an emerging network architecture designed for metro fiber ring networks. This new MAC protocol is designed to overcome the limitations of STP, RSTP, and SONET in packet-based networks. RPR convergence times are comparable to SONET and much faster than STP or RSTP. RPR operates at the Layer 2 level and is compatible with Ethernet and protected or unprotected SONET circuits.

TL1

TL1 on the ML-Series cards can be used for card inventory, fault or alarm management, card provisioning, and retrieval of status information for both data and SONET ports. TL1 can also be used to provision SONET STS circuits and transfer a Cisco IOS startup configuration file to the TCC2/TCC2P card memory. For specific TL1 commands and general TL1 information, refer to the *Cisco ONS SONET TL1 Command Guide*.

VRF Lite

VPN Routing/Forwarding Lite (VRF Lite) is an ML-Series card-specific implementation of a VPN routing/forwarding instance (VRF). Unlike standard VRF, VRF Lite does not contain Multi-Protocol internal BGP (MP-iBGP).

Standard VRF is an extension of IP routing that provides multiple routing instances and separate IP routing and forwarding tables for each VPN. VRF is used in concert with internal MP-iBGP. MP-iBGP distributes the VRF information between routers to provide Layer 3 MPLS-VPN.

VRF Lite stores VRF information locally and does not distribute the VRF information to connected equipment. VRF information directs traffic to the correct interfaces and subinterfaces when the traffic is received from customer routers or from service provider router(s).

VRF Lite allows an ML-Series card, acting as customer equipment, to have multiple interfaces and subinterfaces with service provider equipment. The customer ML-Series card can then service multiple customers. Normal customer equipment serves a single customer.