

This chapter provides an overview of the ML1000-2, ML100T-12, ML100X-8 and ML-MR-10 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.

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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 million packets per second (Mpps). The ML-Series cards are integrated into the ONS 15454 SONET or the ONS 15454 SDH.

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 Transaction Language One (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-MR-10 card is a Multi-Rate Layer 2 mapping module that provides 1:1 mapping of Ethernet ports to virtual circuits. The ML-MR-10 has ten SFP connectors that support IEEE 802.3 compliant Ethernet ports at the ingress offering 10 Mbps, 100 Mbps, or 1000 Mbps rates. SFP modules are offered as separate orderable products for flexibility.

The ML-Series cards features two virtual packet-over-SONET/SDH (POS) ports, which function in a manner similar to OC-N/STM-N card ports. The SONET/SDH circuits are provisioned through CTC in the same manner as standard OC-N/STM-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). The ML-MR-10 supports only framed generic framing procedure (GFP-F) encapsulation for SONET.

ML-Series Feature List

The ML100T-12, ML100X-8, ML1000-2 and ML-MR-10 cards have the following features:

- Layer 1 data features:
 - ◆ 10/100BASE-TX half-duplex and full-duplex data transmission

- ◆ 1000BASE-SX, 1000BASE-LX full-duplex data transmission
- ◆ IEEE 802.3z (Gigabit Ethernet) and IEEE 802.3x (Fast Ethernet) Flow Control
- ◆ IEEE 802.3ad Link Aggregation Control Protocol
- SONET/SDH features:
 - ◆ High-level data link control (HDLC) or frame-mapped generic framing procedure (GFP-F) framing mechanism for POS (ML-MR-10 supports only framed generic framing procedure (GFP-F) encapsulation for SONET)
 - ◆ Two POS virtual ports (ML100T-12, ML100X-8, ML1000-2)
 - ◆ LEX, Cisco HDLC, or Point-to-Point Protocol/Bridging Control Protocol (PPP/BCP) encapsulation for POS (ML100T-12, ML100X-8, ML1000-2)
 - ◆ VCAT with SW-LCAS (ML100T-12, ML100X-8, ML1000-2)
 - ◆ G-Series card and ONS 15327 E-Series card compatible (with LEX encapsulation only), (ML100T-12, ML100X-8, ML1000-2)
- Layer 2 bridging features (ML100T-12, ML100X-8, ML1000-2):
 - ◆ Transparent bridging
 - ◆ MAC address learning, aging, and switching by hardware
 - ◆ Protocol tunneling
 - ◆ Multiple Spanning Tree (MST) protocol tunneling
 - ◆ 255 active bridge group 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
 - ◆ Ethernet over Multiprotocol Label Switching (EoMPLS)
 - ◆ EoMPLS traffic engineering (EoMPLS-TE) with RSVP
 - ◆ VLAN-transparent and VLAN-specific services (Ethernet Relay Multipoint Service [ERMS])
- RPR-IEEE data path features supported:
 - ◆ Bridging is supported, as specified in the IEEE 802.17b spatially aware sublayer amendment.
 - ◆ Shortest path forwarding through topology discovery is supported.
 - ◆ Addressing is supported, including unicast, multicast, and simple broadcast data transfers.
 - ◆ Bidirectional multicast frames flood around the ring using both east and west ringlets.
 - ◆ The time to live (TTL) of the multicast frames is set to the equidistant span in a closed ring and the failed span in an open ring.
- RPR-IEEE service qualities supported:
 - ◆ Per-service-quality flow-control protocols regulate traffic introduced by clients.
 - ◆ Class A allocated or guaranteed bandwidth has low circumference-independent jitter.
 - ◆ Class B allocated or guaranteed bandwidth has bounded circumference-dependent jitter. This class allows for transmissions of excess information rate (EIR) bandwidths (with class C properties).
 - ◆ Class C provides best-effort services.
- RPR-IEEE design strategies increase effective bandwidths beyond those of a broadcast ring:
 - ◆ Clockwise and counterclockwise transmissions can be concurrent.
 - ◆ Bandwidths can be reallocated on nonoverlapping segments.
 - ◆ Bandwidth reclamation. Unused bandwidths can be reclaimed by opportunistic services.
 - ◆ Spatial bandwidth reuse. Opportunistic bandwidths are reused on nonoverlapping segments.
 - ◆ Temporal bandwidth reuse. Unused opportunistic bandwidth can be consumed by others.
- RPR-IEEE fairness features ensure proper partitioning of opportunistic traffic:
 - ◆ Weighted fairness allows a weighted fair access to available ring capacity.

- ◆ Aggressive fairness is supported.
- ◆ Single Choke Fairness Supports generation, termination, and processing of Single Choke Fairness frames on both spans.
- RPR-IEEE plug-and-play automatic topology discovery and advertisement of station capabilities allow systems to become operational without manual intervention.
- RPR-IEEE multiple features support robust frame transmissions:
 - ◆ Service restoration time is less than 60 milliseconds after a station or link failure.
 - ◆ Queue and shaper specifications avoid frame loss in normal operation.
 - ◆ Fully distributed control architecture eliminates single points of failure.
 - ◆ Operations, administration, and maintenance support service provider environments.
- RPR-IEEE non-supported features:
 - ◆ EoMPLS is not supported.
 - ◆ IP forwarding is not supported.
 - ◆ Wrapping, the optional IEEE 802.17b protection scheme, is not supported. Steering, the protection scheme mandated by the standard, is supported.
 - ◆ Layer 3 routing is not supported.
 - ◆ GFP-CSF is not supported. The ML and ML-MR cards do not generate the GFP-CSF Indication on any of the RPR spans. The behavior on receiving a GFP-CSF indication on the RPR interface is undefined.
- Cisco Proprietary RPR (ML100T-12, ML100X-8, ML1000-2):
 - ◆ Ethernet frame check sequence (FCS) preservation for customers
 - ◆ Cyclic redundancy check (CRC) error alarm generation
 - ◆ FCS detection and threshold configuration
 - ◆ Shortest path determination
 - ◆ Keep alives
- Fast EtherChannel (FEC) features (ML100T-12):
 - ◆ 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
 - ◆ Up to 6 active FEC port channels
- 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
 - ◆ Auto-negotiation with Remote Fault Indication (RFI)
- POS channel (ML100T-12, ML100X-8, ML1000-2):
 - ◆ Bundling the two POS ports
 - ◆ LEX encapsulation only
 - ◆ IRB
 - ◆ IEEE 802.1Q trunking
- Layer 3 routing, switching, and forwarding (ML100T-12, ML100X-8, ML1000-2):
 - ◆ 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 (ML100T-12, ML100X-8, ML1000-2):
 - ◆ 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
- Ethernet Virtual Circuits (ML-MR-10)
 - ◆ Point-to-Point topology (UNI to UNI)
 - ◆ Attribute Discovery Frames (ATD) for VLAN mapping
 - ◆ VLAN ID (IEEE 801Q tag)
 - ◆ Ethernet Frame Check Sequence (FCS)
- 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
 - ◆ CTM
 - ◆ Remote monitoring (RMON)
 - ◆ Simple Network Management Protocol (SNMP)
 - ◆ Transaction Language 1 (TL1)
 - ◆ (Not applicable to ML-MR-10 cards) Simultaneous performance monitoring (PM) counter clearing in Cisco IOS, CTC, and TL1
- System features:
 - ◆ Automatic field programmable gate array (FPGA) Upgrade
 - ◆ Network Equipment Building Systems 3 (NEBS3) compliant

- ◆ Multiple microcode images
- ◆ Version up to independently upgrade individual ML-MR-10 cards
- 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, including RPR-WRAP
 - ◆ Raw port statistics
 - ◆ Standard inventory and card management functions
 - ◆ J1 path trace
 - ◆ Cisco IOS CLI Telnet sessions from CTC
 - ◆ Cisco IOS startup configuration file management from CTC