

## Datasheet

# OptiSwitch 910-M with Circuit Emulation Services

## A Pseudowire Solution



### Overview

The OS910-M chassis is positioned for the Metro Ethernet access networks and for the cellular 2G/3G packet backhauling enforced with CES technology.

The incorporated CES technology enables convergence of traditional TDM services over single cost-effective Metro Ethernet network.

The OS910-M multi-service solution is a small form factor (1RU), high-performance chassis offers wide range of modules for CES and intelligent packet services with industry-leading performance and advanced feature integration. The product provides high availability based on redundant and hot-swappable elements to insure maximum uptime for mission-critical Telco services.

### Carrier-class Metro Ethernet E-Line, E-LAN, EPL and CES services on the same platform

- MEF 18 CES compliant
- MEF 9 services and MEF 14 Traffic Management conformance
- H-QoS - enables dynamic bandwidth sharing with superior performance
- Ring service protection (50msec)
- Multilayer end-to-end OAM to guarantee SLAs

### Product highlights

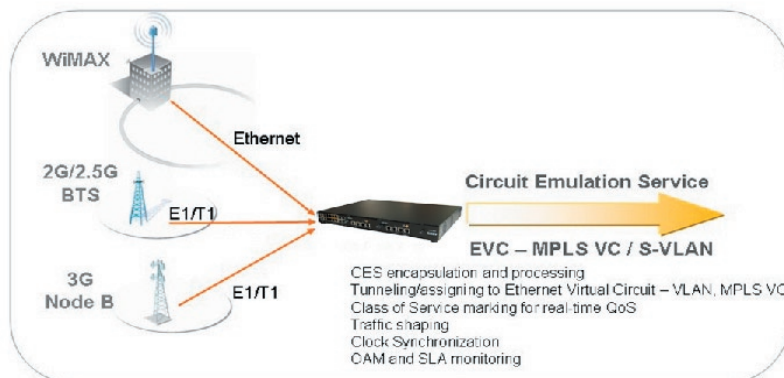
- OS910-M chassis – a modular OS910 platform
  - Build-in 6 RJ45 10/100/1000Base-T and 2 GE combo (RJ45/SFP) + 2 100FX/1000FX SFP ports, and 2 slots to host EM9-CES modules
    - Compact form factor – 1RU height / 12" depth
    - Hot swap fully redundant power supplies and n+1 fans

### Circuit Emulation Line Cards

- CES OC3 / STM- 1 aggregation
- CES 4 x E1/T1
- Circuit Emulation over Ethernet/IP/MPLS networks
  - P2P and point-to-multipoint topologies over wired & wireless
  - Emulates traditional circuits and services over packet networks
  - Preserves native TDM functionality, signaling and clocking
    - Structured & unstructured G.703 & G.704 compliance
    - Adaptive Jitter buffer - G.823 & G824 compliance
    - Payload suppression
- Complies with IETF PWE3, CESoPSN/SAToP & MEF 8
- Local and remote loopbacks

### Applications

- Connectivity of an E1/T1 trunks and PBXs
- Cellular backhaul for GSM, GPRS & UMTS networks
  - Clock synchronization - adaptive, internal/external & loopback



OS910-M leverages resiliency, OAM, QoS & Multi-Service capabilities over Metro Ethernet IP/MPLS transport

### CES Modules Description

The EM9-CES modules enable Circuit Emulation Services (CES) functionality transporting structured or unstructured E1/T1 circuits over an Ethernet/IP/MPLS networks. The modules comply with IETF PWE3 SAToP and CESoPSN industry standards, as well as with the Metro Ethernet Forum's MEF-8 specifications.

The modules perform emulation of T1 or E1 synchronous circuits by incorporating TDM bitstreams into packets and transmitting them over packet-switched networks as streams of packets. These streams are referred to as pseudo-wires (PW) or Ethernet Virtual Circuits (EVC) (tagged with VLAN or MPLS labeled) and marked with real-time priority for strict priority forwarding and minimal latency, jitter & packet loss. A pseudo-wire can transport a full TDM circuit or a bundle of time slots from a TDM structured circuit.

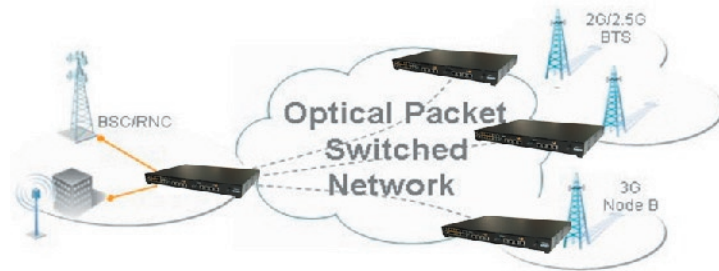
The modules' synchronization over packet performance meets G.823/G.824 jitter and wanders requirements, impaired packet-switched network environments characterized by packet loss, jitter, packet misorder, link disconnects and reroutes.

## Applications

*Cellular 2G/3G backhauling with precise clock synchronization application:*

MRV's solution help passing the E1/T1 Abis or Lub from the base stations to the BSC/RNC over packet network like Metro Ethernet and by that reduce cost of infrastructure.

*Solution for UMTS , GPRS and GSM networks*



*Metro Ethernet access network as transport for TDM traffic:*

MRV's solution help passing E1/T1 voice traffic from PBX to BPX or/ and PBX to Class 5 PSTN switch over packet network like Metro Ethernet and by that reduce cost of infrastructure.



## Architecture

With its design based on state-of-the-art wire-speed technology, the OS910-M offers a futureproof solution for Wireless operators, ILECs, IXCs, MSOs or green-field service providers, fitting various business subscriber SLAs. A single OS910-M, serving as a Multi-Service device, can facilitate the provisioning of revenue generating new value-added services thanks to its wide spectrum of service features.

### VPN Services & Protection

Compliant to MEF Ethernet Virtual Circuit (EVC), the OS910-M can offer three types of VPNs for emulated circuit services:

1. Layer 1 Optical VPN – a cross-connect mode with transparent mode (no MAC learning)
2. Layer 2 VPN – VLAN-based tunneling Q-in-Q stacking, swapping or mapping services
3. Layer 2.5 VPN – a label-based MPLS VC for a pseudo-wire PWE3 or H-VPLS MTU-s

All the above VPN services can be fully protected using port redundancy, dual-homing, and/or ring topology with a recovery time of less than 50 ms.

In addition to L2 VPN, the OS910-M can offer integrated IP router services to save the costs of an external router and provides a single demarcation platform for managed L2 VPN and IP services.

### Traffic Management

The OS910-M enables a value-added network infrastructure, with end-to-end per flow QoS.

It supports full CoS and QoS (MEF 14 model) including flows classification, rate limiting, shaping, WFQ scheduling, and strict priority for lower delay/jitter and guaranteed throughput in real-time applications. In addition, it enables dynamic/adaptive buffer pools to prevent bursty traffic starvation and ensure queuing resources effectiveness.

For network convergence applications that have a clear boundary between customer's and carrier's networks, CoS layers (802.1p, IP ToS & MPLS EXP bits) can be mapped/marked to preserve priorities or map them into predefined protection profiles set by the carrier.

### Hierarchical QoS – CoS-Aware rate limit

Defining premium SLAs is a key fundamental for service differentiation.

The OS910-M enables traffic management based on innovative CoS-aware rate limit to dynamically reuse bandwidth profiles. Dynamic QoS is an important feature that allows for sharing defined rate limited flows with aggregate profile applied to a user network interface or an Ethernet Virtual Circuit. In the new service offering, the consolidated real-time, high-priority and best effort data require different rates and marked class of service. Dynamic QoS helps to share/borrow the bandwidth that was allocated for real-time or high priority applications at a time when these services are not active. Such an offering contributes to a more efficient way of provisioning bandwidth at the access/demarcation of the network without complex configuration sets at the aggregation layer.

### Denial of Service (DoS) protection

The OS910-M incorporates multilayer DoS protection at the hardware architecture on the CPU control plane and data-switching plane. The multilayer control protects the service and the device functionality from hostile traffic without degradation of service performance or affecting of the forwarding database or CPU availability. Multiple traffic types can be policed or discarded starting from frame level such as broadcast, multicast up to IP/TCP/UDP layers.

### Management - OAM

The OS910-M control plane incorporates a list of highly manageable feature that offers ensured interaction with carrier's OSS and NMS platforms, based on industry standard Southbound out-of-band or in-band interfaces. In addition, it can be managed via MRV's MegaVision-Pro NMS to have complete GUI and Northbound gateway (XML, TL1 & SNMP) of an entire map of clustered devices for configuration, performance analysis, and

inventory control.

For the service providers, the OAM that is provided by a demarcation device determines to a significant extent the metrics that can be used to establish the SLA with a business subscriber. The OS910-M incorporates enhanced standards compliant MEF OAM and gives the service provider the ability to monitor the network and provision services, and promptly determine the location of faults remotely from the network operation center.

### Ethernet OAM with IEEE802.1ag & ITU-T Y.1731

The connectivity of Ethernet bridge devices across Metro Ethernet or other transport networks creates dedicated or virtual Ethernet circuits. An end-to-end service architecture requires administrative domain hierarchy with corresponding OAM enabled titles. The OS910-M incorporates connectivity, discovery and fault management along performance statistics of delay, jitter and frame loss for demarcation and intermediate points of service.

### Ethernet loopbacks

The OS910-M offers remote loopback functionality on a physical interface or a specific VLAN that traverses UNI or NNI interfaces. The loopback function allows for the troubleshooting of the service, remotely, from NOC, or any other manageable location without needing to actually visit the customer premises. Loopback functionality performed in hardware level for performance monitoring and SLA verification in wire-speed.

### Copper TDR

The OS910-M incorporates copper TDR that can identify problems with CAT5 copper cables on a customer's site such as opens, shorts and wrong impedance.

### Optical Performance Level Monitoring (Digital Diagnostics)

The OS910-M supports the SFP Digital Diagnostics standard (as per SFF-8472). A powerful OPM tool, it provides access to a number of real-time SFP operating parameters such as optical TX/RX power, voltage and temperature, as well as component information such as vendor code, serial number and wavelength. The information provided by Digital Diagnostics, together with alarm and warning thresholds, enables a network administrator to identify potential problems in optical transmission and take preemptive action before any service outage actually occurs.

### Per-service performance monitoring

The OS910-M offers real-time and historical reporting on various service performance metrics, including port/VPN-EVC utilization, transmission errors, and QoS threshold exceptions.

Each service can be tracked for statistical information to help in base lining and troubleshooting traversing services. This service enables users to verify service guarantees, increase network reliability by validating network performance. Performance monitoring uses pro-active monitoring to generate traffic in a continuous, reliable, and predictable manner, thus enabling the measurement of network performance and health.

### Link Fault Reflection/Propagation

The link fault reflection propagates the fault from network interface to user interface. Such functionality is configurable and operated on LOS fault that will trigger the user link to down mode. In scenario of network interfaces protection, the fault propagation will be triggered only after the LOS of both network interfaces.

### Sniffer VLAN

The OS910-M incorporates a powerful tool called Sniffer VLAN. This feature enables the operator to configure a dedicated sniffer VLAN to remote surveillance center for remote analyzer. Sniffing on the OS910-M can be set per specific customers' VLAN, per L2-3-4 fields or per learn table MAC. The remote service monitoring inline with interception processes based on requirements of Law Enforcement Monitoring.

## Specifications

### Physical ports:

- Built-in 6 RJ45 10/100/1000Base-T and 2 GE combo (RJ45/SFP) + 2 100FX/1000FX SFP ports
- 2 slots to host EM9-CES modules - up to 8 E1/T1s per system
- Out-of-band management RS-232 & Ethernet
- Hot-swappable SFP optics - short /long haul multi-rate and xWDM

### Power supply:

- 1+1 redundancy - hot Swappable AC/DC power supplies

### Mounting:

- Rack size: 1RU
- Rack mounting: 19" & 23" mounting
- Wall mounting

### Hardware

- Auto-MDI/MDIX on copper ports
- MAC table size: 16K
- Jumbo frames (16,000 bytes) on all ports
- Packet buffer management
- Environmental sensor

### Switching Services

- IEEE 802.1Q and IEEE802.1ad provider bridges
  - 4K active VLANs
  - Q-in-Q stacking per port+VLAN
  - VLAN translation and mapped modes (per port +VLAN)
- Transparent cross-connect mode (No MAC learning)
- Learning table limit per VLAN/port
- Service protection
  - Automatic Optical switching on network interfaces (1:1)
  - IEEE802.3ad Link Aggregation (1+1)
  - Multiple Instance Spanning Tree IEEE802.1s & compatibility to 802.1w/d

### Traffic Management Services – MEF Compliant

- Inbound & Outbound traffic management per flow
- Classification by physical port, MAC, Ethertype, VLAN, IP/TCP/UDP, IEEE 802.1p (VPT), DiffServ (IPv4 & IPv6 TC)
- Marking/remarking profiles between layers (802.1p, ToS & MPLS EXP)
- 8 hardware queues per port & configurable CoS adaptive buffer
- In-profile & out-of-profile service counter sets ( per UNI, CoS, EVC)
- Class-aware rate limit - dynamic bandwidth reuse between mapped classes
  - Hierarchical -QoS model with CIR/EIR rates

### Tunneling - L2 Services

- Q-in-Q - mapped mode or translation
- Layer 2 VPN - Martini MPLS pseudo-wire
- Spoke H-VPLS - MTU-rs

### IP Services

- IGP and EGP routing - Master-OSTM
  - Routing Information Protocol (RIP v1, v2)
  - Open Shortest Path First (OSPF)
  - Intermediate System to Intermediate System (IS - IS) Protocol
  - Border Gateway Protocol Version 4 (BGPv4)
  - Virtual Router Redundancy Protocol (VRRP)
  - DHCP Server/Client/Relay

### Security

- CPU DoS protection
  - Frame rate control
  - Dedicated queues
- Wire-speed Access Control Lists
  - L2-3-4: from frame to application layer
- MAC, ARP and BPDU filtering
- Rate limit protection for Unicast/Multicast/Broadcast packets
- Security thresholds for L2 statistics counters

### Management & Diagnostics Tools

- Industry Standard CLI
- Out-of-band Ethernet management – EIA-232 console
- Out-of-band Ethernet management – Dedicated Ethernet RJ45 port
- Telnet, SSH v2, SNMPv3, RMON (4 groups)
- Port mirroring - ingress & egress traffic to analyzer port
- Remote service/flow mirroring per ACL – Sniffer VLAN
- Ping, Trace route, DNS lookup, TCP dump (built-in sniffer)
- Management ACL for trusted connections (Telnet, SSH, SNMP)
- Optional SNMP/CLI disable
- Hierarchical Administration policy
- RADIUS / TACACS+ AAA for management sessions
- Configuration load/save via FTP, Secure Copy (SCP)
- NTP – Network Time Protocol
- Internal / Remote Syslog
- Scripting tool for macro configurations & maintenance
- Action scheduler for automated rules
- IPv6 management\*

### Standard Operation, Administration & Maintenance

- End-to-end Service OAM IEEE802.1ag
  - Connectivity Fault Management per service MEP/MIP
  - In-service EVC loopbacks, Linktrace & continuity check
- End-to-end Performance Measurement ITU-T Y.1731 & IP SLA\*
  - Jitter, Latency & Loss per service
- Optical signal level monitoring (SFP SFF-8472)
- Copper cable diagnostics TDR on RJ45 ports
- Remote failure notification / reflection

### Device Technical Specifications

<b>Standard compliance</b>	UL-1950; CSA-22.2 No.950; FCC part 15 Class A; CE-89/336/EEC, 73/23/EEC – ROHS compliant
<b>Environment</b>	Operating temperature: 0 to 50 °C (32 to 122 °F) Non - Operating temperature: -40 to +70 °C (-40 to 158 °F)
<b>Humidity</b>	85% maximum , non-condensing
<b>Diagnostic LEDs</b>	Power, Power RST, Temperature, FAN, Management , PS Online/Active /Alarm Ports: Link, activity
<b>Mounting</b>	19" or 23" racks (1RU) and wall mount
<b>Physical dimensions WxDxH</b>	443 x 315 x 43.8mm / 17.44 x 12.4 x 1.72"
<b>Weight</b>	4.5 kg (9.92 lb)
<b>MTBF</b>	240,353 HRS @ 25°C/77°F
<b>Power Specifications</b>	Power AC: Auto-range 90-240 VAC Power DC: -36VDC to 72VDC Power Consumption: Min: 20W Max: 60W
<b>BTU (min/max) per hour</b>	204 / 375

### CES E1/T1 Technical Specifications

<b>Circuit Emulation Protocols</b>	SAToP, CESoPSN, CESoETH MEF-8
<b>TDM Traffic</b>	SAToP structure agnostic CESoPSN structured & unstructured CESoETH structured & unstructured Fractional (DS0 granularity)
<b>Signaling</b>	CAS relay as per CES standards
<b>Clocking</b>	• Internal, External, Loopback, Line1 • Adaptive Jitter/Wander Compliance G.823/G.824 Jitter compensation 1 ms. - 200 ms., configurable
<b>Standards - E1</b>	ITU-T Rec. G.703, G.704, G.823
<b>Standards - T1</b>	AT&T TR-6241 / ITU-T Rec. G.703, G.704, ANSI T1.403, G.824
<b>Framing - E1</b>	CRC4 MF, CAS MF
<b>Framing - T1</b>	D4 (SF), ESF
<b>Data Rate</b>	E1= 2.048 Mbps T1=1.544 Mbps
<b>Line Code</b>	E1=HDB3, AMI T1=AMI, B8ZS
<b>Receive Level - E1</b>	0 to -43 dB / 0 to -12 dB
<b>Receive Level - T1</b>	0 to -36dB / 0 to -15 dB

### CES OC3/STM-1 Technical Specifications

<b>Circuit Emulation Protocols</b>	SAToP , CESoPSN, CESoETH MEF-8
<b>TDM Traffic</b>	Fractional (DS0 granularity) full structured & unstructured
<b>Emulated Circuits</b>	up to 63 E1s / 84 T1s
<b>Clocking</b>	Adaptive, Internal, External, Loopback Jitter/Wander Compliance G.823/G.824 Configure Jitter compensation 0.25 ms. - 256 ms Synchronization over packet based on IEEE1588v2
<b>Standards</b>	ANSI, T1.105-1995, T1.105.02, T1.231-1997 AT&T-TR 54016, TR 62411 Bell Communications Research TA-TSY-000191, TR-NWT-000233, TR-TSY-000303 ETS - IETS 300 417-1-1, January 1996 ITU-T G.707, G.781, G.783, G.783 Amendment 1, June 2002
<b>OC-3 Interface</b>	155.52 Mbps rate / Telcordia Technologies GR-253-CORE. GR

### Order Info

#### OS910-M MMS Platform

OS910-M Mini Multi Service Modular platform - 6 10/100/1000T ports + 2 Combo GE (RJ45/SFP) + 2 SFP 100FX/1000FX ports with 2 multipurpose slot, hot-swappable dual redundant power supplies (AC/DC should be ordered separately)

#### Hot-swappable power supplies for OS910-M chassis

EM9-M-PS/AC AC power supply for the OptiSwitch® 910-M (90-240V AC)

EM9-M-PS/DC DC power supply for the OptiSwitch® 910-M (-48V DC)

#### CES line cards

EM9-CES-4T1c 4 - port T1 Circuit Emulation Service module with high-precision clock

EM9-CES-4E1c 4 - port E1 Circuit Emulation Service module with high-precision clock

EM9-CES-OC3 1 - port OC-3/STM-1 - 1:1 protected - Circuit Emulation Service Aggregation module

#### Accessories

EM910M-BR-1 19" mounting brackets for a Telco rack

EM910M-BR-2 23" mounting brackets for a Telco rack