OptiPacket® Series: OP-X Packet Optical Transport Platforms

Overview

The OptiPacket® OP-X family is a portfolio of Packet Optical Transport Platforms (POTPs) that combine the features and expertise of MRV's optical and packet product families in a single, powerful, and intelligent multi-layer family of products. Capitalizing on the latest innovations in packet and optical technologies, the OP-X family offers outstanding flexibility, capacity, and intelligence in a platform that leads the industry in bandwidth density, capacity, and power efficiency.

Unlike traditional POTP elements, the OP-X family is optimized for deployment as a packet-only platform, as an optical transport-only platform, or as a converged packet-optical platform. As a packet-only platform, OP-X offers a full spectrum of MEF CE 2.0 Layer 2 services as well as MPLS technology and VPLS L2 VPNs. It is ideal for high bandwidth aggregation applications such as DSL/CMTS/FTTX residential networks, mobile backhaul, and Mega POPs as well as high capacity business and enterprise services to multi-tenant locations where flexibility, space, and power are at a premium. As an optical transport-only platform, the OP-X family can be the core of an OTN/WDM network for the transport and management of multi-service carrier networks, data center interconnection networks, and optical enterprise networks. As a converged packet/optical platform, the features from both platforms can be combined flexibly according to network demands.

The OP-X family is based on an innovative software and hardware architecture that allows greater bandwidth density and a comprehensive feature set as well as a well-defined path to future network technologies. Hardware innovations include front-to-back ventilation with horizontal card placement and a single board computer (SBC) deployed on all cards to enable higher density and increased functionality. Software innovations like MRV's widely deployed and feature-rich MasterOS operating system enable greater intelligence and service options. Other design innovations ensure that the OP-X family is a solid foundation for the revolution in network design coming with software defined networking (SDN) and network function virtualization (NFV).

The OP-X family is fully integrated into MRV's advanced Pro-Vision® service provisioning and management platform, which enables OP-X to operate seamlessly in a mixed environment including MRV's optical transport and carrier Ethernet products. A combined network utilizing MRV's OptiPacket® optical product line and OptiSwitch® carrier Ethernet product line along with the OP-X family can provide a complete end-to-end solution for multiple metro, data center, cloud service, and other network providers.

Highlights

- MRV's family of converged packet and optical transport platforms (POTPs) combining MRV's optical and packet expertise
- Large (OP-X4, 8RU) and small (OP-X1, 2RU) chassis
- Optimized as a packet-only platform
- Optimized as an optical transport-only platform
- Optimized as a converged packet-optical platform
- Innovative hardware and software architectures
- Industry leading density, capacity, and power efficiency
- Open architecture designed for SDN/NFV from day 1
- Series of platform sizes to fit a wide range of applications and deployment scenarios
- Fully integrated into the MRV product line
- Powered by MRV's field-proven Master-OS™ Linux-based operating system.
- Dual purpose OTN/Ethernet fabric
Innovative Hardware

The OptiPacket OP-X family includes a series of OP-X4 and OP-X1 chassis designed to fit service provider needs. Each chassis has common line cards, fabric elements, and control cards to maximize flexibility and minimize operational costs. All chassis offer carrier-class features such as control card redundancy, in-service software upgrades, hot-swappable cards, and multiple levels of redundancy.

Each line card in the OP-X family includes an on-board computer that has the ability to run standards-based software. This single board computer (SBC) system enables many more powerful capabilities and a significantly reduced feature enhancement cycle. Also, by putting powerful and flexible control capabilities directly onto the line cards, a path to future SDN and NFV functionality is enabled. This capability is exposed on the control cards, which offer SDN ports that are directly connected to the line card SBC, bypassing the main CPU entirely. As SDN features evolve and mature, the hardware design of the OP-X family offers both software and hardware design innovations to create control and data plane separation to offer maximum packet processing power and flexibility.

Rather than dividing packet technologies onto separate cards, the OP-X platforms include flexible packet interface cards that can support Ethernet, MPLS, IP, and other protocols without requiring additional hardware or software upgrades. This innovation means that service providers can offer a variety of packet-based services from Layer 2 through Layer 3 on the same hardware, significantly reducing platform complexity and increasing the percentage of revenue-generating ports on the shelf.

For the smaller chassis types, the novel front-to-back cooling architecture with horizontal cards means that operators do not have to abandon high density horizontal designs to meet data center and CO hot/cold aisle cooling requirements. This hardware innovation can save operators up to 30% in cooling costs and makes the OP-X one of the greenest systems available.

Innovative Software

The OP-X series control software uses MRV’s field-proven MasterOS™ operating system. MasterOS is based on Linux and, as such, is able to quickly integrate new innovations in operations and management. The rich feature set of MasterOS, developed over many years by MRV, provides industry-leading Carrier Ethernet features such as SOAM as well as MRV innovations including Application Awareness.

MRV is focused on the move to software-defined networks (SDN) and network function virtualization (NFV), and the OptiPacket line is designed to take advantage of emerging standards. To support this evolution the OptiPacket operating system is based on an x86 processor architecture, with Single Board Computers running on every line card as well as on the control card. This unique architecture enables control plane functions to be moved to a virtual network controller in the future. Another OptiPacket design innovation is the chassis controller which includes SDN ports that allow direct access to the computers on the line cards in anticipation of future network needs for control plane separation and additional control plane processing power. Therefore, application servers can be run as external devices and, eventually, as dedicated blade servers within the OptiPacket chassis that are capable of running hundreds of virtual machines each hosting their own telecom dedicated application (DPI, Load Balancing, WAN Optimization, etc.).

The OP-X software offers MRV's innovative Application Awareness capability, which allows network operators to view and analyze the applications running on their network so that they can engineer the network to meet client needs, use the network efficiently, and maximize service revenues.

Industry Leading Density and Capacity

OptiPacket OP-X is one of the industry’s most dense platforms with 3.2 Tbps of switching capacity in 8 RU of space (OP-X4). Each slot supports up to 800 Gbps of bi-directional traffic, including up to forty GE/10GE SFP+ ports, four 100GE ports or even sixty four 1GE (CSFP based) and eight x 10GE ports in a single line card. In addition, the dual purpose OTN and Ethernet fabric makes the OptiPacket series a premium P-OTP solution. It can host dense high bitrate line side OTN cards (5G-100G upstream) and super dense low bitrate client side cards (16M-5G downstream).
All of the functionality of the OptiPacket® series is achieved with remarkably low power consumption per bit. A carrier-grade chassis with a complete 3.2Tbps fabric requires only 2.5kW of power (maximum), which is less than 0.8nW per bit.

**Fully Integrated into the MRV Product Line**

Additional optical functionality and flexibility can be provided by combining the OptiPacket OP-X shelves with MRV’s advanced OptiDriver™ platform. OptiDriver™ is optimized for passive optical elements such as filters and splitters as well as active optical elements such as amplifiers and ROADMs. The combined OptiPacket**/OptiDriver™ system is managed as a single P-OTP element, with the OptiDriver™ shelf viewed as a subtending shelf from the OptiPacket™ shelf.

The OptiPacket® operating system and packet engine is based on the same software as MRV’s highly successful OptiSwitch® line of switch/routers, enabling seamless interoperability across platforms and allowing MRV to offer a complete end-to-end solution from end user to core. In addition, OptiPacket® is supported by MRV’s advanced Pro-Vision® service delivery and provisioning software, which provides a complete system for discovering, provisioning, monitoring, troubleshooting and reporting on the network from packet to optical and from edge to core.

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### Technical Specifications

<table>
<thead>
<tr>
<th>Switching Capacity</th>
<th>OP-X4 with 3.2 Tbps and OP-X1 with 800 Gbps, 800 Gbps per line card</th>
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</thead>
</table>
| **Layer 1 Services** | - Local cross-connect between Ethernet/VLAN interfaces  
- Multi-service OTN line cards (OTU 2 and OTU4) with rate adaptation and encapsulation  
- ODU switching (ODU0, ODU1, ODU2, ODU4, ODUflex)* |
| **Layer 2 Services** | - Virtual Switching Instances  
- Q-in-Q VLAN translations  
- MEF CE 2.0 EVCs  
- Advanced QoS mechanism |
| **Layer 2.5 – 3 Services** | - IP Control Plane:  
  - Full IPv4 routing  
  - OSPF (v2 & v3), ISIS  
  - MPLS Control plane:  
    - OSPF-TE, IS-IS-TE, LDP, RSVP-TE  
    - Protection: FRR  
  - OAM  
    - LSP-Ping, trace-route  
    - BFD  
    - VCCV  
    - SOAM  
  - VPNs  
    - QinQ  
    - MEF CE 2.0 EVCs  
    - L2 VPWS (P-t-P)  
    - VPLS L2 VPN (MP-t-MP)  
    - H-VPLS (MTU-rs) |
| **Layer 5 Services** | Application Awareness for cloud and business services |
| **Network Management** | - SNMP (v1, v2, v3)  
- OpenFlow for SDN **  
- Netconf support for service creation **  
- 10/100/1000Mb Out-of-band  
- Serial  
- Pro-Vision integration |

* Future option  
** Future software release
### Physical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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<tbody>
<tr>
<td>Operating Temperature</td>
<td>0°C to 50°C (32°F to 122°F)</td>
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<tr>
<td>Storage Temperature</td>
<td>-40°C to 70°C (-40°F to 158°F)</td>
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<tr>
<td>Relative Humidity</td>
<td>85% maximum, non-condensing</td>
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<tr>
<td>Physical Dimensions</td>
<td>OP-X4: 8RU, OP-X1: 2RU</td>
</tr>
<tr>
<td>Max. Power Consumption</td>
<td>OP-X4: 2500W, OP-X1: 530W</td>
</tr>
<tr>
<td>Compliances</td>
<td>FCC Part 15 (Class A); EMC Directive: Emission (Class A) and Immunity; LVD Directive: Electrical Safety; CE; TUV-R mark (Canada, USA); GOST; RoHS Directive, REACH SVHC, WEEE Directive; NEBS Certified.</td>
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MRV operates worldwide sales and service offices across four continents.

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