

## Application Guide

### OptiSwitch® VDSL Application

#### Introduction

Transmission of data over 2 wire copper lines gained significant momentum due to the expansion of the ADSL technology over the past few years. This was suitable for applications in the past; this status has changed because of the increased development of broadband software applications that require higher bandwidth.

The existing asymmetrical ADSL technology can't address bi-directional HDTV (digital TV with DVD quality) and interactive services like home gaming or provide higher bandwidth.

In order to provide an adequate symmetrical bandwidth capability with a technology that can offer up to 50 Mbps and to be pure-simple Ethernet all the way, VDSL became the de-facto alternative. MRV's EoV is an Ethernet over QAM-based VDSL physical layer solution. This technology complies with the Ethernet standard (IEEE 802.3) and with the approved ETSI VDSL requirements and the evolving ETSI, ITU and ANSI standards for the VDSL physical medium.

#### Market

VDSL enables true Broadband service that is enforced by a technological capability of obtaining a bandwidth of up to 50Mbps. Service providers have the opportunity to offer a variety of communications and entertainment services, including carrier-class telephony, high-speed Internet access, broadcast multi-channels television, direct broadcast satellite (DBS) television, and interactive, two-way video-based services. All these services are provided over Telco distribution networks via copper lines to the home or business with a level of adaptability permitting the support of future services.

MRV's cost-effective solutions of VDSL broadband services enable the transport of key service features, such as quality-of-service (QoS) guaranties, which ensure the successful transmission of integrated voice, video, and data services by prioritized traffic. The MRV's EoV accompanies existing set of transport technologies that are empowered by an unprecedented fiber variety to carrier network or the IT central room in the Enterprise.

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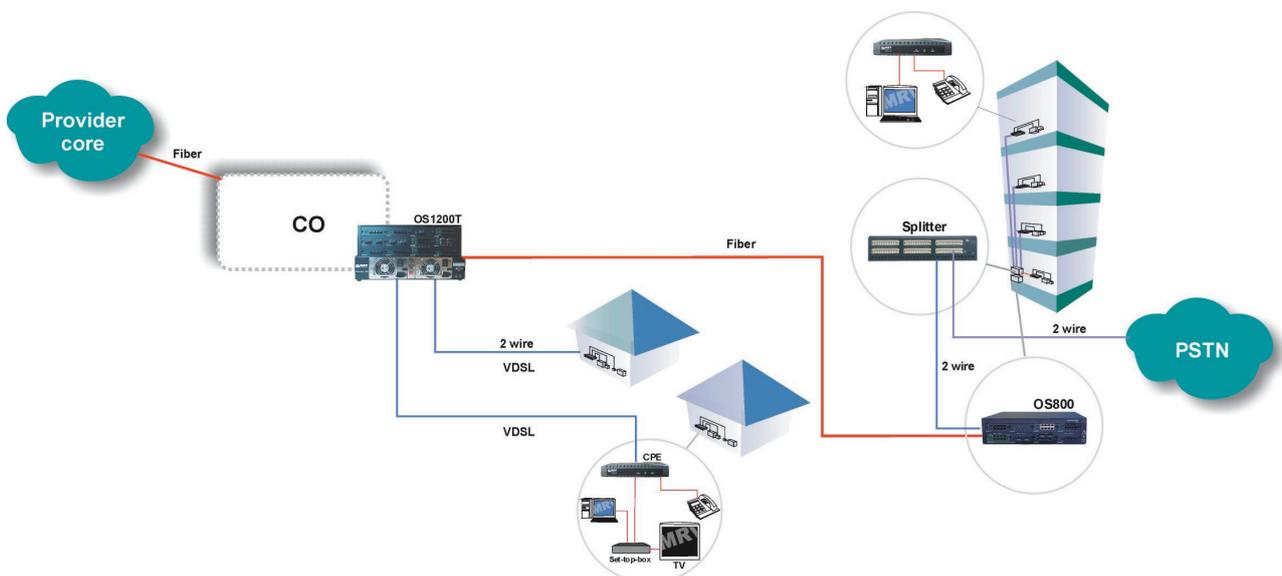
When examining potential markets for EoV®, we find that it can be used to implement any application requiring an Ethernet-over-telephone-lines solution. Last-mile networking:

- MTU/MDU
- Hotels
- Office buildings
- Campuses
- Entertainment centers
- Medical centers
- Access Networks

The MRV EoV® solution is very easy to install: simply plug it into the existing infrastructure and activate.

#### EoV® access solution

The EoV® solution is comprised of a customer premises unit (CPE), an EoV splitter and a choice of 10 different types of OptiSwitch® EoV modules that can be hosted in any of the modular OptiSwitch chassis. Various scenarios can be addressed with this OptiSwitch® functionality, including EoV trunking for traffic aggregation of multiple lines as LT (line termination) and NT (Network Termination). Even though EoV is used for simultaneous traffic of voice and data, in case no voice is



required, the splitter can be omitted from the lines connectivity. OptiSwitch EoV technology supports a transmission bandwidth of up to 15 Mbps for a full-duplex Ethernet link over telephone line with operating distances of up to 1500 m. For extended distances of up to 4km, operation is in 4-Band mode with asymmetrical VDSL bandwidth (ADSL Band plan).

### Modular and Hybrid Solution

With over 10 different types of VDSL dedicated modules and 90 types of uplinks that can be hosted in a variety of 5 chassis, OptiSwitch® enables a “pay as you grow” model: only the VDSL port density required at the time of installation needs to be acquired. Thanks to its “all-modular” design, you can either replace/add modules as needed, or reuse the existing modules in a larger chassis.

The modules include a modular Ethernet VDSL with QoS solution. This most advanced modular EoV® technology enables the creation of high-speed links, with a future capability for EoV® transmission of up to 40 Mbps full duplex (with 4 band technology), over standard telephone lines. Ethernet traffic over VDSL, reaches distances of up to 1500 m (2 band) and up to 4000 m (4 band ADSL rates), in parallel to the POTS or ISDN service. The OptiSwitch Ethernet over VDSL solution includes extremely rich software and hardware features empowered by the EoV QoS modules, capable of answering any type of application demand.

To ease the deployment of the Ethernet over VDSL solution, the OptiSwitch incorporates an Automatic Link Integrity, Line Quality and Self-Healing tools. That tool automatically sense degradation of line quality, and applies a series of error correction algorithms, carrier rate modifications and line rate modulation in order to provide the highest quality of service.

The OptiSwitch® unique ability to dynamically modify the data rate - a feature of carrier-class DSL solutions - and to measure physical line quality parameters, such as Signal-to-Noise Ratio and Bit-Error Rate, enables it to gauge a line's quality in real time. As soon as the quality threshold is crossed, the OptiSwitch automatically changes the data rate on the line to preserve link integrity.

### EoV® management

### Conclusions

Ideal for infrastructure, MRV's VDSL access networks support the whole QoS technologies for the Multimedia access services, offering an exceptional variety of broadband media services, built on the OptiSwitch® access platform. The systems are ideal for Enterprises and Carriers (broadband service providers), who offer communications services and are looking for fast ROI and scale-up solution design.

The investment in the MRV EoV® solution creates an advantage with its Broadband service offerings, and generates new revenues with its state of the art technology that is extremely scalable, cost-effective and answers tomorrow's bandwidth demands.

The management is the key factor of successful and cost-effective implantation. VDSL technology has the tradeoff at bandwidth to distance ratio, and several considerations have to be taken. MRV's VDSL solution offers standard SNMP management capability, and enhanced diagnostic tools to predict line behavior at initial phase installation or future scenario changes. This is certainly creates a significant benefit for carrier to assure line SLA, and automatically adapt VDSL rate according to the line quality, or preserving policy, that is per-port configurable with few different modes.

### MRV's Ethernet over VDSL highlights

- Modular design with a range of 6 chassis variations
- Density from 4 to 188 VDSL ports per chassis
- Telco chassis with up to 1536 VDSL ports per 40 U rack
- Hot-Swap – add-remove VDSL ports on the fly
- Integration with Gigabit copper/fiber, CWDM optics, Wireless modules, E1/T1 Voice over Ethernet, Fast Ethernet copper/fiber and hybrid modules
- Policy rules for enhanced traffic control QoS (DiffServ/VPT) for all subscriber lines to address video, voice and data convergence.
- Rate limitation per interface / application  
-in 1K granularity
- NT-LT variations for VDSL trunking or CPE to CPE (modem applications)
- Maximum supported upstream and downstream data rates testing for VDSL links, and automatic setting of these rates
- Extended distances of up to 4km in 4-Band mode with asymmetrical VDSL bandwidth (ADSL Band plan)
- Internal integrity tool for BER/SNR on all lines (Real-time automatic link healing)
- ETSI 997, ETSI 998, and Maximum band allocation
- Smart phones support
- Fully SNMP managed solution
- Telco approved/certified

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for more information: [international@mrv.com](mailto:international@mrv.com)

[www.mrv.com](http://www.mrv.com)