



Optical Communications Systems®

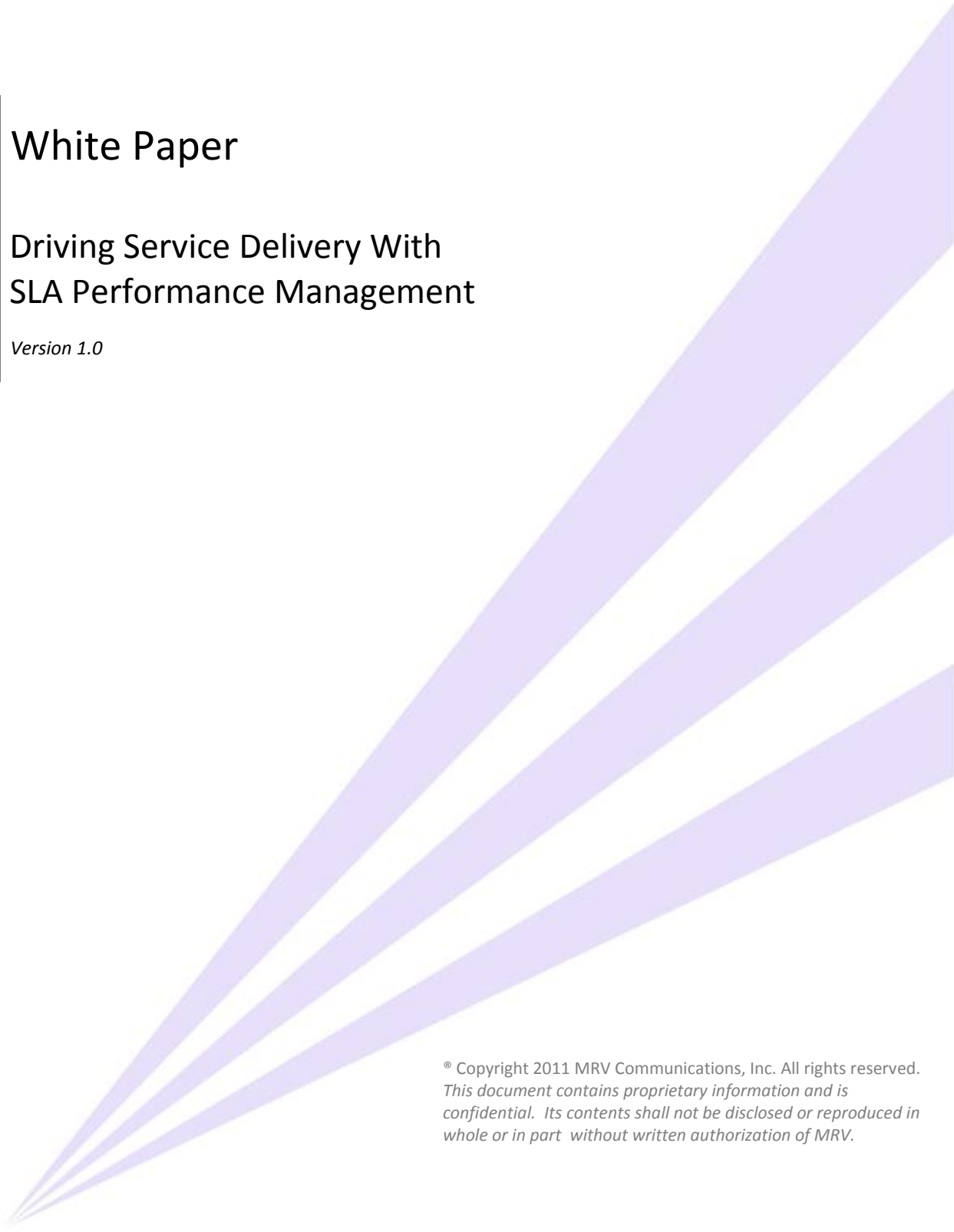
Empowering the Optical Edge™

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## White Paper

# Driving Service Delivery With SLA Performance Management

Version 1.0

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# 1 Providers #1 competitive advantage

Service providers more and more depend on Ethernet services as the networks are evolving from traditional voice (circuit switch) to next generation packet based infrastructure. This transition of network presents unlimited number of opportunities for Business Ethernet, Wholesale and Mobile Backhaul services.

The Service provider investment in Carrier Ethernet is growing rapidly. Infonetics estimates Carrier Ethernet revenue will grow to \$32.3B by 2014, driven chiefly by the move to IP NGN packet networks and growing traffic from consumer, business, and mobile backhaul networks. The Ethernet Access Devices (EAD) revenues will reach \$1.7B in 2014, CAGR 26%.

While Carriers are rapidly adopting Ethernet as preferred service, a survey conducted by IDC (Enterprise CIO survey) shows that the **provider's key challenge is delivering services and supporting services**. As shown in the figure 1 below, nearly 60% of service/support problem is due to issues with provisioning times, reporting and monitoring and billing administration.

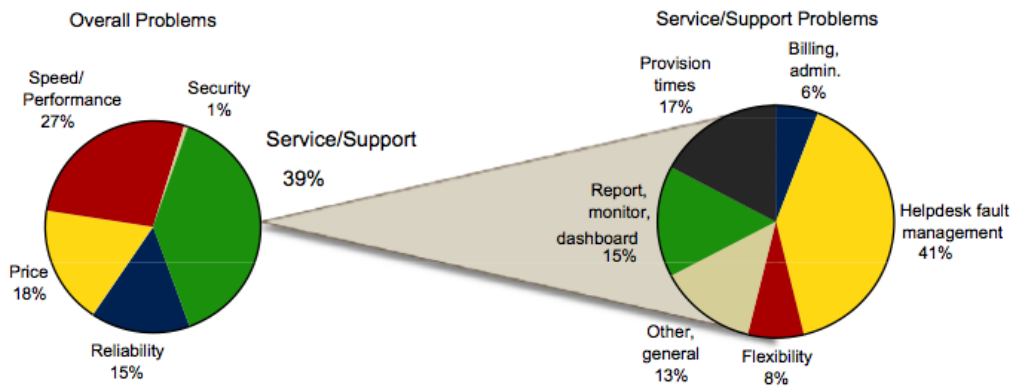


Figure 1 Service providers service delivery overall problems

**Service visibility and service delivery assurance is essential. Comprehensive service provisioning and performance management are important competitive advantage in today's market.**

MRV's Pro-Vision® service provisioning and management system combined with its powerful Carrier Ethernet Optiswitch® solution allows create new revenues, reduces Operating expense (Opex) and secures investment. It provides complete visibility of service performance and automated Service Level Agreement (SLA) monitoring.

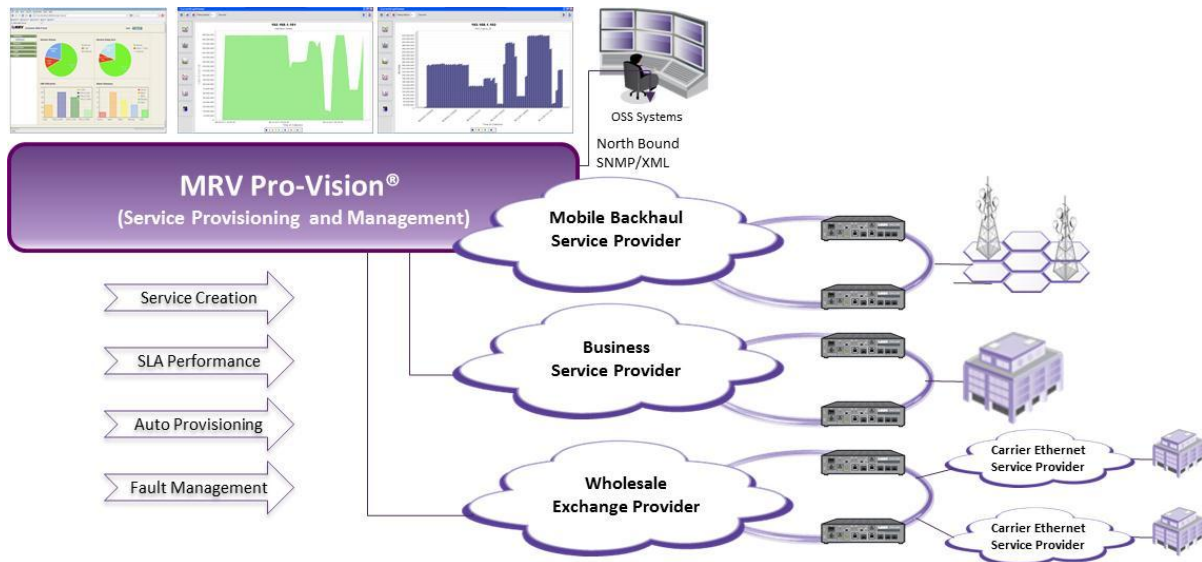


Figure 2 Provision SLA Monitoring and Service Provisioning

## 2 SLA Service Delivery Life Cycle

Ethernet services are delivered to a customer through a single Ethernet user network interface (UNI) that can handle many applications with SLA guarantees. MEF has undertaken a significant amount of effort toward defining set of attributes and implementing Quality of Service (QoS) to ensure standardized SLAs are delivered. This enables service providers to deliver some traffic with strict SLAs while other traffic with best effort. Subscribers can purchase and pay for only the bandwidth they need. Furthermore, subscribers can be assured of a “committed” amount of bandwidth that meets certain performance objectives in an SLA.

The SLA Life Cycle involves several stages as shown in Figure 3.

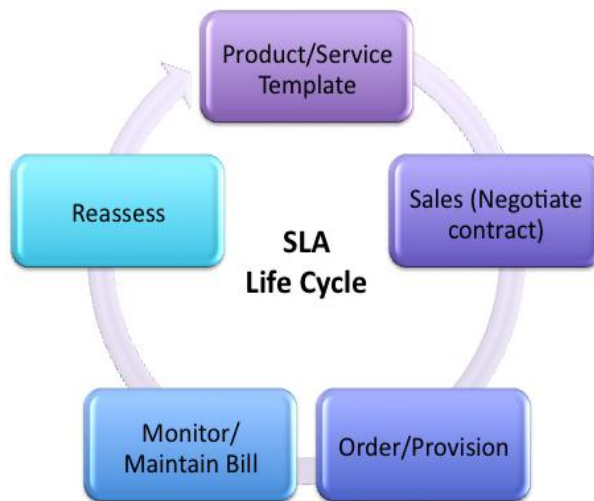


Figure 3 SLA Life Cycle Management

Typical SLA content is comprised of the following:

- Service Provider and customer responsibilities
- Fault classification
- Service restoration time vs. response time
- Service accessibility, link availability
- Measuring and reporting SLA compliance
- Financial compensations and bonuses
- Contract termination

**Stage 1 – “Product/Service Template”:** The First stage involves defining the product or service template and SLA performance parameter boundaries.

Every Ethernet service has an associated traffic parameter or Bandwidth profile and can be applied at the UNI or for an Ethernet Virtual Circuit (EVC). When there are multiple services

associated with a UNI, there is a corresponding Bandwidth profile associated with each of these services. A Bandwidth profile specifies a limit on the rate at which Ethernet frames can traverse the UNI associated with an Ethernet service. Service providers can sell bandwidth in increments. Subscribers can purchase and pay for only the bandwidth they need. Furthermore, subscribers can be assured of a “committed” amount of bandwidth that meets certain performance objectives (usually specified in an SLA) and “excess” bandwidth that may not meet the SLA.

The bandwidth profile associated with an Ethernet service consists of four traffic parameters: Committed Information Rate (CIR), Committed Burst Size (CBS), Excess Information Rate (EIR), and Excess Burst Size (EBS). The CIR is the average rate up to which service frames are delivered as per the performance objectives (such as delay, loss, etc.) associated with the service; these service frames are referred to as being CIR-conformant. The CIR value is always less than or equal to the UNI speed and guarantees that the specified amount of bandwidth (or service frames) will be delivered according to a predetermined performance level.

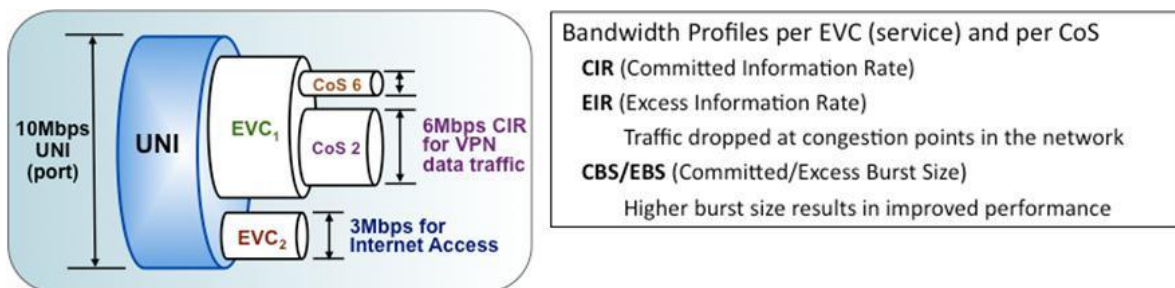


Figure 4 Bandwidth Profile and Class of Service (CoS)

The performance parameters affect the service quality experienced by the subscriber and consist of the following:

- **Frame Delay** This critical parameter can have an impact on real-time applications such as VoIP and is defined as the maximum delay measured for a percentile of successfully delivered Committed Information Rate (CIR)-conformant (green) service frames over a time interval
- **The frame delay** parameter is used in the Class of Service (CoS) service attribute
- **Frame Delay Variation** is also critical in real-time applications such as VoIP or IP video. Such applications require a low and bounded delay variation to function seamlessly
- **Frame Loss** Frame loss is defined as the percentage of CIR-conformant (green) frames not delivered between UNIs over a measured interval. At this point, frame loss has been defined for only Point-to-Point EVCs
- **Availability**, This is still being formalized by the MEF but essentially attempts to indicate the availability of a service at a predefined performance SLA

This set of performance parameters allows a Service Provider to actually define the specific SLAs associated with a particular commercial service. These parameters provide significant latitude for defining numerous levels of service premiums. Further, these parameters although associated with a service, are enforced across the underlying infrastructure delivering that service. This enables service providers to sell premium services for example:

- Service redundancy for mission critical traffic, (link aggregation, linear protection, protected bandwidth, ring protection etc.)
- Quality of service by application (voice, video, data, finance etc.) VoIP, Video on Demand,
- Number of devices on network
- By customer or organization
- Performance guarantees, enable customers to track the service performance metrics e.g. Delay, Delay variation, packet loss etc.

The CoS refers to the performance enforced on a set of similar services. It is usually associated with a group of services. The CoS enables Service Providers to model service demands realistically; customers are increasingly subscribing to services with very different performance demands, for example, Internet access and Voce VoIP require different treatments. These CoS mechanisms enable service providers to apply associated charging schemes helping them improve their Return on Investment (ROI) in network infrastructure.

**Stage 2 – SLA contract negotiation:** The second stage of SLA Life Cycle is comprised of sales negotiation and contract. This is important from commercial perspective.

**Stage 3 – Order/Provisioning:** The third stage is comprised of taking line or service orders and provisioning or commissioning. The capability to provision new Ethernet services rapidly is key advantage compared to the legacy TDM services. This capability translates into allowing granular increases in bandwidth to existing services; the addition of new services, each with a specific performance assurance (SLA); and the ability to enable these services remotely.

**Stage 4 – SLA monitoring:** Once the service is provisioned, the fourth stage involves service SLA performance monitoring. With this the customers get the assurance that the underlying Carrier Ethernet services are performing according to stringent SLA requirements. The service management portal reports performance success directly to demanding customers by turning on the standards based OAM test and providing both real-time and historical measurements.

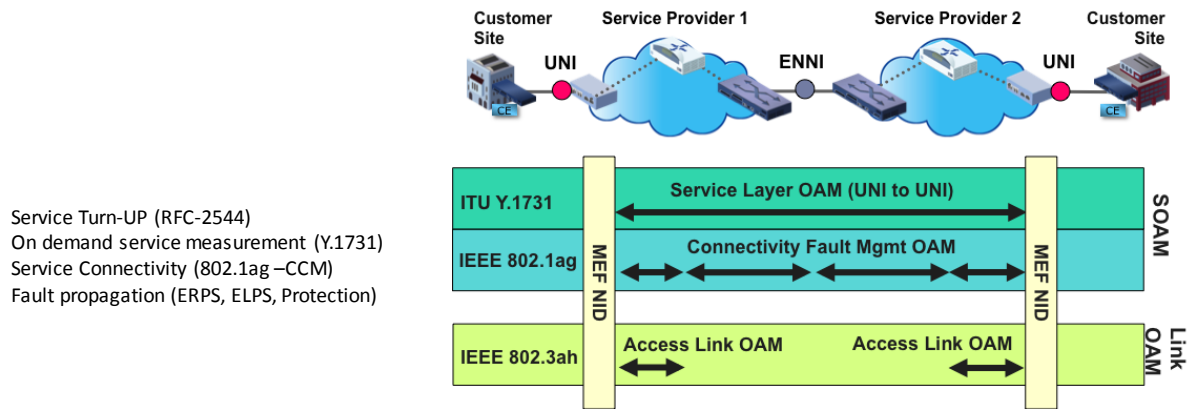


Figure 5 Carrier Ethernet Service OAM standard activity

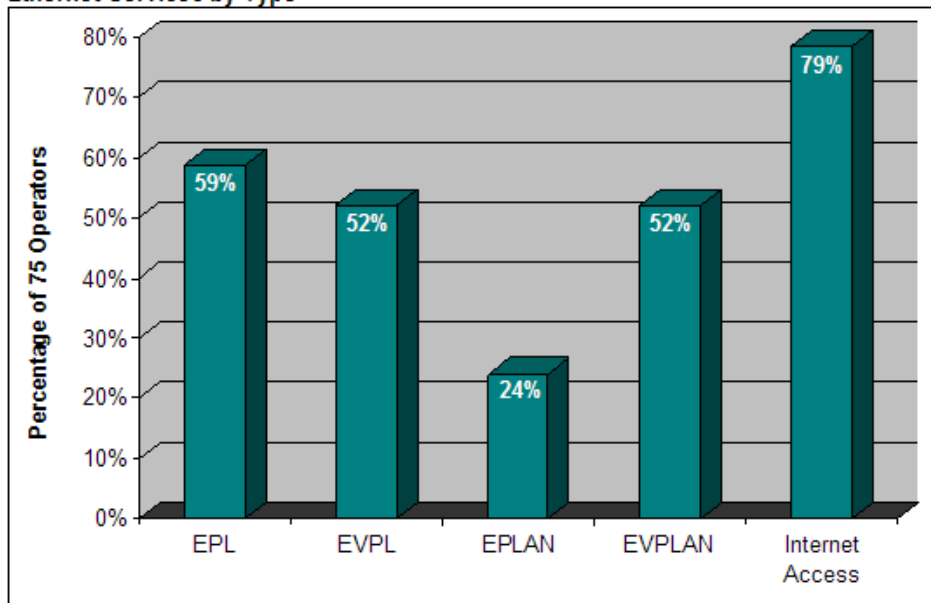
**Stage 5 - Reassess:** The service reassess stage keeps a record of end-to-end traffic statistics and quality of service performance metrics.

### 3 Creating New Services

Carrier Ethernet services not only present new revenue opportunities but also differentiates the service providers from their competition. Creating differentiated service requires activation and testing the service end-to-end. Service providers must ensure services are provisioned, configured (E-Line/E-LAN) and proper service turn-up testing procedures are executed (e.g. RFC 2544). In addition to the existing business services such as Ethernet Private Line (EVL), Ethernet Virtual Private LAN (EVPL) and Internet service providers can offer differentiated premium value-added SLA services. Service creation is also important for the rapid deployment of next-generation business and consumer applications such as IPTV, video on demand (VOD), Voice Over IP, mobile video conferencing, real-time gaming and more.

Study conducted by Heavy reading reveals that there are about 500 different Ethernet services being offered by over 200 Carriers in the U.S. alone.

Ethernet Services by Type



Source: Heavy Reading

## 4 End-to-End Service Visibility

End-to-end service visibility entails the ability to monitor service performance, service availability, measure actual bandwidth usage in per megabits increments, per port and per service on a daily, monthly or customer defined basis and exposing the results to customers directly in real-time or historical analysis.

Some of the key service parameters include the following:

- Service performance Trending – showing exported file on a graph
- Real time SLA monitoring
- Frame Loss e.g. notify after 5min sustained.
- One-way delay: 5ms
- Notify after 5min sustained
- One-way Jitter: +/- 1ms
- Notify after 5min sustained
- Availability: 99.995% N/A contact immediately upon check failure
- Other parameters to monitor real-time are:
- Port signal present: Up/Down
- Availability to check upon check up/down time
- Latency, Jitter Average and Frame Loss

## 5 MRV SLA Performance Management

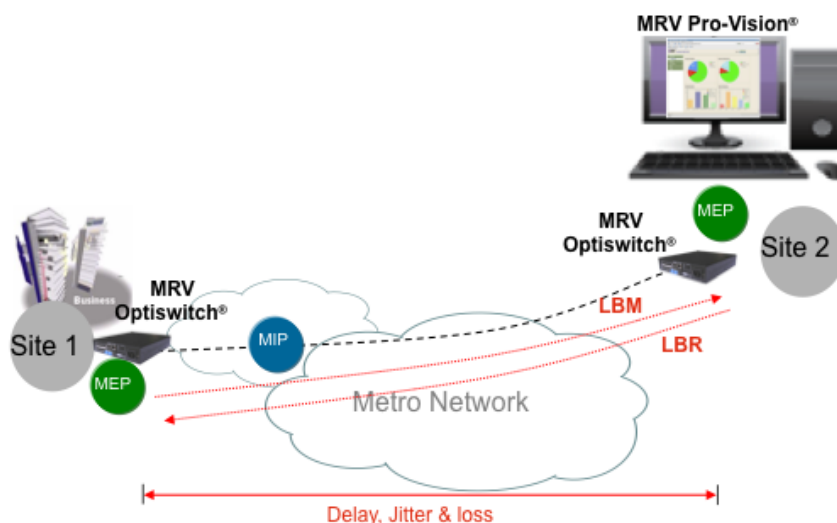
MRV's Pro-Vision® provides real-time collection and analysis of SLA performance data from the network deployed Carrier Ethernet Optiswitch elements. It ensures customer centric performance levels are met providing real-time performance monitoring, availability of service, diagnosing and graphically reporting on various service and network performance metrics such as fault status, historical counters and resource usage monitoring, capacity planning, link utilization, trend analysis, and problem resolution. It provides standards based per service accounting and GUI based performance monitoring using ITU Y1731 and MEF RFC 2544 test and reporting OAM results in both real-time and historical counts in a graph viewer. Configurable data collection and thresholds, periodic data collection with on demand reports, alarm suppression, per service loopback and schedule performance-monitoring test.

MRV's Optiswitch Carrier Ethernet switches incorporate comprehensive SLA conformance and verification via standards based service OAM (IEEE802.1ag) Connectivity Fault Management (CFM) and ITU-T Y.1731 Performance Management functions.

The service OAM functions enable:

- End-to-end service monitoring and fault detection via continuity check
- SLA conformance/verification via loopback
- Alarming upon failure
- Threshold alarms on connectivity (service) and performance violation

As shown in the figure below, the Optiswitch Maintenance End Point (MEP) use unicast Loopback messages (LBM) to pro-actively and periodically measure service performance. The performance messages enable Latency, loss - Two-way, Jitter – Two-way and one-way.



MRV's Pro-Vision® Portal provides highly granular service visibility to customers' centric service data via web based portal views. The web based graphical portal view provides Instant dashboard view of per service SLA KPI Service availability - % Continuity Check Message (CCM), bandwidth utilization and service delay SLA.

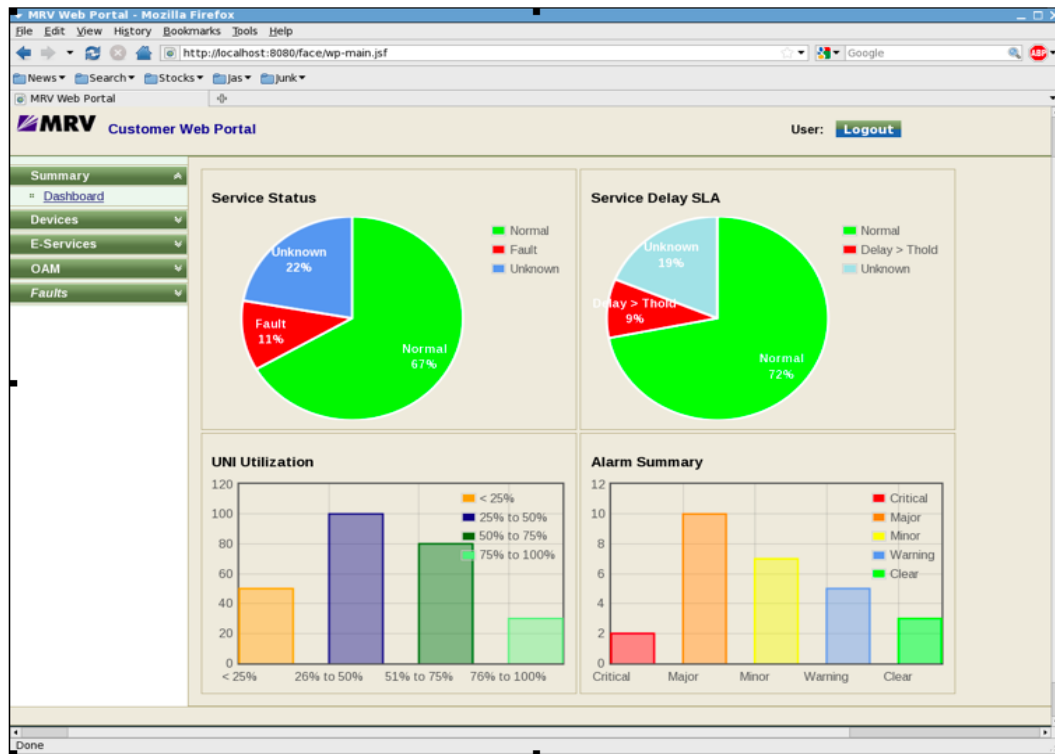


Figure 6 Pro-Vision Portal SLA Performance Dashboard View

The Pro-Vision Portal provides complete graphical view of ITU Y 1731 OAM test results, Real-time and Historical Reports, Performance Delay Graph, Delay Variation (Jitter), Frame Loss Ratio, Customized Performance Management test result graphs.

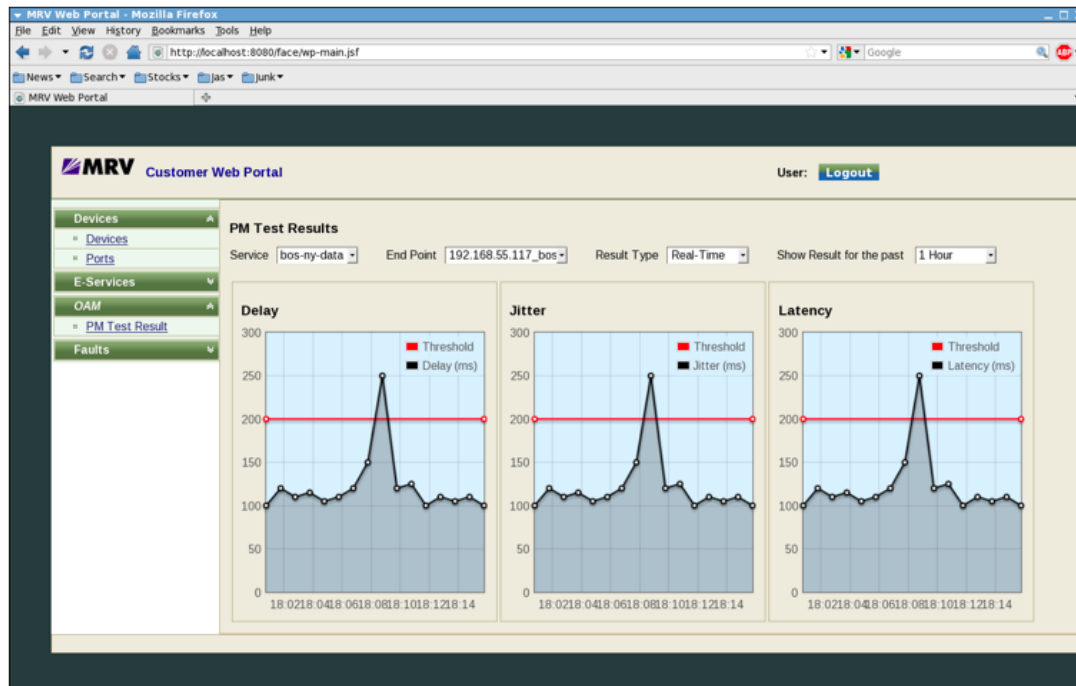


Figure 7 Pro-Vision Portal Performance (ITU-Y 1731) Test Portal View

Pro-Vision collects a comprehensive set of real-time and historic counters. It enables Ingress/Egress service SLA performance statistics collection. The Pro-Vision portal provides graphical view of the performance management (PM) Y.1731 OAM test results. The Y.1731 identifies the OAM functions in an Ethernet network that are needed to allow fault management and performance monitoring. It allows the measurement of typical SLA parameters around error counts and delay measurements such as loss of Ethernet frames, delay between frames, variation or jitter, link up or down, throughput. The portal allows the user to select real-time or historical test results.

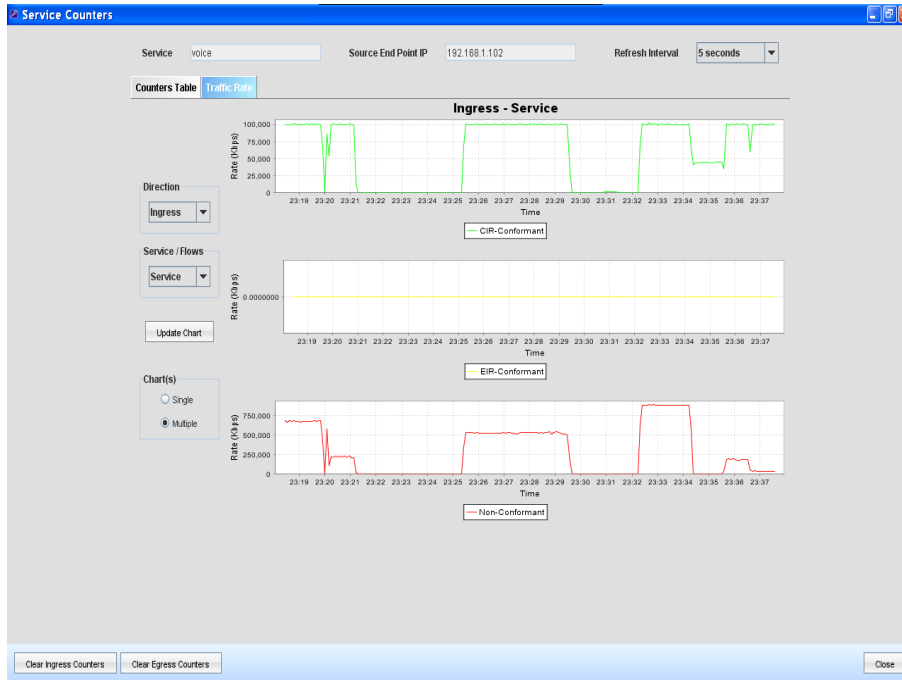


Figure 8 Pro-Vision Service Performance Statistical Analysis

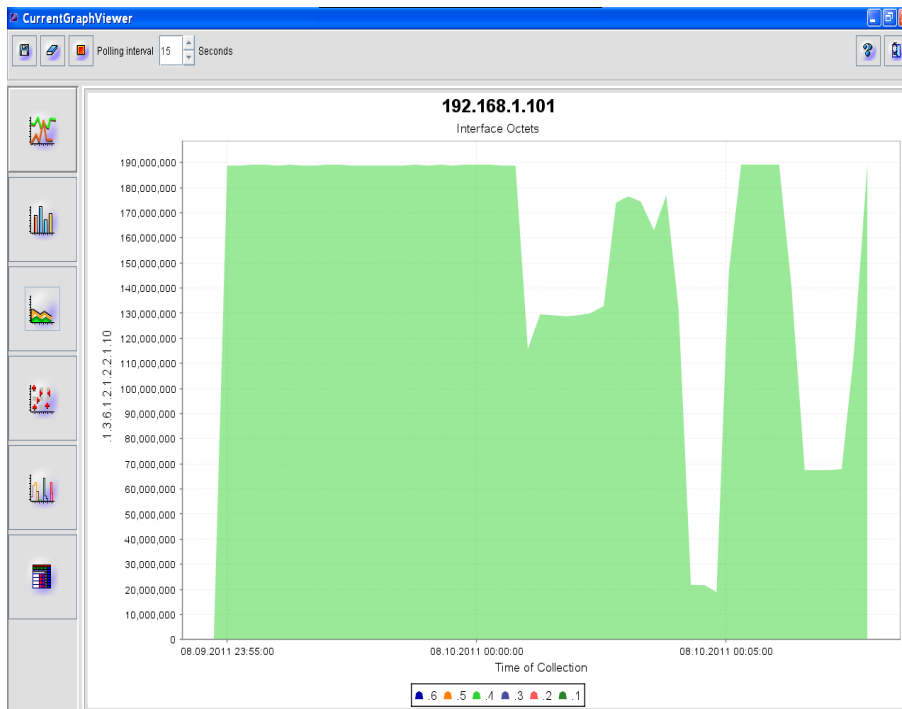


Figure 9 Pro-Vision Service Interface Statistical Analysis

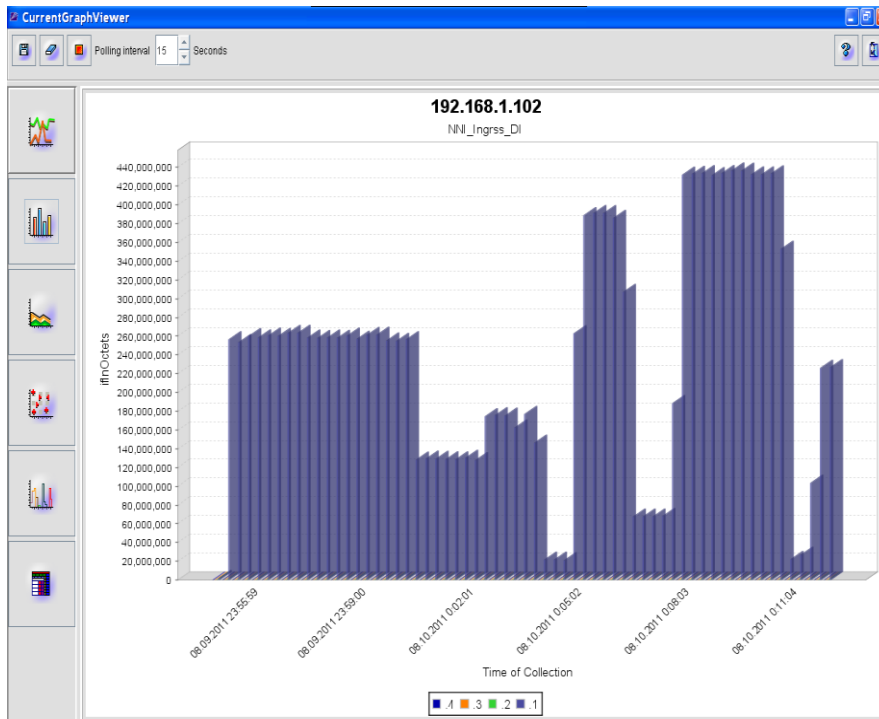
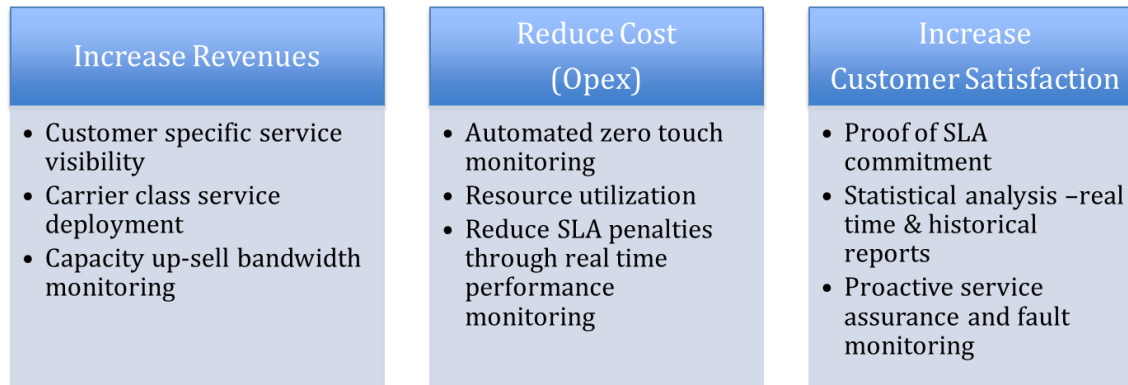


Figure 1 Pro-Vision NNI Ingress traffic statistics polling

## 6 Pro-Vision® Value Proposition

MRV's Pro-Vision SLA performance management pro-actively monitors service parameters and provides the following key benefits:

- **Enables guarantee of the customer SLA.** Verification of SLAs can be demonstrated via enhanced Performance Monitoring, visual graphical reports, reduce network downtime
- **Confirms service levels with highly granular statistics** that includes resource, traffic, and end-to-end service statistics. Data is collected with a distributed polling architecture that enables performance trend and analysis of the entire network or sub-networks in either a graphical or tabular format.
- **Provides ongoing network resource usage**, link bandwidth utilization, and trend analysis to ensure that new services can be supported without performance impact
- **Automatic Zero-touch remote turn up process:** minimize technician on-site operations and simplifies device installation and turn-up. It allows auto download of up-to-date device software and firmware versions, device configurations and database synchronization



**Pro-Vision Portal Platform**  
Secured customer and user access control  
Simple Web based Global View with Customize Charts and Dashboard,  
Per Customer per service performance analysis and SLA reporting  
Built on Carrier Grade Pro-Vision Service Provisioning & Management

## 7 About Pro-vision®

Pro-Vision® is MRV's carrier-class service provisioning and management platform that offers service providers a wide range of applications and tools to fully manage and control large-scale Carrier Ethernet networks for converged voice, data and video networks. The GUI-based software platform allows service provisioning, monitoring and troubleshooting tasks to be performed from an easy-to-use, central network management application. Pro-Vision complements MRV's industry leading MEF compliant OptiSwitch 9124-410G Carrier Ethernet packet-optical aggregation platform and OptiSwitch 900 series of service demarcation devices. The software provides the ability to pre-define individual service profile components that can be used to easily build new service offerings and reduce time to revenue.

Pro-Vision state-of-the-art feature set includes rapid service creation, powerful performance monitoring and network health checking, including real-time reporting on various service and network performance metrics, port and Ethernet virtual circuit (EVC) utilization, transmission errors and quality of service (QoS) thresholds with historical reporting that can be exported. Pro-Vision also includes per-service and end-to-end fault detection tools, multi-user security levels, site-wide maintenance, zero-touch mass deployment along carrier-class scalability and high-availability.

Pro-Vision supports a northbound interface for interconnection with service provider and equipment vendor operations support system (OSS) systems.



## **8 About MRV**

The Optical Communications Systems division of MRV Communications is a global provider of Carrier Ethernet, WDM transport and infrastructure management solutions since 1988. MRV products enable the delivery of next-generation optical transport and Carrier Ethernet services over any fiber infrastructure. Since its inception, MRV has demonstrated expertise and experience offering innovative products that address future challenges while reducing network complexity and costs. MRV solutions are deployed in prominent worldwide networks of multinational service providers, wireless operators, cable MSOs and mission-critical enterprises in government, finance, military, transportation and utility sectors.

MRV delivers a continuous stream of innovative products and has won numerous technological awards for its products. MRV's global infrastructure includes R&D centers in North America and Europe, along with support centers, and sales offices around the world.