

The Impact of Carrier Ethernet on Service Providers

*Managing Next Generation
Service Provider Networks*



Dorado Software Whitepaper

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com

Fax: +1 916-673-1042
www.doradosoftware.com

Introduction

The advent of mobile internet access and the subsequent explosive demand for high bandwidth services on mobile devices has created a pivotal point for service providers. Widely considered the most disruptive technological event for service providers since mobile phones were first introduced, consumer demand for mobile internet access has quickly outstripped the capabilities of existing infrastructure. In addition, mobile phone and VoIP use continues to steadily increase while traditional land-base lines maintain a year-over-year decline (A Jupiter/Forrester research report surveying landline decline for 2006 and 2007 has landlines declining at 1% to 1.7% each quarter).

This highly competitive and rapidly expanding market creates an unprecedented opportunity for service providers. By meeting the demand while maintaining efficient networks and increasing profitability, service providers have the ability to expand their footprint and market share by a significant percentage. Conversely, the ability to make costly mistakes in infrastructure planning also exists, resulting in an unsatisfied public, high competition and, ultimately, loss of market share. Service provider infrastructure needs to be adaptable, scalable and cost-efficient. These qualities will give stakeholders the ability to customize their service offerings to an ever changing and expanding market.

Problem

One of the key aspects of this sea-change from a mobile network perspective is the rise and adoption of Carrier Ethernet for Mobile Backhaul. Compared to traditional hardwire solutions, switched ethernet provides a more economical solution while providing greatly increased bandwidths. Highly optimized for packet-based traffic and the ability to be transported over a variety of transport media, Ethernet-based infrastructure has quickly become a de-facto standard for the backhaul segment. Utilizing existing copper infrastructure and running Ethernet over Copper provides viability from an in-ground perspective although bandwidth limitations with copper leave fiber as the clear leader for backhaul solutions.

Fiber's limitations include the expense of existing copper replacement and the physical inability to run fiber to certain locations. These issues leave a service provider managing multiple services over divergent vendor equipment.

By meeting the demand while maintaining efficient networks and increasing profitability, service providers have the ability to expand their footprint and market share by a significant percentage.

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com

Fax: +1 916-673-1042
www.doradosoftware.com



The associated management applications for each brand of equipment, while tuned specifically by the vendor for the brand, typically falls short when providing interfaces to other brands selected for subsequent network segments.

From a hardware and management perspective, service providers are faced with a dizzying array of potential solutions for addressing carrier ethernet for mobile backhaul. While reviewing, vetting and selecting potential solutions, the ongoing needs for increased bandwidth, simplified management and cost cutting are the principal drivers. It is too easy to implement solutions for various segments of the backhaul network and pay too little attention to the ongoing provisioning, management, Quality of Service (QoS) and fault management of the entire network.

A major problem in the selection process arises when specialized equipment is selected for each segment of the network. While some vendors provide cost-effective and reliable customer edge equipment, other vendors excel in the provider edge space. Still other vendors provide a good choice for core equipment. While interfaces do exist, their maintenance and upkeep from an OAM perspective are expensive to maintain and typically do not perform all tasks needed for typical provisioning and OAM activities. Aside from the interfaces, the learning curve, upkeep and maintenance of the discrete management applications is time-consuming and costly. The level of operational complexity increases along with cost and the time to execute typical tasks such as provisioning. Worse, service providers are sometimes relegated to Command Line Interface (CLI) for key steps in the provisioning and maintenance process. These human-interface touch points increase the margin of error and decrease the reliability of the infrastructure.

In addition, fault monitoring and management applications along with asset discovery and inventory are usually separate entities to the OAM consoles. For instance, in a typical environment using typical fault management applications, while thousands of alarms may be announced, the nominal interfaces to OAM and inventory platforms means the network managers can find it difficult to identify which alarms are against provisioned equipment, which have active customers and which have priority QoS.

To add to the complexity of provisioning in a multi-vendor environment, service providers typically deal with a variety of service level agreements and quality of service parameters that must also align with 3GPP, 3GPP2 and 802.16-based standards. Consumer demand and the competitive landscape will not accept a lack of adherence to QoS.

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com

Fax: +1 916-673-1042
www.doradosoftware.com



Redcell Services

ELine Circuit

LDP Martini

ELAN Kompella

BGP

Layer 2 VPN

ELINE (Point-to-Point)

ELAN

VPLS

BGP

ELAN

VPLS

LDP

VPLS

ELAN (Multipoint) Layer 2 MPLS

**Named
Path**

Label Switch Paths

RSVP-TE

MPLS

Traffic Engineered LSPs / Paths

UNI

VLAN

Carrier Ethernet

UNI Service (Port Configuration)

VLANs (Access / Trunk)

**Customer
VPN**

**Extranet
VPN**

**Management
VPN**

Layer 3 MPLS VPN

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com


Fax: +1 916-673-1042
www.doradosoftware.com



Previous Options

Historically, service providers, like others in the enterprise IT industry, have had to plan around the shortfalls in multi-vendor network segments. This especially holds true for the relatively new carrier ethernet solutions: for every choice of media on which carrier ethernet can travel, there is equipment specifically tuned for that media. For every service provider (and every media), there is a unique and distinct solution for each problem. The problem areas of those solutions can include:

- **Disparate Vendor Console Interfaces** – Whether provided by the vendor or created in-house, console interfaces provide a measure of control for typical activities. Instead of initiating activities at each management console, interfaces can reduce the level of intervention and manual entry by passing alerts, information and directives between systems. The drawback with interfaces, especially ones developed internally, is the ongoing and costly time-sinks of patching and upgrading. For each firmware upgrade for each affected device, the related interfaces have to be tested, patched, tested again and redeployed enterprise-wide. Many times these interface updates are tight-timeframe events requiring an “all-hands” approach. These activities are not only time-consuming but also hard to plan against and hard on staff.
- **CLI** – The worst-case scenario for any service provider is Command Line Interface or scripted entry for provisioning. As discussed earlier, this lowest denominator of network management and maintenance opens the door for operator error which results in lower reliability and increased customer dissatisfaction.
- **Standards Adherence** – Industry standards bodies continue to contribute to the Ethernet protocol in order to increase the scale, capacity, QoS and management capabilities of Ethernet. The Metro Ethernet Forum alone has contributed no less than 19 individual technical specifications for Carrier Ethernet. The IEEE, IETF and ITU have all contributed their own specifications in order to enable consistent deployment of Carrier Ethernet within service provider networks around the world. Today each service provider meets these myriad specifications in their own unique way. While the standards are standard, meeting them is an internal creation. This standards management, combined with the above-mentioned multi-vendor interfaces and potential CLI activities creates an environment of high cost, slow responsiveness and tenuous QoS.



Rather than moving from one discreet console to another for provisioning and other fulfillment processes, providers need the ability to initiate these tasks from a single console...

The Solution

Service providers are continuously exploring ways to speed provisioning and delivery to market while simplifying network management, maintaining standards and regularly improving the customer experience. Again, the core drivers of increased bandwidth, simplified management and cost cutting are never more prevalent than in today's rapidly expanding mobile web market. Some obvious solution examples include single console management and automation of repeatable tasks.

Service providers need the ability to manage the end-to-end network through a single console and have the management workflow execute the processes network-wide. This single console should be able to handle provisioning from the customer-owned equipment, through aggregation, the edge equipment, the core and through the other edge to the web, PSTN, or another end device. This provisioning should include E-Line, E-LAN and E-Tree services. In addition, since UNI is a discrete subservice within an AVC (with its own customer-specific QoS, and Customer VLAN to Provider VLAN mappings) provisioning from a single console should provide capabilities for EVC and accompanying UNI provisioning. By controlling provisioning and other OAM tasks through a single console, the service provider eliminates the need for problematic cross-vendor interfaces as well as the need for multiple tasks on multiple applications to satisfy one activity. Two of the three core drivers are satisfied: network management is simplified and costs are reduced by accelerating the speed of fulfillment.

Furthermore, a single management application capable of discovery, inventory and QoS would eliminate other costly standalone applications while making it easier to proactively identify and remedy key network points.

By automating the numerous facets of network management, especially repeatable processes, CLI and other manual solutions can be relegated to only extremely rare instances. By standardizing repeatable tasks through automation, adherence to industry standards is also improved. This type of automation reduces costly errors which lead to lost revenue and customer dissatisfaction.

Fault management is another area where a single application solution is desirable. As previously noted, if fault management is not tied to inventory, it is difficult to identify the piece of equipment as provisioned or customer-active. By having fault management, inventory, QoS and SLA tightly related like that of a single platform, the ability to identify, prioritize and resolve key issues occurs faster and more proactively. Mean time to repair is reduced and customer satisfaction increases.

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com

Fax: +1 916-673-1042
www.doradosoftware.com

MEF Acronym	Description	Related Redcell Services
UNI	Service that maps a Port for a customer's traffic in to discrete flows that can be associated to EVC(s).	Ethernet UNI
E-Line (Ethernet Private Line - EPL)	Point-to-Point service used to transport traffic for an EVC across an Ethernet Backbone. Redcell provides an L2 MPLS LDP based circuit for delivery of this service across multiple vendors.	MPLS L2 Eline Circuit
E-LAN (Ethernet Virtual Private Line - EVPL)	VPLS <ul style="list-style-type: none"> • Multipoint service used to emulate a virtual LAN and transport traffic for an EVC across an Ethernet Backbone. • Redcell Service Center's VPLS Module provides LDP VPLS service provisioning for devices from multiple vendors. Redcell Service Center's VPLS Module also contains the BGP VPLS Service, which is supported by Juniper Networks L3 MPLS VPN Multipoint service used to provide a multipoint VPN service. Redcell Service Center's L3 VPN Module supports multiple L3 MPLS VPN topologies, including Intranet and Extranet VPNs.	MPLS L2 ELAN BGP VPLS MLS L2 ELAN LDP VPLS MPLS L3 VPN (Full Mesh)
E-Tree (Ethernet Virtual Private Line - EVPL)	E-Tree is a point-to-multipoint service that can be provisioned using label switched path capabilities of MPLS. Using L3 VPN as a transport service for an EVC provides multiple IP capabilities including Multicast.	MPLS L3 VPN (Hub & Spoke)

The [Dorado Software Solution](#)

Carrier Ethernet solution provides answers for many of the problems plaguing service providers with respects to managing and scaling network segments including the carrier ethernet mobile backhaul. Dorado Software's [Redcell](#)[™] solution helps service providers reduce costs, simplify network management and increase customer satisfaction by providing a single console to manage the entire carrier ethernet network lifecycle. From provisioning, OAM, monitoring, fault management to discovery, inventory and proactive QoS and SLA administration, Redcell provides a single platform for the high majority of a service provider's needs.

The single console aspect of Redcell removes the costs associated with vendor-centric discrete management consoles and the maintenance aspects of the accompanying interfaces. With all facets of network management residing within a single platform, application maintenance is greatly simplified.

Redcell provides [service provisioning](#) with GUI interfaces for UNI, EVC, E-Line, E-LAN and E-Tree services. The flexible, multi-vendor activation and management of these services, including Port based and VLAN based virtual connections, provides Ethernet connectivity to subscribers and offers multiple options for data transport. Redcell's one-touch end-to-end provisioning supports MPLS Named Path and MPLS LSP services as well.

QoS/CoS provisioning is a centralized management function included in the [Redcell Carrier Ethernet](#) solution. By supporting QoS from a single console, a service provider can enforce specific behaviors for Triple Play Communications over their converged network. Single console QoS is a significant time saver which ultimately increases customer satisfaction and reduces costs. Also, with Redcell's network monitoring and fault detection, service providers can maintain effective SLA metrics. By alerting you when availability and performance thresholds are nearing outside tolerance, Redcell helps mitigate problems before the network or end-users are impacted.

Fault management is better executed due to the association of services with logical and physical resources. By combining SLA with inventory, the prioritization of assets can be more easily managed: active customer equipment can be prioritized over other, less critical assets. Device and link discovery of an environment is highly flexible and can be executed via subnet, IP range, IP address or hostname. All inventory data is database driven, extensible and shared with other Redcell features including Assurance, Reporting and Performance.

Redcell provides extensive [OAM](#) service diagnostics including performance and reporting tools. OAM capabilities provided within

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com

Fax: +1 916-673-1042
www.doradosoftware.com

Redcell's discovery and inventory management features provide clear insight into equipment status including physical, network and service topology.

Redcell also support complete lifecycle management for delivering and supporting next generation applications and services such as IPTV, Video-on-Demand, Storage Extension and Disaster Recovery. Configuration of ports can be in conjunction with assigned VLANs and associated security levels such as MEPs and MIPs.

A major part of Dorado Software's success is the rapid implementation time of the Redcell platform. A faster discovery and implementation cycle coupled with a more flexible response mechanism makes the Redcell solution quicker to begin realizing ROI. Dorado Software is also known for moving quickly to adopt new technologies and standards. One case in point is the adoption of various management protocols including the imminent release of IEEE 802.1ag for service verification, IEEE 802.3ah for link layer troubleshooting and MEF Ethernet Local Management Interface for service status and auto provisioning of customer premises equipment.

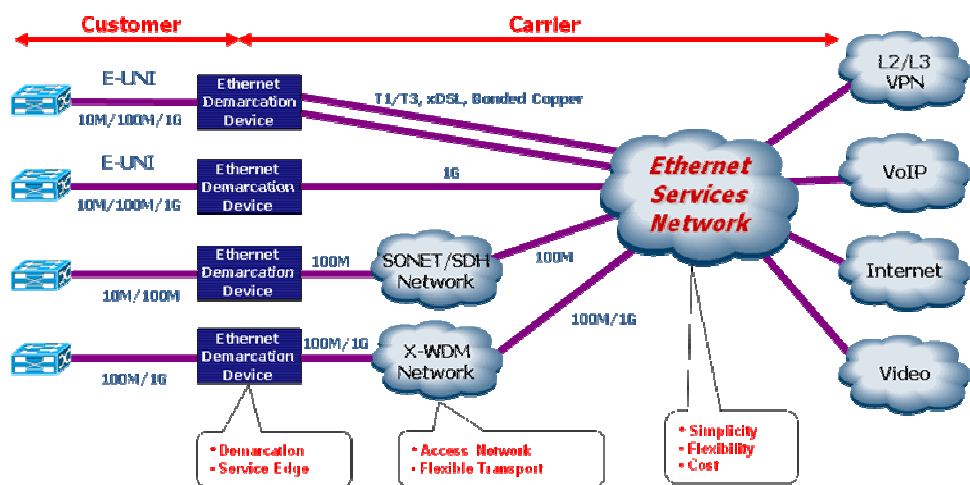



Figure 1 – Redcell End-to-End Provisioning

Dorado's Software Development Kits increases Redcell's depth by enabling the creation of [device drivers](#) and extensions. By exposing APIs and creating a pre-determined toolbox of generic driver solutions, engineers are able to quickly create drivers for attached equipment. In addition, Redcell's open API scheme provides effective integration to 3rd party applications. This ability provides for the inclusion and management of legacy applications alongside the Redcell solution.



Instead of time spent managing application interfaces, providers can focus on the differentiating next generation services and features.

Summary

Rapid customer adoption rates with associated demand for fast browsing and video streaming is driving the changing landscape of an industry undergoing radical transformation. With stiff competition, rapid expansion and high consumer expectations, service providers need next generation tools to succeed in the next generation communications market. Carrier Ethernet has been identified as a key solution to help scale the enterprise as well as simplify and standardize on a proven, successful technology. Dorado Software's Redcell platform gives service providers the ability to simplify and manage such a multi-vendor environment while maintaining imposed standard, cutting costs and continuing to scale.

By using a single console and application platform to provide Discovery, Inventory, Provisioning, QoS, Fault Management, Health/Performance Management, Ethernet OAM, Topology, Configuration Management, OS Management and Comprehensive Reporting, service providers are better able to address higher level customer-facing issues.

With a low cost of entry, rapid time to market and the ability to decrease mean time to repair, network engineers can benefit greatly from adopting the [Redcell](#) platform.

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com

Fax: +1 916-673-1042
www.doradosoftware.com



Contact Us

For more information <http://www.doradosoftware.com/solutions/service-provider.html>

Corporate Headquarters

Dorado Software, Inc
110 Woodmere Road
Folsom, CA 95630

URL: www.doradosoftware.com

EMAIL: info@doradosoftware.com

Copyright 2009 Dorado Software, Inc. All rights reserved. Dorado and Redcell are registered trademarks of Dorado Software, Inc. All other marks are the property of their respective owners.

Dorado
SOFTWARE

Dorado Software Inc.
110 Woodmere Road, Suite 200
Folsom, CA 95630
Phone: +1 916-673-1160
info@doradosoftware.com

Fax: +1 916-673-1042
www.doradosoftware.com