A private MPLS-based Wide Area Network (WAN) has been the cornerstone for Enterprises to connect branch offices with their corporate data centers for the last decade. Service Providers around the world have invested heavily in their MPLS network infrastructure to support their customers’ demand. However, the branch networking landscape has changed recently with the ubiquitous availability of Internet broadband access and widespread adoption of cloud services. According to Nemertes research, enterprises’ adoption of Internet as a WAN is growing 25% annually1. Cloud-based applications drive enterprises to rely more heavily on Internet connectivity, and also change the traditional traffic pattern from a branch-to-Data Center to a branch-to–Cloud pattern. The legacy network design of traffic flow from the branch-to-Data Center causes inefficiencies that impacts the performance of cloud applications, while driving up costs and complexities of enterprise networking. All these changes are occurring at a time when Service Providers are facing fierce competition that is adversely impacting growth of MPLS deployment and the associated revenue margins.

Service providers can transform their networks to deliver unified elastic transport, enable direct access to cloud services and increase network agility.

BACKGROUND
A private MPLS-based Wide Area Network (WAN) has been the cornerstone for Enterprises to connect branch offices with their corporate data centers for the last decade. Service Providers around the world have invested heavily in their MPLS network infrastructure to support their customers’ demand. However, the branch networking landscape has changed recently with the ubiquitous availability of Internet broadband access and widespread adoption of cloud services. According to Nemertes research, enterprises’ adoption of Internet as a WAN is growing 25% annually1. Cloud-based applications drive enterprises to rely more heavily on Internet connectivity, and also change the traditional traffic pattern from a branch-to-Data Center to a branch-to–Cloud pattern. The legacy network design of traffic flow from the branch-to-Data Center causes inefficiencies that impacts the performance of cloud applications, while driving up costs and complexities of enterprise networking. All these changes are occurring at a time when Service Providers are facing fierce competition that is adversely impacting growth of MPLS deployment and the associated revenue margins.

ENTERPRISE DEMAND FOR BANDWIDTH AND ACCESS TO CLOUD SERVICES
Enterprises are asking for a network service that allows them to consume cloud and rich media applications while maintaining the stellar performance to which they are accustomed. They are also increasingly aware of a hybrid WAN networking paradigm that allows them to combine both MPLS and Internet transport. Hybrid WAN has gained popularity in the last few years but it is quite difficult to manage and operate due to its complexity. For the Service Provider — managing two disparate, disjointed networks of MPLS and Internet can be quite complex to configure, operate, and troubleshoot. Service Providers around the world are assessing how
to transform their networks to meet the customer demand:

1. Need for on-demand bandwidth without major network re-architecture
2. Expand WAN services to provide direct, optimal path for Cloud services and enhance application delivery
3. Unified management and orchestration network model
4. Seamlessly integrate with existing network infrastructure, improve operation efficiency and reduce total cost of ownership

Software-defined WAN (SD-WAN) is a new solution that effectively leverages private MPLS links and ordinary broadband links to carry branch office traffic. A centralized policy can be defined to provide application steering according to business requirements, policy, and governance. And while there are several SD WAN solutions being marketed in the industry today, Service Providers are carefully considering an SD-WAN solution that can be implemented easily with flexible deployment options and also provide a foundation of a next generation carrier network that can deliver rich cloud services, increase revenue opportunities, and reduce overall cost.

**TRANSFORMING THE MPLS NETWORK TO A SERVICE-READY NETWORK**

VeloCloud is a pioneer in cloud-delivered SD-WAN that combines the economics and flexibility of multiple WAN transports with the deployment and agility of a cloud-based service. VeloCloud provides a turnkey, cloud-ready solution for Service Providers looking to deliver Internet-augmented MPLS service. By combining Internet links with MPLS coupled with a centralized policy controller, Service Providers can meet the demands for a unified, elastic bandwidth service. In addition to higher reliability, increased available bandwidth, and improved application performance for their end customers, Service Providers can easily operate and integrate this new architecture into their existing MPLS network. Internet Augmented MPLS (iMPLS) can be the next generation of hybrid WAN service that is easier to manage and deploy, and is one valuable service that can be built on the foundation of a cloud-delivered SD-WAN.

**HOW THE VELOCITY SOLUTION ENABLES SERVICE PROVIDERS**

VeloCloud delivers a turnkey solution to enable service providers to deliver Internet-augmented MPLS. The solution consists of multiple key components.

- VeloCloud orchestration provides centralized policy management, monitoring, and troubleshooting as well as simplified control plane elements. Its multi-tenant architecture enables SP operators to easily provision new customers and manage across multiple customers. Each customer can be provided access to their own self-service Web portal for monitoring and policy configuration. Both the SP and Enterprise portals have granular role based access. Its easy to use, intuitive Web interface enables operational efficiency with minimal training. VeloCloud’s application level policy framework provides a business level abstraction for how the network should steer application flows across different transports and to hybrid cloud destinations. Its API driven architecture also means that SPs can easily integrate the Orchestrator into their operations.

- VeloCloud Edge is a high performance branch customer-premise edge (CPE) or virtual CPE (vCPE) that is designed to be very easy to deploy. The VeloCloud
VeloCloud edge is available as both a hardware and virtual appliance supporting various throughput performance tiers. The virtual form factor supports major hypervisors including VMware, Xen, and KVM. The VeloCloud edge supports multiple wired and wireless connectivity on both the WAN and LAN ports. The VeloCloud Edge can be provisioned from the Orchestrator and VeloCloud zero touch deployment allows service providers to deploy a new branch within minutes. Once enabled, it automatically detects the circuit characteristics, such as bandwidth, latency and more. It then builds a secure overlay network with the VeloCloud gateways across all the available links and starts steering the applications per the configured policy. VeloCloud dynamic multipath optimizationTM ensures superior application experience by dynamically steering packets on the best available path and protects critical applications from sub-optimal performance from the underlying transport.

- VeloCloud Gateway is a multi-tenant virtual appliance that is installed in the service provider core network. It terminates the overlay tunnels from the VeloCloud Edge coming over both private (MPLS) and public (Internet) links. Its multi-tenant architecture provides cost effective, scalable SD-WAN gateway installation in the service provider core network. It also seamlessly integrates with existing MPLS VPN networks by supporting virtual routing and forwarding (VRF) handoff to the service provider router. This allows service providers to support co-existence of VeloCloud branches with classic MPLS or Internet branches for the same customer. VeloCloud gateways scale horizontally in order to meet the scale and performance requirement of the service providers.

**EASY DEPLOYMENT AND CONFIGURATION**

VeloCloud SD-WAN Service can be quickly installed with zero-IT-touch branch deployment. The branch edge is either provisioned as a virtual machine or custom-hardware shipped to the branch office, where a non-technical person simply plugs in a few cables. Activation, configuration, and on-going management are all managed in the cloud. It efficiently integrates LAN, WAN, Wi-Fi and 4G-LTE connectivity options in a single-device.

**CLOUD ORCHESTRATION AND MANAGEMENT**

Working with the Edge, the cluster delivers dynamic, multi-path optimization so multiple, ordinary broadband and private links appear as a single, high-bandwidth link. Orchestrator management provides centralized configuration, real-time monitoring, and one-click provisioning of virtual services. The VeloCloud Orchestrator business policy framework makes setting policy as simple as one-click. Providers can define business rules, such as prioritizing collaborative applications over social

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**Figure 1. VeloCloud Cloud-delivered SD-WAN solution for Service providers**

- VeloCloud Site
- VeloCloud Edge
- Dynamic Multi-path Optimization
- Orchestrator
- Service Provider
- MPLS Cloud
- Cloud Gateways
- PE
- Cloud DC
- SaaS
- Customer Edge Router
- Non-VeloCloud Site
media, and QoS mechanisms, resource allocations, link/path steering, and error correction are automatically optimized. Deployment options, like branch-to-branch and branch-to-data center, are also flexible and easy to configure.

SECURITY
Cloud VPN provides site-to-site virtual private networks (VPNs) to secure traffic. Edge to Edge and Edge to Gateway VPN tunnels are automatically provisioned. Legacy sites can be connected to the cloud VPN with no additional appliance installations via standard VPNC-compliant IPsec tunnels.

PERFORMANCE IS CRITICAL
VeloCloud Cloud-Delivered SD-WAN boosts the service level of standard private MPLS and broadband links by implementing a number of patent-pending technologies, including:

Dynamic Multi-Path Optimization:
Packets are steered to the optimal link based on performance metrics, application requirements, business priority of the application, and link cost. This technology can create a virtual, high bandwidth pipe from multiple, inexpensive broadband links and leased lines, providing customers improved WAN economics and quality.

When real-time traffic (e.g., VOIP) with higher business priority is identified, on-demand forward error correction can be performed to reduce or eliminate packet loss. In tests on approximately six million anonymous data records, an Internet connection had performance issues that impacted voice quality (dropped segments of calls) about 25% of the time. A combination of packet steering and forward error correction reduced voice degradation to less than 1% of the time.

Real-time Analytics: A dashboard displays network and application performance that can be used to make traffic control decisions, such as treating real-time interactive and bulk streams differently. The service classifies over 3,000 applications, which enables granular control of applications when optimizing QoS.

SOLUTION BENEFITS
Service Providers can continue to leverage their investment in their MPLS networks, but gradually and seamlessly enable integrated SD-WAN technology into their core network. The multi-tenant architecture and flexible form factor of the VeloCloud solution enables Service Providers to quickly implement and operationalize a new class of WAN service: Internet-augmented MPLS. Service Providers can quickly meet the customer demand and protect their existing MPLS revenue. It also lays a foundation for the Service Provider to transform their network to become an extensible, service-aware platform that supports their customers’ adoption of cloud services.

The branch office WAN is in transition as new solutions help improve the economics and quality of WAN connections. Along these lines, VeloCloud Cloud-Delivered SD-WAN Service offers enterprise-grade performance, security, visibility, and control over both Internet and private networks, combining the cost-effectiveness of the Private MPLS and Internet with the flexibility of the cloud.

For more information about solutions from VeloCloud, visit www.velocloud.com.

1 Source: Nemertes Research, WAN Adoption Benchmark survey, Q3 2014