Cloud Service Delivery Architecture Solutions for Service Providers

White Paper for Network Managers

Brocade enables service providers to transition from bandwidth providers to cloud service providers with innovative Virtual Private LAN Services (VPLS)-based cloud service delivery architecture solutions that help unlock new revenue streams.
This paper details how Brocade® cloud service delivery architecture solutions speak directly to the challenges service providers face and help create new revenue-generating opportunities through advanced cloud services. It identifies the challenges for service providers and discusses how Brocade solutions for Wide-Area Network (WAN) infrastructure address these issues and provide a unified solution that enables service providers to monetize new services.

THE CHALLENGE
The evolution of data consumption and bandwidth needs amplifies pressures on current service provider networks. With the proliferation of smart mobile devices and powerful apps, demand for bandwidth is escalating at a rapid pace. At the same time, increased competition is driving down the price providers can charge for bandwidth services. This leads to a revenue gap that challenges service provider profitability.

Mobility, smart devices, and powerful apps come with changes in usage patterns—a rise of video-rich media and longer, more unpredictable data flows. Users expect access to their applications and data no matter where they are or when they want it, with nothing less than full application performance at all times. Additionally, flows are becoming more collaborative in nature, with the direct sharing of cloud-based apps and data between end users on the network.
All of these trends increase the difficulties for service providers that support such services in a very dynamic landscape. Furthermore, many new competitors have emerged, running Over-the-Top (OTT) services and utilizing existing service provider broadband infrastructure to deliver these services to end users.

![Figure 1. The challenge for service providers.](image)

Service providers that have their own service delivery network are at an advantage; they can deliver cloud services via their WAN, providing end-to-end service-level guarantees. In addition, they can leverage their geographic proximity to the end customer through their Point of Presence/Network Access Points to push content and latency-sensitive application services to the edge of their network, close to the customer. This not only creates an opportunity with new high-value services and advanced monetization models, but it also alleviates one challenge—significant bandwidth consumption across the service provider network.

**SERVICE PROVIDER CONSIDERATIONS FOR CLOUD DEPLOYMENT**

Deploying cloud services requires complete consideration of the network within both the cloud data center and the service delivery network (core and metro) that connects the cloud data centers to one another and to end users. To ensure optimal application performance and customer experience, service providers must have the ability to provide Service-Level Agreements (SLAs) for all types of services.

When looking to take advantage of opportunities to deploy cloud services, providers must consider how their networks will evolve to help them alleviate strain, improve business agility, and increase their ability to satisfy their customers’ needs through new services and innovative business models. This means considering which new services to offer and the best means for offering them.
Cloud Service Monetization

Transitioning to the cloud enables service providers to offer new services and realize new revenue streams. A cloud network greatly expands the growth potential and flexibility of a service provider’s offerings, from Infrastructure as a Service (IaaS) to Software as a Service (SaaS). Service providers need to leverage all areas of their cloud network to create tiered revenue generating services that address their customers’ expectations and needs.

By implementing monetization methods like user licenses, tiered bandwidth rates, and pay-per-instances, service providers can generate granular revenue streams through services like Communication as a Service, Security as a Service, Load Balancing as a Service, Storage as a Service, and Compute as a Service. The potential variety of offerings within each of these areas enables providers to customize their services for the needs of their customers and maximize their revenue.
Optimizing their cloud network for the services they wish to offer helps service providers combat the challenges they face from increasing bandwidth demand and decreasing revenue pressures. Tiered revenue generating opportunities are manifest end-to-end in the cloud. Many of these services simplify and provide value for a service provider’s clients in ways that have not been previously explored. Additionally, the more the provider can provide services that simplify and add value for their specific customers, the more likely those customers are to remain with their provider rather than moving to a new competitor.

**The Role of Virtualization**

The strain on service provider networks directly affects their technology, scalability, and economics. To solve these pain points, service providers and enterprises are adopting server virtualization at a rapid pace. As more and more workloads shift to public clouds, the adoption rates of virtual machines is beginning to exceed those of physical machines. The virtual machine is increasingly becoming the basic unit of work in the data center, taking on the roles of application resource allocation and SLA management over the physical server. The mobility and ease of deployment of virtual machines can alleviate some of the network strain faced by service providers.

**Figure 4.**

Project public cloud usage.

**Figure 5.**

Adoption rates of virtual machines.
The benefits of virtualization can be realized in the network as well. Through the enhanced control infrastructure and optimized flow control enabled by Software-Defined Networking, service providers can support additional new revenue generating services through efficient scaling and rapid deployment of network applications. Using Software-Defined Networking to add a layer of virtualization to the network allows service providers to increase the range of their service offerings by providing completely different views of their data center architecture and services to tenants, based on tenant requirements.

As virtualization becomes more prevalent on both the server and the network levels, the underlying network infrastructure must be able to provide the scalability, resilience, and performance necessary for providers to fully optimize the potential value. In this new environment, service providers need a truly powerful and scalable core-to-edge network infrastructure with the agility to support large-scale multitenant environments, enabling the delivery of differentiated cloud services to an increasingly wide range of customers. By using a model where they implement Software-Defined Networking, build virtualized data centers, and leverage their networking infrastructure to deliver services over the cloud, providers can offer these higher-value services and compete more effectively.

**Figure 6.** Projected virtualization growth.

---

**Bringing Data Centers to the Service Edge**

Competing effectively also means that service providers need to serve mobile users that are demanding anytime, anywhere access to their data through their smart mobile devices across vast geographical distances. It is no longer feasible to have data stored in one physical place, potentially thousands of miles away from users’ locations.

Building distributed data centers close to the service edge allows the core network to scale efficiently. The technology building blocks for interconnectivity that are offered include VPLS, which provides relatively simple routing complexity with a high choice flexibility in traffic engineering, allowing for long-term scale that can be decentralized and can adapt better.
Moving data centers to the service edge has the advantage of enabling providers to offer services that are latency-sensitive, interactive, and location-based. Additionally, delivering these services close to the service edge can remove backhaul, greatly reducing costs, especially for high-bandwidth services such as video. An example of a service provider bringing data centers to the service edge is a telecom company that restructures its central offices into data centers in order to offer new services, which has the further advantage of repurposing under-utilized space.

Figure 7.
Network coverage maps.

Without a reliable and high-performance networking infrastructure to deliver services to end customers, there would be no public cloud service offerings. The unification of the service edge with the data center, the increasing role of virtualization, and the rise of Software-Defined Networking all allow the development of a new flexible and agile framework to deliver services to a provider’s clients. With their data centers and network infrastructure, service providers can deliver end-to-end cloud services with SLAs from the customer all the way to the service in the data center.
BROCADE CLOUD SERVICE DELIVERY ARCHITECTURE

WAN Infrastructure to Service Provider Data Centers

A cloud-ready network for metro and provider core with embedded business-aware services must offer features that help solve an enterprise IT department’s broader challenges. To satisfy the concerns of clients, cloud providers must have a WAN infrastructure to their data centers that includes a unifying packet transport vehicle that can guarantee cloud Quality of Service (QoS), security, and SLAs, while maintaining high-quality service performance and monitoring. Each of these needs has its challenges.

Within the WAN infrastructure, the primary focus a service provider must have is around unifying packet transport technologies, such as Multiprotocol Label Switching (MPLS) and Ethernet, into a single, coherent network with consolidated, centralized application management and control. Addressing issues like scalability with technologies like 100 Gigabit Ethernet is a crucial part of this solution as well. Without a solution for the transport of cloud services, the rest of the considerations are moot.

A service provider’s cloud services delivery architecture needs to be able to address and handle more than just packet transport, however. The following considerations must be taken into account:

- **Cloud QoS**: As services and applications move from local to centralized storage, a cloud provider’s service delivery architecture must be able to maintain cloud QoS by provisioning network access according to business-critical application requirements. Brocade enables service providers to optimize QoS for the specifics of their needs and deployments. The Brocade QoS implementation provides the capability to honor customers’ 802.1p Priority Code Point (PCP) setting end-to-end, ensuring high QoS throughout the cloud.

- **Cloud Security**: Security is a major concern for enterprises, and with a new service delivery model, cloud service providers need to be able to ensure the necessary security in an environment where traditional security mechanisms may not be a perfect match. There are a number of security concerns associated with cloud computing, but these issues fall into three broad categories: user authentication policies for customers at the edge, network security policies faced by cloud providers (organizations providing Software-, Platform-, or Infrastructure-as-a-Service via the cloud), and application security and availability. Brocade provides a comprehensive suite of security solution support, ranging from authentication to network to applications, so cloud providers can ease their customers’ concerns and protect the sanctity of their data.

- **Cloud SLAs, Performance, and Monitoring**: Cloud service providers need to have fault detection, verification, and isolation of cloud services throughout the network at every level while simultaneously providing proactive detection of service degradation. This includes a need to provide continuous and cost-effective cloud SLAs by guaranteeing high availability and performance of business-critical services through the provider’s MPLS or cloud delivery architecture. Brocade provides standards-based comprehensive end-to-end Operations, Administration, and Maintenance (OAM) tools to track a high level of care for these services, ensuring full performance and service monitoring as part of the Brocade VPLS cloud service delivery solution.
The widespread expansion of mobile devices means that providers must consider new services. They need to be able to automatically provision and reallocate resources for new applications, network sites, and additional end users. The prominence of virtualization to the end user increases in the cloud, and technology such as nesting can play an important role in the future. Not every user will want to access cloud services from a stationary, predictable location. Cloud service providers, therefore, must also consider how to ensure the same levels of service for mobile users that require anywhere, anytime access.

**UNIFIED PACKET TRANSPORT**

As service providers move their data centers closer to their customers, the need for scalable, seamless, and unified solutions to interconnect their geographically distributed datacenters and deliver services to end users takes on more and more importance. Brocade MPLS VPLS is a scalable multitenancy solution targeting data center interconnection and WAN service delivery. Because it is built on top of MPLS, VPLS inherits all the benefits of MPLS, including Traffic Engineering (TE), QoS, Fast Reroute (FRR) and hot-standby Label Switch Paths (LSP) for quick restoration from any disruptions, and more. VPLS provides fully resilient, multipoint transport of traffic between geographically distributed data centers, allowing for interconnection via a single VPLS domain.

**Overview and Benefits**

The networking infrastructure requirements for a service provider network to provide VPLS-based data center interconnection services are quite simple. The service provider network should support provider edge-to-provider edge (PE-to-PE) IP/MPLS. Options for doing so include either Label Distribution Protocol (LDP) or Resource Reservation Protocol (RSVP). To take advantage of the high availability provided by FRR and PE-to-PE traffic load balancing capability utilizing RSVP, Brocade recommends RSVP support in the service provider’s core network. A fully-meshed targeted LDP peering among PEs prevents traffic loops. Traffic received from other PEs is forwarded only to the local customer and never to other PEs.

![Figure 8. An example of VPLS deployment](image-url)
Figure 7 depicts a very basic IP/MPLS network deployment that provides Layer 2 VPLS services to customers. Both Customer A and Customer B are spread across three different physical locations. The same service provider serves both customers and interconnects all their sites. Customer A has two data centers: one connects to the service provider’s PE3, and the other connects to PE4. Customer A also has a site connecting to PE2, from which some users need to access the two data centers. Customer B is almost the same, except that one of its data centers is connected to the service provider’s PE1 instead of PE3. VPLS RED is configured for Customer A, while VPLS BLUE is configured for Customer B.

A Brocade VPLS solution like the one shown above has the following major advantages for cloud service providers:

- **Transparency:** The Brocade VPLS solution has minimal impact on the existing networking infrastructure for both the service provider and the customer. The customer requires only a single Ethernet port to connect to the cloud service provider, and the provider does not need to overhaul the network to serve a new range of customers. The Brocade interface-based implementation of VPLS VLAN isolates the customer’s VLAN space from the service provider’s VLAN space.

- **Multitenancy:** Having the capability to support multiple customers is critical for the deployment of all cloud services. Multitenancy focuses on sharing and isolation—sharing the same physical infrastructure while isolating data and service policies from different customers. The Brocade VPLS solution provides extensive multitenancy capabilities, with a single Brocade MLXe® Series Router supporting 16K MPLS VPLS instances. This enables service providers to serve an individual customer with either single or multiple VPLS instances, depending on its specific requirements, while maintaining VLAN isolation.

- **Scalability:** MAC address table scalability has a direct impact on the number of customers, number of customer sites, and number of devices at each customer that can be supported. Brocade ensures that service providers can scale their cloud network to flexibly support large numbers of customers and VPLS instances through the Brocade MLXe platform, which supports up to 16K VPLS instances and 1 million MAC addresses. For even greater scalability, VPLS can be integrated with Provider Backbone Bridging (PBB) at the edge to provide isolation between the customer MAC address and provider core MAC addresses.

- **Endpoint Flexibility:** Different types of endpoints can seamlessly work with each other in the same VPLS domain, enabling providers to deliver services to an expanded range of customers. The Brocade VPLS solution supports multiple types of endpoints for customers to connect to the service provider network, as well as VLAN translation functionality. This provides enhanced flexibility for a service provider to match different VLAN allocations and configurations across different sites from the same customer.

- **Traffic Load Balancing:** Load balancing enables service providers to fully utilize all available bandwidth. Brocade VPLS supports load balancing across multiple tunnel LSPs from PE-to-PE. The multiple LSP paths can actively share the traffic carried between the PEs, providing redundancy and optimizing the allocation of network resources. Brocade supports multiple methods of load balancing to provide greater flexibility for service providers.
• **Network Resiliency:** Two fundamental requirements for data center networking infrastructure and data center interconnection are high availability and high resiliency. Integrated with MPLS FRR or hot-standby LSP in the core, the Brocade VPLS solution provides sub-50 ms network resilience in the service provider core network. Brocade supports both hot-standby paths and detour and bypass FRR as LSP options. The option that a service provider chooses depends on the details of its needs and deployment.

A complete WAN cloud service delivery solution offers dependable performance and monitoring techniques, as well as guaranteeing cloud QoS, security, and SLAs. The Brocade VPLS solution provides all of these through a unified packet transport solution that interconnects a provider’s data centers and delivers cloud services to its customers.

**SUMMARY**

A cloud network enables service providers to deliver new high-value-added services, increasing the margins and combating the revenue gap and network strain that providers face today. The potential for tiered revenue streams through cloud-based service offerings creates an opportunity for service providers to differentiate themselves and fortify their positions against increased competition.

By virtue of its heritage and technology leadership in both the data center and service provider markets, Brocade is uniquely qualified to help service providers deploy cloud-optimized networks and build out their cloud infrastructures. Brocade VPLS-based cloud service delivery architecture solutions and Brocade CloudPlex™ with Ethernet Fabrics offer an attractive end-to-end option for service providers to increase scalability, business agility, and resiliency in their network, while focusing on cost efficiency as they make the transition from connectivity provider to cloud provider.

Visit [http://community.brocade.com/serviceproviders](http://community.brocade.com/serviceproviders) for more details.

**ABOUT BROCADE**

Brocade (Nasdaq: BRCD) networking solutions help the world’s leading organizations transition smoothly to a world where applications and information reside anywhere. This vision is realized through the Brocade One™ strategy, which is designed to deliver key business benefits such as unmatched simplicity, non-stop networking, application optimization, and investment protection.

Innovative Ethernet and storage networking solutions for data center, campus, and service provider networks help reduce complexity and cost while enabling virtualization and cloud computing to increase business agility.

To help ensure a complete solution, Brocade partners with world-class IT companies and provides comprehensive education, support, and professional services offerings.

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