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WHITE PAPER

Cloud Networking: Scaling Data Centers and Connecting Users

Software-based networking leverages easy, low-cost, and highly flexible capabilities to deliver secure connectivity, efficiency, and scalability in cloud environments.

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While the business promise of cloud computing is broad, there are a few basic enabling themes underlying an effective cloud design:

- Highly dynamic, on-demand infrastructure
- Granular service control levels
- Extremely high infrastructure utilization

As cloud moves from vision to reality, networking quickly moves to the front as a major impediment to meeting these major requirements. The reason is simple: traditional networking infrastructure has not been modernized the way server and storage infrastructure has been over the past decade.

The inability to treat networking workloads with the same agility as other parts of the infrastructure has a huge and compounding effect on the effectiveness and efficiency of the entire cloud. Software-based networking is the most effective way to deploy critical networking tasks while meeting the fundamental business requirements of a cloud.

Traditional Networking Fails To Meet Cloud Business Requirements

A cloud data center is only as strong as its weakest link. While the computer-related part of the infrastructure can be highly optimized for cloud, it simply cannot be leveraged well if the network infrastructure is stuck in the old hardware-based model.

Customer-Facing Requirements

Examine some of the most basic business needs for a cloud as it relates to customer acquisition and retention, and how those translate to requirements for the infrastructure:

Business Need	Infrastructure Requirement	Traditional Networking
Dynamic provisioning	Instant system activation	Hours / days to deploy
On-demand service levels	Variable resource availability	Fixed resource
Seamless scale-up	Add HW resource virtually	Overprovision expensive devices
Multiple network workloads	Multi-purpose infrastructure	Specialized devices
Move & replicate infrastructure	Physical & geographic mobility	Rack-constrained

Modern compute and storage can address these requirements; old-style networking infrastructure simply cannot.

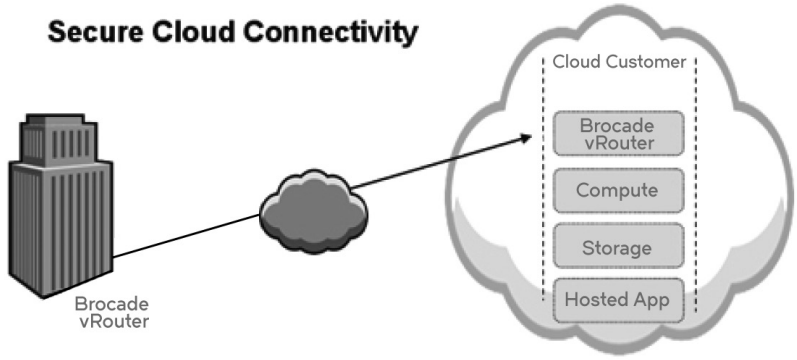
Use Cases for Software-Based Cloud Networking

There is a wide variety of ways to leverage software-based networking to achieve both the external and internal requirements for a successful cloud offering. A few key opportunities follow.

Secure Connectivity

Cloud users access their applications and data over the Internet, requiring every user's connection to be encrypted for security. This requires VPN infrastructure at every single access location and within the cloud itself.

Software-based networking is an exceptionally clean solution for this requirement. Within the cloud a new VPN virtual machine can be started in moments, using a small fraction of an existing server. The high cost associated with acquiring and installing a unique physical device is completely eliminated, as is the requirement for more space, power and cooling. The customer can deploy the same software or virtual machine at each access location rapidly and with minimal expense, as a "secure cloud connector."



Instant Firewalls

For IT architectures within a customer's own data centers, it's common for firewalls to be deployed at various places to ensure data security for sensitive databases and transaction systems. Issues related to both internal security (HR databases, financial systems) and external compliance (credit cards, health care, etc) must be clearly addressed.

Deploying these IT systems in a cloud environment increases this firewall requirement. The customer not only must firewall its sensitive systems as it had before, but also to ensure security in a multitenant environment using a shared connection to the public Internet.

Using traditional networking would require a lot of traditional hardware firewalls at a high cost, slow deployment, and with deep inflexibility. Software-based networking allows firewalls to be instantly deployed as virtual machines with no operating cost. The benefits for the customer are obvious (dynamic provisioning, seamless scale-up), while the cloud provider eliminates significant amounts of both CapEx and OpEx.

Dynamic Subnets

Network topologies in use on a customer's premise must be enabled when their infrastructure is cloud-based. Traffic needs to be routed and subnets / VLANs need to be established.

Software-based networking puts easy, low-cost and highly flexible capabilities in the cloud customer's hands. Whether booted on an entire piece of hardware or deployed as a virtual machine, critical functions such as IP routing, address management, NAT, authentication, QoS and others can be rapidly deployed where and when the customer needs them.

Disaster Recovery

It is common for a cloud customer to want to replicate their operational infrastructure design to another location as a disaster recovery measure. When all of their IT functions are software-based, this is relatively easy and inexpensive. However, when key functions are tied to traditional networking devices, this replication is extremely costly in both CapEx and OpEx, both for the initial replication as well as for mirroring the changes that occur in the operational systems over time.

With software-based networking, the customer's total IT architecture can replicate easily to another location. Similarly, changes to topologies and policies are easy to push to the disaster recovery replica. This is key to cost-effective and dynamic disaster recovery services in the cloud.

Business Model Advantages

The use cases above give good examples for how software-based networking can be leveraged for superior infrastructure services. In addition, there are a few other main considerations that can have a profound effect on the success of the cloud business model: Scaling costs, utilization rates, and pricing models are high on that list.

Highly Efficient Scaling Costs

Cloud adoption will drive radical growth in traffic within the data center and between the data center its customers. Like any other utility, the cost of supporting that traffic must scale at extremely efficient levels.

Traditional networking can't meet this requirement because it is characterized by two fundamental flaws:

- Arbitrary usage limitations per device (e.g., throughput limits, tunnel limits, user limits)
- Near-logarithmic upgrade pricing paths (e.g., $1,000 device followed by a $10,000 device)

For the cloud provider, these facts immediately force a bad business choice: Either over-provision a very expensive device and have very low utilization for a long period of time, or under-provision a small device and be forced to upgrade quickly into radically more expensive larger devices as usage grows. For example, if the CapEx for a given networking workload with traditional infrastructure is 1× today and 10× in one year, the 12-month CapEx is 11×.

Software-based networking allows a network workload to be virtualized on a fraction of a 1U server. The workload can scale by simply provisioning more of the server, allowing the network to scale at a cost equation similar to a commodity utility. In this way, CapEx can to start at only ~0.25× today and grow in smooth increments (as server resources are released to it) to a maximum cumulative total of only 1× in a year. This translates to a 10× CapEx advantage for software-based networking, an advantage that compounds with each upgrade cycle. As a result, clouds that embrace software-based networking will quickly gain strategic advantage through a radically more cost-effective network scaling model.

High Utilization Rates

In late 2009 Amazon published that for their data centers servers comprise 45% of the total IT cost and consume 55% of the power—yet their average server utilization is only 10–30% due to limitations caused by traditional proprietary networking infrastructure. In other words, old-style networking causes the single most expensive asset in a cloud data center to be more than 2/3 unutilized. Given that one of the primary business requirements for cloud is extraordinary efficiency, this is clearly unacceptable.

Usage-Based Pricing Models

Software-based networking eliminates the high upfront costs of traditional networking gear, instead leveraging existing server infrastructure. It also enables easy on-demand service capabilities such as increasing or decreasing network service levels.

Key Advantages:

1. Use standard x86 server hardware
2. Offer on-demand service creation
3. Eliminate expensive proprietary systems
4. Remove ordering and sparing requirements of proprietary equipment

Those inherent technology advantages can be further leveraged by engaging with the networking software vendor on a Cloud-based licensing model. This can create exceptional financial opportunities for cloud vendors.

At its most simple level, volume license agreements can create a foundation for constantly lower variable cost per customer. These benefits continue to compound as the cloud gains in size, underwriting a “scale-based” business benefit for the cloud vendor.

Taking this one step further, Service Provider licensing models are available which allow the cloud provider to synchronize license payments with their pricing models to users. By spreading costs over the duration of the customer contract, the cloud vendor's financial performance gains the large benefits of a variable-cost infrastructure model.

At more involved levels, utility-based pricing can also be established with flexible software vendors. For cloud providers employing highly granular usage-based pricing, it is possible to create similar usage-based licensing structures with software-based networking vendors.

Create Your Cloud Network – With Brocade

For cloud providers, software-based networking offers tremendous and market-disrupting business advantages. Those who embrace these advantages early will gain the most over time.

Brocade encourages all cloud vendors to initiate the evaluation of how Brocade software can meet their networking challenges. Many around the world are already either in operational mode with Brocade or are readying their rollouts now.

Brocade also wants to share our depth of cloud experience to increase the business advantages for those who base their networks on our software based solution. We encourage cloud vendors to contact Brocade directly to discuss their objectives and the solutions that are uniquely enabled by Brocade.

For more information, visit www.brocade.com.

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