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The Road to SDN: Software-Based Networking and Security from Brocade

Software-Defined Networking (SDN) presents a new approach to rapidly introducing network services with centralized management and control. The Brocade software-based networking and security solution provides unique functionality and networking services focused on programmability and flexibility to enhance and facilitate the move to SDN.

There is tremendous excitement in networking today about Software-Defined Networks, or SDN. You might be tempted to ignore SDN, but this newly emerging technology has the potential to completely change the networking landscape. The benefits promised by SDN create real value to customers, which is a clear indication that SDN offers a real revolution in networking, not just exaggerated hype.

The Brocade® software-based networking and security solution complements emerging SDN architectures, providing a way to ensure a smooth transition from today's networks to the flexible, agile SDN networks of the future.

Why Is SDN Needed?

A recent development most commonly known as the private cloud, provides the needed transition to operation of IT infrastructure as a utility. Although the IT industry has considered this topic for many years, the technologies that enable this utility model are finally a reality and have matured. Internal IT departments are being recast as service providers. Leading IT organizations adopting this approach describe a self-service portal where their customers (that is, departments) can request compute, storage, and networking resources for instant availability, just as they would from leading public cloud service providers.

Opportunities are opening up again for enterprise IT programmers, and many companies are realizing that internal IT is now the competitive battleground. The challenges are to build connections between content on mobile devices and social media into ad campaigns, product fulfillment and customer affinity—all in order to improve the bottom line. Programmers are aligned with product groups and business units, rather than centralized in an IT department, and when resources are needed, immediate availability is the expectation.

In its search for a more responsive data center, IT is building easy-to-provision, agile internal capacity with the ability to create application environments by provisioning virtualized servers and storage. If an application's needs grow, Virtual Machines (VMs) can be added on additional servers to meet the request. Virtualization vendors and others are providing new tools for creating this highly dynamic environment. Often the public cloud is used to handle demand beyond what internal servers can satisfy.

The network has not kept up with these new virtual technologies, especially higher-level network functionalities. Instead, the network remains dependent on hardware devices that require physical rack space and wiring.

SDN Offers Programmability

The most basic requirement for implementing SDN is that network elements need to be programmable. Orchestration platforms are emerging and maturing—such as CloudStack, OpenStack, Eucalyptus, Chef, and Puppet—which enable the provisioning user interface to create, configure, and connect server, storage, and networking resources on demand. Some data centers today are run via homegrown scripting, which uses the Application Programming Interfaces (APIs) of the components to create a custom orchestration environment. The DevOps movement goes even further in abstracting data center resources to the point that they can be called in-line within code—code that then defines the operation of the data center.

Some SDN products available today use OpenFlow as a common interface between a controller and the actual switching elements. The principle behind this usage is that centralized control improves the efficiency of the entire network. Yet the real value is in using the controller as a point of programmable control. A centralized point that can be used by orchestration layers to quickly effect change in the network enables the IT-as-a-utility model. All except the simplest networks require multiple controllers in order to reach meaningful scale.

So, the most significant benefit to using SDN is that it makes networks programmable and responsive to demand. There are other benefits of SDN, however.

SDN Offers Abstraction

Today, departments and applications are most often segmented using 802.1q VLAN encapsulation. This method works pretty well, yet it creates administrative complexity. It requires network operations to keep track of who is using various VLANs, while adding extra manual configuration work. Today's emerging SDN products use new encapsulation methods, such as Virtual eXtensible Local Area Network (VXLAN), Network Virtualization using Generic Routing Encapsulation (NVGRE), and Stateless Transport Tunneling (STT), to segment a department's network. Departments can use any IP addresses and VLANs they want to use, without restriction, which vastly simplifies the coordination required from the operations team.

Is SDN Ready to Build Yet?

There are some SDN deployments and proof-of-concept tests in place today, and vendors and users are working together to bring SDN to maturity. Google has deployed OpenFlow in its production network, but Google's internal network engineering teams are as yet unmatched by other companies. It is expected that SDN adoption will continue to grow, as its underlying technologies mature.

The Larger Networking Story

It is clear to Brocade that fundamental networking technologies are still needed in the world of SDN. In fact, they become even more important. When Virtual

Local Area Networks (VLANs) are used to create separate pools of computing power, routers and firewalls are used to provide connections between them, as well as connections to the corporate network. Often it is necessary to run cables to a large and expensive centralized set of routing and security gear. This expensive shared resource cannot be scaled under software or API control, and it does not coincide with the vision of the public cloud. Instead, it consists of numerous agile, programmable resources surrounding a fixed, limiting physical network core.

Flexible Networking to Fit the Flexible Cloud

To deploy networks effectively, they need to be:

- **Scalable:** Creating as much capacity as needed by creating more instances, as with a compute VM
- **Programmable:** With a RESTful API and connections to OpenStack and other emerging orchestration tools
- **Close to the applications:** To avoid creating extra traffic on the network that unnecessarily accessing central resources

Brocade makes a router that runs in a VM, providing these features:

- Offers stateful firewall, IP security (IPsec) and Secure Sockets Layer (SSL)-based VPN, web filtering, dynamic routing, and underlying services like Network Address Translation (NAT), Dynamic Host Configuration Protocol (DHCP), and more as IP version 6 (IPv6)-ready prepackaged VMs
- Has mature and widely tested Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), and Routing Information Protocol (RIP)

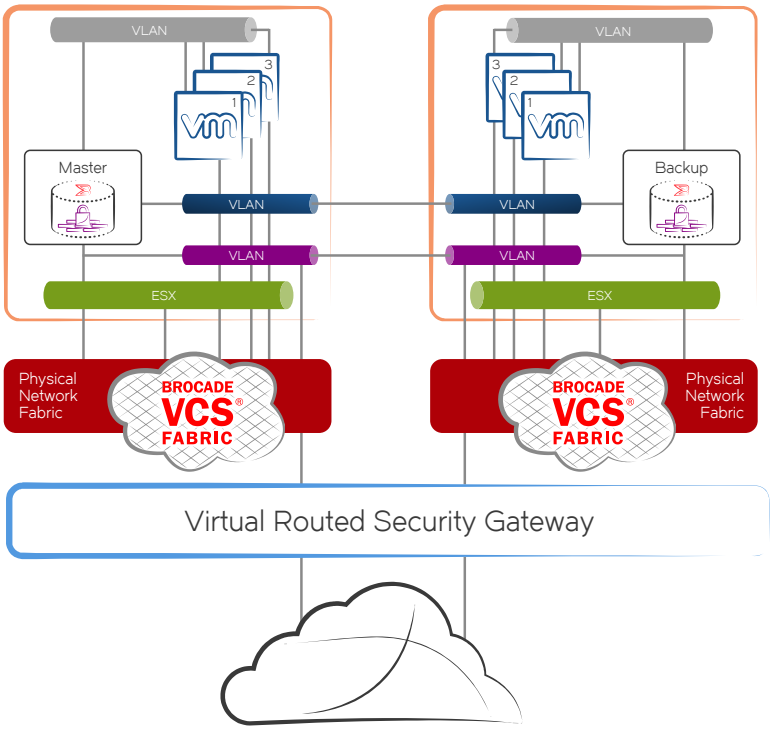

Figure 1: Brocade vRouter deployed in the server edge providing flexible, scalable and programmable advanced L3-L7 services.

- Runs on VMware, Xen, XenServer, Hyper-V, and KVM
- Is optimized for fast speeds on today's x86 servers—the most common and widely available resource in the data center

It is now possible to orchestrate and deploy routing like you do with any other VM-based data center resource, leveraging the economies of the x86 infrastructure. Brocade creates the security that is required between separate pools of compute and storage—no matter if the pools are created by VLANs or by SDN products.

Transitioning to SDN

For more than 30 years networking and security technologies have been evolving and improving in order to adapt to a wide variety of special cases. Every enterprise network is built on a complex set of established networking technologies that have been installed, updated, and optimized over time. It is challenging for an enterprise to consider a complete restart of their networking and security systems or to ask them to trust business-critical operations to an entirely new technology such as SDN.

So it makes sense for enterprises to use established protocols to bridge existing networks with new SDN installations.

Any new SDN installation beyond a small proof-of-concept requires BGP or OSPF routing, which should extend seamlessly from the existing network to the new one. For the same reasons, it makes sense to use a similar approach across today's VLAN-based private cloud and tomorrow's SDN-based cloud. For security as well, it is sensible to use the same firewall technology across existing and new systems.

Brocade vPlane Technology and the Future of SDN

If the Brocade Vyatta® Network OS provides many of the advantages of SDN today, Brocade vPlane™ technology will soon deliver even more benefits at a higher speed. Brocade vPlane is the industry's first highly scalable Layer 3 (L3) forwarding plane for next-generation enterprise and cloud networks.

Brocade vPlane is a distributed L3 forwarding plane that is architecturally separate from the control plane of the Brocade Vyatta vRouter, enhancing the product with a split control and data plane to significantly increase forwarding performance. The vPlane technology runs on individual x86 cores and takes advantage of the latest Intel advances in networking performance. With this architectural separation, vPlane allows Brocade to deliver an order of magnitude of faster forwarding performance, which can scale linearly with the number of available server cores. The Brocade vPlane software can process 14.5 million packets per second per CPU core and, so far, has been tested to 200 million packets per second on an industry-standard x86 server.

By separating control and forwarding planes instead of combining them in one integrated piece of hardware, vPlane provides the ability to massively scale the router's data plane while preparing for a central controller in the future. Like the control plane envisioned in SDN, the control plane within each vPlane router operates under APIs and is controlled by software.

vPlane will enable:

- Near line-rate 10 Gbps throughput at all packet sizes, to leverage the new era of 10 Gbps servers
- Physical decoupling of the forwarding plane from the control plane
- Full interoperability with existing network infrastructure
- The ability to accommodate new protocols such as OpenFlow

vPlane represents a major extension of the Brocade commitment to software-based networking, a rapidly growing category that Brocade pioneered and continues to lead.

Conclusion

Consumers of technology love simplicity, while vendors lean toward complexity. When VLANs were first introduced, they were widely used because they offered a way to simplify networks. Network complexity is a current "pain point" for enterprises, and SDN offers a solution.

As data centers begin to offer services resembling internal utilities, a new way of providing networking is needed. Brocade enables programmable networking without requiring changes to network or security configurations. Brocade solutions use proven routing, firewall, VPN, and other technologies to deliver required network resources at the right place and at the right time. With its software-based networking and security solution, Brocade makes it possible for enterprises to build toward an SDN environment today.

For more information, visit www.brocade.com.

Corporate Headquarters
San Jose, CA USA
T: +1-408-333-8000
info@brocade.com

European Headquarters
Geneva, Switzerland
T: +41-22-799-56-40
emea-info@brocade.com

Asia Pacific Headquarters
Singapore
T: +65-6538-4700
apac-info@brocade.com

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