

Brocade and VMware Solutions

Recent testing results demonstrate that Brocade Virtual Core for Mobile Solutions can manage unpredictable surges in LTE traffic up to 10 times more efficiently than physical infrastructure. The Brocade VCM software and VMware ESXi hypervisor running on commodity blade servers achieved exceptional efficiencies while processing control plane traffic.

Challenge

- To demonstrate that the optimized performance of LTE Evolved Packet Core control plane processing on standard, commercial-grade servers and virtualization software is greater than what is available today on purpose-built systems and software.

Solution

- The Brocade vEPC (virtual Evolved Packet Core) software solution that is powered by VMware ESXi 5.5 release software tested against the Ng4T LTE simulator on industry-standard, high-volume servers.

Obtaining An Elastic, High Performance, and Flexible Mobile Infrastructure

Brocade® Virtual Core for Mobile (Brocade VCM) Solutions use Network Functions Virtualization (NFV) to enable mobile operators to address challenges related to packet core networking, such as managing peaks and troughs of load on the Evolved Packet Core (EPC) for both control plane and data plane surges. Brocade VCM Solutions use a unified, centrally-managed, elastic, scalable, and robust virtualization platform that is powered by VMware. This success story describes Brocade VCM Solutions, powered by VMware vSphere, and the excellent results they have achieved.

Introduction

The mission of Brocade is to bring the advances of virtualization and cloud computing to the evolved packet core. The Brocade VCM platform is a unique innovation—one of only a few that has been introduced to the mobile operator infrastructure in many years. Brocade VCM Solutions fundamentally change the way in which the networks are built, deployed, and managed. With Brocade VCM Solutions, carriers can, for the first time, economically address the rapid growth in services, the number of IP endpoints, and the associated signaling.

Brocade Virtual Core for Mobile Solutions

The Brocade Virtual Evolved Packet Core (Brocade vEPC) was the first instance of a virtualized LTE Evolved Packet Core that was deployed running on standard

data center infrastructure. This solution comes at a time when the telecom industry is demanding change. For many years, carriers have been saddled with the high cost of proprietary hardware with closed software, and its high operational cost due to complex procedures and the dimensionally-challenged interconnection.

Recently, new data applications and devices are arriving with increasing frequency from a variety of vendors. They add stress to the underlying network. Adding network capacity faces challenges such as the complexity of point-to-point interconnects and node-based capacity planning, along with assuring availability across those connections. The traditional remedy of vertical node-based capacity growth is proving to be too expensive in terms of both CapEx and OpEx.

HIGHLIGHTS

- Demonstrated 10:1 performance improvement in the capability to process the same number of attach-requests using industry standard blade servers with the VMware ESXi hypervisor, in contrast to a traditional physical environment
- End-to-end test of complete EPC functionality for control plane traffic on single blade
- Provides a unified, centrally managed, virtualization and cloud architecture to deliver computing resources and infrastructure
- Reduces the TCO with significant savings from reduced hardware and infrastructure, and increased profitability
- Increases the ROI due to operational efficiencies and increased flexibility through virtualization

“Our vision is to enable telecom operators to transform their business model and service delivery through innovation. Working with innovators like Brocade, our telecom technology team aims to help our carrier partners transform their networks to handle signaling storms and future network loads through the use of our virtualization enablers.”

— Patrick P. Gelsinger, Chief Executive Office, VMware

“Frankly, the spectacular results we have achieved in our collaboration with VMware underscore the reality that virtualization is critical to the health and wealth of the mobile network operator business. Breakthroughs such as these have the potential to change the economics of deploying new mobile broadband networks. We are very excited to announce these results.”

— Sachin Kapur, Senior Director, Software Engineering, Brocade

In order to address the challenges in packet core networking, virtualized packet core technology called Virtual Core for Mobile was developed. Brocade VCM Solutions take advantage of years of innovation and investment from computing and data networking entities such as VMware to enable an elastic, scalable, and robust platform optimized for operational simplicity.

By mapping the packet core transaction and activities into basic computing units, the Brocade VCM Solution uses the virtualized environment to add and remove capacity dynamically in order to handle peaks and troughs of signaling capacity. The solution manages “signaling storms” in a cost effective and predictable way.

The resulting solution has both technical and economic efficiency. With the Brocade VCM solution, carriers are, for the first time, able to accelerate the growth of rich data services, and build faster mobile networks with unrivalled capacity. This results in a lower unit cost with reduced energy consumption.

Brocade VCM Solutions powered by VMware

VMware, a key partner, powers the high-performance cloud architecture using the VMware vSphere 5.5 virtualization and cloud computing platform, with the VMware ESXi 5.5 hypervisor. Brocade utilizes VMware vSphere because it is a preferred, optimal secure, flexible, high-performance virtual environment.

VMware vSphere increases the consolidation of physical servers, infrastructure, and associated resources. The VMware platform enables rapid integration, the rapid allocation of computing resources, rapid access to those resources on demand, and increased utilization. It facilitates operational efficiencies, including faster response times, immediate access to datacenter resources, extensive security, and simplified management.

With VMware, the Brocade VCM Solution uses a pool of virtual machines to handle tasks related to underlying activities.

For example, signaling activity or packet forwarding. This results in better hardware utilization creating an infrastructure with increased energy efficiency and a lower Total Cost of Ownership (TCO). With VMware’s inherent scale and capacity management capabilities, the Brocade VCM solution can effectively lower the operator’s CapEx and OpEx.

VMware virtualization improves performance with scaling that delivers the appropriate resources where they are needed most. In addition, it provides for greater flexibility and elasticity to extend and increase resources such as on-demand memory, and to expand resource capabilities.

Unprecedented Scale, Availability, and Performance

The Brocade VCM solution has unique architectural attributes that take advantage of modern data center tools.

The Brocade VCM Solution delivers unprecedented scale, availability, and performance using low cost, high volume x86 servers. The Brocade VCM Solution is highly cost-effective and addresses the growing demand in both signaling and data throughput. This solution is capable of addressing elasticity, scale, and service velocity in the largest mobile broadband networks.

10:1 Performance Improvement Compared to Proprietary System

Collaborative trials were recently performed to validate the best way to optimize the efficiency of 4G LTE EPC control plane processing. Using a service-oriented view of EPC functionalities, Brocade uses a computational method to map packet core functions. Demand in the network capacity (signaling, bearer, or throughput) is translated to a common computing resource requirement (CPU, memory, I/O, and storage). This enables

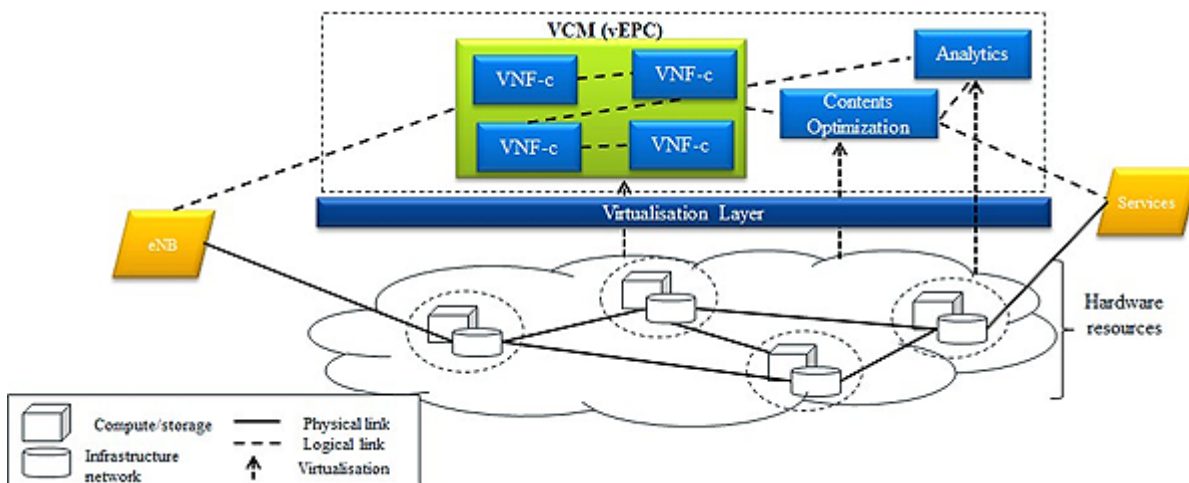


Figure 1. The Brocade VCM Solution.

the solution to add computing resources in units of virtual machines to address the underlying network activity.

This testing simulated thousands of attach procedures per second handled by the constituent virtual machines of the Brocade vEPC on a single x86 Xeon™ blade server running the ESXi hypervisor. When compared to traditional offerings, the improvement in performance was dramatic. Processing the same number of attach procedures using an equivalent traditional offering required a total of 10 active processing blades across three different nodes (MME, S-GW, P-GW).

The Brocade VCM Solution is implemented using highly distributed, stateless components that are managed at a service level on a single server, and allowed to scale independently. On a single machine, the complex interactions between these components limit vertical scalability. Brocade virtualized cohesive sets of components to demonstrate performance by managing horizontal scalability and elasticity.

These engineering tests showed optimal

server resource utilization on VMware ESXi, with multiple instances of virtual machines running appropriate groups of vEPC components.

Ordinarily, distributing these processes on different virtual machines incurs the overhead of inter-virtual machine communication, and this would not be an optimal solution. However, the VMware VMXNET3 para-virtualized, virtual network driver mitigated this issue.

VMXNET3 allowed the components to reach the required throughput and maintain the performance. This testing confirmed throughput in excess of 30 Gbps with VMXNET3 across the virtual machines.

Hardware Consolidation, Resource Management, and Elasticity

The Brocade VCM Solution provides for the full virtualization of system resources using VMware, including the consolidation of servers, storage, and networking infrastructure.

The Brocade VCM Solution uses VMware

infrastructure to enable virtual networking elements that are similar to those used in the physical environment, but with some advanced capabilities. Importantly, Virtual Distributed Switch (vDS) is used to abstract physical network interfaces and provide access-level switching in the ESXi hypervisor. vDS acts as a single switch across all associated hosts that are managed by administrators and it enables virtual machines to maintain a consistent network configuration.

In addition, VMware infrastructure also includes virtual Network Interface Cards (vNIC) that enable virtual machines to provide support for VMXNET3 vNICs, VLANs enable virtual networks to join physical VLANs or to support Quality of Service (QoS) policies. It also includes LBT load balancing, an advanced vDS feature, and Central Management. Network policies on vDS get pushed to the host automatically when the host is added to the distributed switch.

VMware optimization includes the use of VMware Tools to gain access into virtual machine operation. vSphere Performance

Monitoring and Performance Analysis Tools are used for time- or post-analysis visual performance monitoring, and to collect performance data such as for CPU load, network I/O, memory utilization, disk I/O, and more. The VMware ESXi command line utilities esxtop and resxtop were particularly useful when troubleshooting bottlenecks.

The VMware virtual machine templates create preconfigured virtual machines images and configurations. Internal and external deployment of distributed virtual machine templates allowed “snap rollout” of the complete system.

VMware vCenter Server provides for centralized monitoring, including aggregating all resident virtual machines and hosts. vCenter uses patented analytics and an integrated approach to dramatically simplify management tasks, such as to provide sufficient CPU and memory resources. vCenter proactively ensures health, efficiency, and compliance with IT policies.

The Brocade vEPC running on the VMware platform delivers excellent carrier-grade performance. It provides for the dynamic allocation of resources using an elastic, highly available cloud architecture, powered by VMware.

Learn More

Brocade partners with companies of all sizes to deliver innovative solutions that help organizations maximize the value of their most critical information. To learn more, visit www.brocade.com.

About Brocade

Brocade networking solutions help organizations transition smoothly to a world where applications and information reside anywhere. 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. Learn more at www.brocade.com.

About VMware

VMware is the leader in virtualization and cloud infrastructure solutions that enable businesses to thrive in the Cloud Era. Customers rely on VMware to help them transform the way they build, deliver, and consume Information Technology resources in a manner that is evolutionary and based on their specific needs. With 2013 revenues of \$5.21 billion, VMware has more than 500,000 customers and 75,000 partners. The company is headquartered in Silicon Valley with offices throughout the world and can be found online at www.vmware.com.

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VMWARE AT WORK

VMware vSphere / VMware ESXi

VMware vSphere 5.5 Enterprise Plus Edition

VMware ESXi 5.5

VMware vCenter

VMware vCenter Server 5.5

DEPLOYMENT ENVIRONMENT

Primary application

Transformation of mobile broadband infrastructure through network functions virtualization (NFV).

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