

## **Dell Networking S6000**

### **High-performance 10/40 GbE Top-of-rack Switch**

**Hands-on Testing Verifies Excellent End-User QoE and Substantial Scalability in Virtual Desktop Infrastructure Environment**



## **Miercom Lab Testing Report**

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## 1.0 Key Findings

- Dell Networking S6000 10/40 GbE switch proved switching fabric support for scalability for 10,000 desktop Virtual Data Infrastructure (VDI) sessions and target ARP table address capacity of 20,000
- As spine in a leaf/spine test topology, the S6000 delivers excellent performance and services that support quality end-user experience in VDI environment
- High-performance, top-of rack/end-of-row S6000 switch exhibits high degree of scalability by easily transmitting traffic at line rate with low latency and no loss
- S6000 was not a limitation to scalability in a VDI environment; VMware Horizon View server CPU and memory resources were limitations
- Proprietary Verified Virtual Link Trunking (VLT) protocol provides S6000 with Layer 2 multipath redundancy that maximizes network utilization and is simpler to configure and manage than Spanning Tree Protocol

## 2.0 Equipment Used in Testing



The Ixia XM12 chassis was used with the Ixia IxNetwork application and BreakingPoint FireStorm to drive network traffic through the switches using various test methodologies. Ixia ([www.ixiacom.com](http://www.ixiacom.com)) is an industry leader in performance testing of networking equipment. Ixia's exclusive approach employs coordination of energy measurements with network traffic load, allowing energy consumption to be charted against network traffic volume. Real-world traffic is generated by Ixia's test platform and test applications, principally IxAutomate for Layer 2-3 switching and routing traffic.

The Apposite Linktropy 7500 PRO WAN emulator was used in end-user Quality of Experience (QoE) testing and scalability testing.

Login Consultants VSI script helped to automate the launch of Microsoft Office applications.

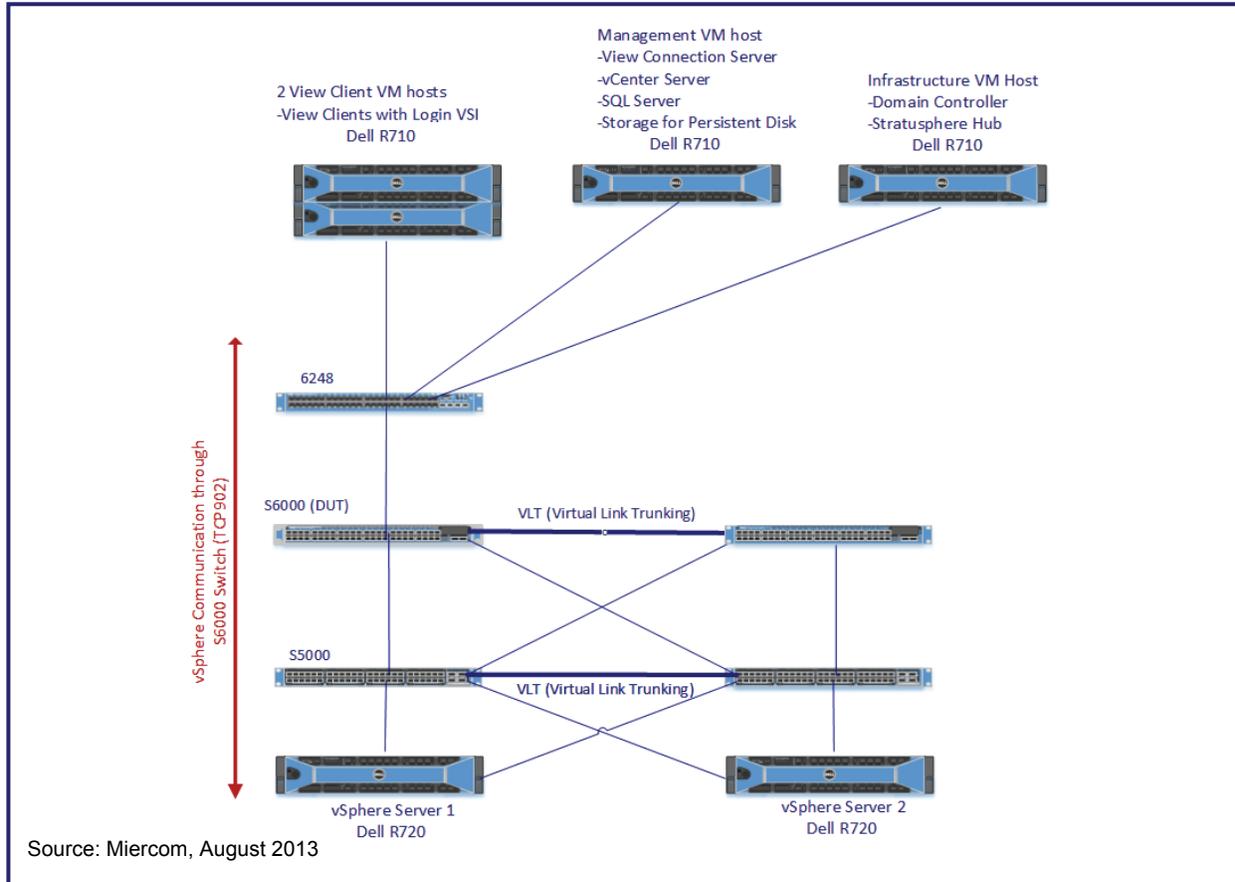
A software-based desktop monitoring tool, the Stratusphere UX virtual appliance from Liquidware Labs, Inc. was used to provide **subjective** evaluation of QoE testing.

The OmniPeek network analyzer from WildPackets, Inc. was used to provide **objective** evaluation of end-user experience in QoE testing.

The tests in this report are intended to be reproducible for customers who wish to recreate them with the appropriate test and measuring equipment. Contact [reviews@miercom.com](mailto:reviews@miercom.com) for additional details on the configurations applied to the system under test and test tools used in this evaluation.

Miercom recommends customers conduct their own needs analysis study, and test specifically for the expected environment for product deployment before making a selection.

## 2.1 VDI Topology Test Diagram



*A leaf spine fabric, two spine Dell S6000 switches and two leaf Dell S5000 switches connected via Dell proprietary protocol Virtual Link Trunking, was used to assess Quality of Experience for 200 users and scalability to 10,000 users in a VDI environment.*

## 2.2: Hardware and Software Featured in Testing

Hardware		
Name	Function	Details
Dell S6000	Spine switches	FTOS version 9.0 (2.87) (pre-release)
Dell S5000	Leaf switches	FTOS 9.0 (1.0)
Dell Networking 6248	Access switch	
Dell PowerEdge R720	VMware vSphere Servers for virtual desktops	Intel Xeon E5-2690 2.9GHz * 16 CPUs 196GB RAM, RAID10 146GB * 10 SAS Disks
Dell PowerEdge R710	VMware Horizon View Infrastructure Server	Intel Xeon X5670 2.9GHz * 12 CPUs 96GB, 146GB SAS Disk * 5 Units
Dell PowerEdge R710	VMware Horizon View clients	Intel Xeon E5-2690 2.9GHz * 16 CPUs 196GB RAM, RAID10 146GB * 10 SAS Disks
Dell PowerEdge R710	Horizon View Management Server	Intel Xeon X5670 2.9GHz * 12 CPUs 96GB, 146GB SAS Disk * 5 Units
Dell Latitude E5530	Packet capturing	Core i7 Ivy Bridge 2, 9GHz, 16GB, 250GB SSD
Ixia XM12	Scalability testing	Primary traffic generator
BreakingPoint FireStorm	Scalability testing	Alternate traffic generator
Apposite Linktropy 7500 PRO	Scalability testing	WAN emulation
Software		
Name	Version	Description
VMware ESXi	5.1 Update1	Hypervisor
VMware vCenter Server	5.1	vSphere
VMware Horizon View	5.2	Virtual Desktop System
Windows 7 Enterprise SP1		Operating System for VMware vSphere Servers (R720)
Windows 8 Enterprise		Operating System for VMware Horizon View Clients (R710)
LoginVSI	Agent version 3.7	View Client Launcher
Stratusphere UX	5.3.1	End-user QoE Testing, Desktop Monitoring Tool
WildPackets OmniPeek		End-user QoE Testing, Network Analyzer

### 3.0 Virtual Desktop Infrastructure (VDI) Environment

In testing, Miercom verified that the Dell Networking S6000 10/40 GbE high-performance, top-of-rack/end-of-row switch can easily transmit the traffic needed to support 10,000 virtual desktop users in a VDI environment.

A VDI environment consists of servers that host virtual PCs as a central storage repository plus the variety of client devices that can be utilized to access a virtual PC.

A virtual PC exists on a physical server as a software image that consists of the operating system and applications. The software image operates in conjunction with specialized software called a hypervisor that creates and runs a virtual PC. A virtual PC typically runs on a server, but can run on any compatible hardware.

Users in a VDI environment can access virtual PCs from any compatible client device using an Internet and/or network connection as well as a Web browser or a simple client application.

Examples of client devices include laptops, tablets and thin clients. A common type of thin client is a dumb terminal or monitor that provides the user with a graphical interface.

Client devices do not need to have computing power in a VDI environment. Their sole function is to provide users with a conduit to the virtual PC, which is running on a server that could be located anywhere.

A user can also interact with a virtual PC running on the server via only a keyboard and mouse. Peripherals such as printers, scanners and Webcams can be connected to the terminal or monitor via USB.

### 4.0 VMware Horizon View Desktop Virtualization Solution

In testing of the S6000, the latest version of the desktop virtualization software, Horizon View 5.2 from VMware, was utilized. Two Horizon View 5.2 clients served as virtual-machine hosts and ran on two Dell PowerEdge R710 rack servers. Horizon View can function as a standalone solution or as part of the VMware Horizon Suite, a comprehensive platform for workforce mobility.

Horizon View 5.2 is built on the VMware vSphere virtualization platform. It has enhancements and new features that improve performance and scalability as well as the experience for network administrators and end users. These include Windows 8 support, hardware-accelerated 3-D graphics and Horizon View clients for iOS and Android with Unity.

### 5.0 Test Bed: Leaf Spine Switching Fabric

The heart of the test bed was a leaf spine switching fabric of high-performance Dell 10/40 Ethernet switches. It was used to evaluate the ability of the Dell S6000 switch in a virtual desktop Infrastructure (VDI) environment to provide **end-user Quality of Experience to 200 virtual desktops** and **scalability to support 10,000 virtual desktops**.

## 5.1 About the Dell Networking S6000 Switch

The Dell Networking S6000 is a Layer 2 and Layer 3 top-of-row/end-of-rack Ethernet switch designed for use in high-performance virtualized data centers. Two S6000 switches were used as the spine switches in the test bed.

Deployment scenarios for the S6000 require a combination of high bandwidth and low latency:

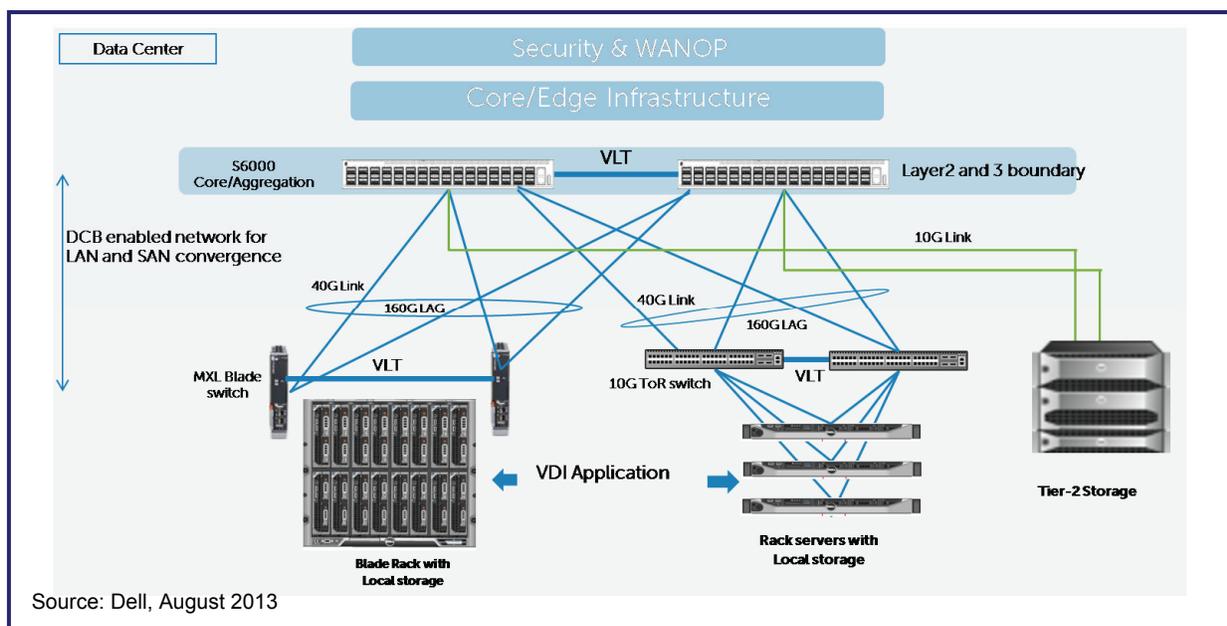
- Ethernet switch in traditional Ethernet and Layer 2 fabrics for virtual data centers
- Aggregation switch for enterprise LAN serving mid-sized and large customers or handling high-frequency financial trading, Web 2.0, big data and other heavy workload operations
- Traditional Ethernet switch with redundant connections to 10 GbE rack and blade servers

The S6000 delivers high performance, 2.56 Tbps of switching I/O bandwidth in full duplex mode, from a compact 1U form factor, which conserves rack space. The primary configuration is 32 ports of 40 GbE QSFP+. It also can be configured with 96 ports of 10 GbE and eight additional ports of 40 GbE to provide a path for the migration of speed in the network core to 40 Gbps.

Layer 2 multi-path support via Virtual Link Trunking (VLT) is a key feature of the S6000. A proprietary Layer 2 link aggregation protocol, VLT offers servers connected to different access switches a redundant, load-balancing connection to the network core in a loop-free environment that has benefits beyond that of Spanning Tree Protocol.

The S6000 also supports Multi-domain Virtual Link Trunking (mVLT), a proprietary Dell design for multi-dimensional VLT that allows multiple VLT domains to be linked with a VLT LAG. VLT and mVLT enables the S6000 to be positioned as core-aggregation layer and to serve as a Layer 2 top-of-rack core or aggregation switch as shown in *Figure 1*. The combination also provides a robust, multi-chassis lagging feature that permits the switch infrastructure to maintain high availability even during chassis upgrade times.

**Figure 1: S6000 VDI Solution Design, Virtualized Data Center**



*In a virtualized data center deployment, VLT and mVLT enable the Dell Networking S6000 to serve as a Layer 2 core or aggregation switch.*

## 5.2 About the Dell Networking S5000 Switch

The Dell Networking S5000 is a Layer 2 and Layer 3 10/40 unified storage switch. Two S5000s were the leaf switches in the leaf spine test infrastructure that evaluated QoS and scalability of the S6000 in a VDI environment.

The converged, modular S5000 is used for FCoE and in VDI installations that use Fibre Channel for storage. The primary configuration is 48 10 GbE SFP+ ports and FC/FCoE ports. The S5000 also can be configured with 4 40 GbE QSFP+ ports.

Designed for high-performance data center and computing environments, the S5000 can facilitate LAN/WAN convergence to help simplify the IT infrastructure. The switch supports Data Center Bridging (DCB), which enables converged data center networks.

The S5000 can run Ethernet, Internet Small Computer System Interface (iSCSI, the IP-based storage networking standard for linking data storage facilities), native Fibre Channel (at up to 8 Gbps) and Fibre Channel over Ethernet (FCoE).

## 6.0 End-user Quality of Experience and Scalability Testing

Testing of the Dell Networking S6000 switch consisted of two phases. Two S6000s served as spine switches in a leaf frame test fabric that simulated a desktop virtualization environment.

In the first phase of testing, the quality of experience (QoE) for end users was evaluated using a test bed environment with 200 virtual desktop clients.

In the second phase, the scalability of the Dell Networking S6000 was assessed to 10,000 users utilizing emulated, stateful, bidirectional traffic representative of traffic used in the 200-user environment. The S6000 proved in the second phase that it can easily support 10,000 virtual desktop clients with low latency and without frame loss or other network anomalies.

Different traffic load generators were used in each phase of testing. Traffic observed in the first phase was captured and replayed in the second phase.

### 6.1 End-user QoE Tests (200 Virtual Users)

In the first phase of testing, the QoE for end users was evaluated using a sample set of 200 virtual desktop clients.

Horizon View 5.2 was utilized as the desktop virtualization solution. The Horizon View client ran on two stacked Dell PowerEdge R710 rack servers, which were among six end nodes in the test bed. Of the other four end nodes, two were PowerEdge 710 servers and two were PowerEdge R720 servers.

Horizon View 5.2 was built on VMware vSphere. The two R720 servers used the Windows 7 operating system and ran VMware vSphere ESXi hypervisor. Functioning as a “virtual desktop,” they housed virtual desktop master images and replicas as well as applications in the Microsoft Office Suite, such as Word, Excel, PowerPoint and Windows Media Player, were used to create traffic for testing.

Two R710s used the Windows 8 Enterprise operating system and served as Horizon View clients.

Login VSI, a load testing tool for virtualized desktop environments, was installed on each version of Windows 8 Enterprise on these two servers. Each Login VSI launched multiple Horizon View virtual desktops.

Another R710 server, the Management Host, housed the Horizon View Connection Server, the vCenter Server with View Composer, the SQL server, and a server that stored user profiles for virtual desktops.

The other R710, the Infrastructure Host, housed non-VMware servers needed to run Horizon View: the Microsoft Active Directory Domain Controller and the Stratusphere UX desktop monitoring tool from Liquidware Labs, Inc.

VMware View Composer reduces storage requirements for virtual desktop machines by up to 90% and enables organizations to manage desktop images more effectively. With View Composer, a single parent virtual image can be created and pushed out to multiple users across the enterprise in minutes. It also allows updating, patching or rolling out hundreds of desktops from a single master virtual image and refreshing desktop images while retaining user settings during updates and patches.

The heart of the test bed was a leaf/spine fabric composed of Dell top-of-rack 10/40 GbE switches. The S6000 switches are connected by VLT, a proprietary link aggregation protocol available in Dell data center- and enterprise-class switches.

VLT offers servers connected to different access switches a redundant, load-balancing connection to the network core in a loop-free environment. Because all physical links are active, the need for Spanning Tree Protocol (STP) as well as advanced and proprietary versions, is eliminated.

STP creates a spanning tree within a network of connected Layer 2 bridges, which typically are Ethernet switches. Links that are not part of the spanning tree are redundant, leaving a single active path between any two network nodes. Redundant links remain blocked until an active link is disrupted.

The existence of inactive, redundant links, plus the inherent complexity of designing and implementing STP, makes VLT an attractive alternative for Layer 2 redundancy.

Both leaf switches in the test bed were Dell S5000s, which were connected via VLT. Also, the S5000 switches were connected to each vSphere (R720) and spine (S6000) server.

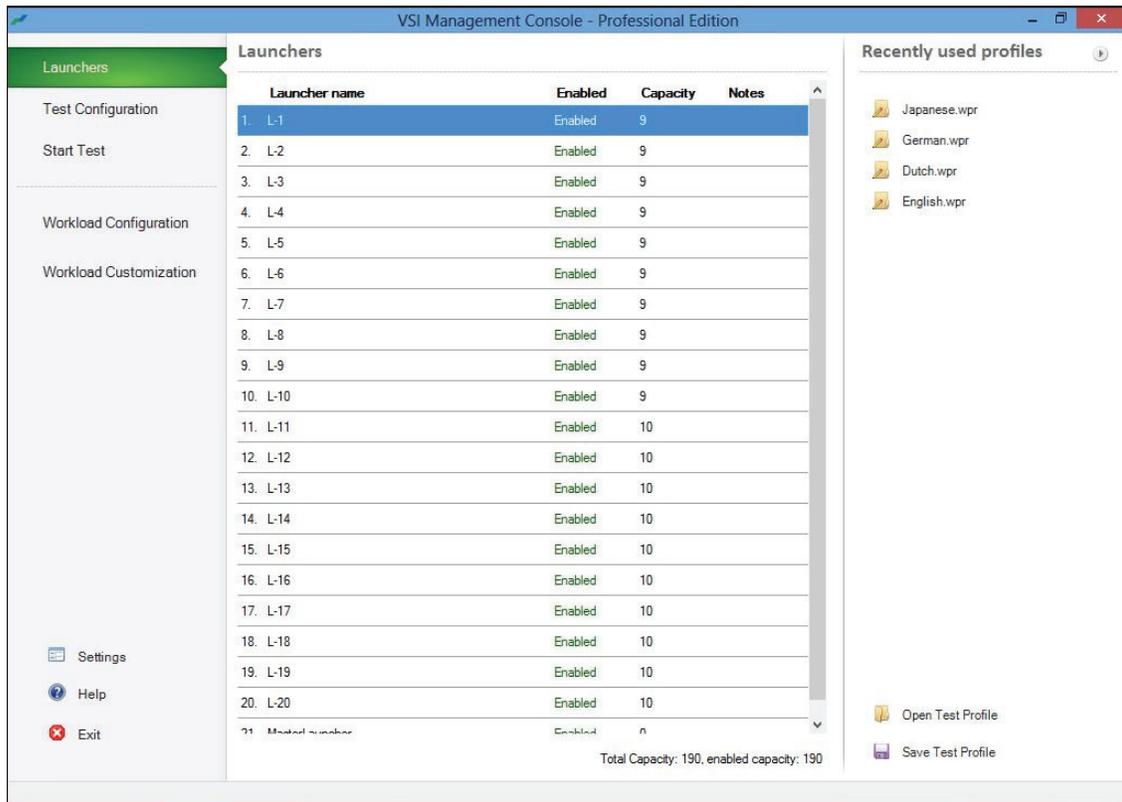
A 1G, Layer 3 management switch was connected to a S6000 server and all three Horizon View servers (Client Host, Management Host and Infrastructure Host). It provided a management VLAN for all end nodes housing the servers.

To begin the QoE testing, 16 guest operating systems residing on the two stacked R710 servers functioning as the Horizon View client were launched. Each guest OS had the Login VSI load testing tool. Each Login VSI generated multiple Horizon View clients.

After a Horizon View client signed in to the virtual desktop on the vSphere ESXi hypervisor, Login VSI generated a pre-configured script that imitated realistic user activities, such as accessing the Internet, using Microsoft Outlook, writing and editing documents in Microsoft Word, playing video and playing audio (music).

The Login VSI screenshot in [Figure 2](#) on [page 11](#) shows 190 virtual users are enabled. To impose stress on the test network and its hardware components, Login VSI repeated the script for the duration of the test, which lasted about 15 minutes.

**Figure 2: Login VSI Interface**



*Login VSI interface shows 190 virtual users enabled in end-user Quality of Experience testing.*

During this test, two parameters were changed to simulate conditions in a VDI environment on a real-world network.

One was the level of user activity generated by the Login VSI script for the ESXi load test. Workloads classified as “medium” and “heavy” were imposed on the Horizon View infrastructure.

A medium workload consisted of opening five applications simultaneously (of seven available) at a type rate of 160 ms per character. The applications were replayed in a loop. Approximately two minutes of idle time was included to simulate the behavior of real-world users.

The seven applications were: Microsoft Outlook 2007/2010 (browse 10 messages), Internet Explorer (one Website left open, two Websites browsed), Word 2007/2010 (one instance to measure response time and one instance to review and edit a document), Bullzip PDF Printer and Acrobat Reader, Excel 2007/2010 (open a large spreadsheet), PowerPoint 2007/2010 (review and edit a presentation) and 7Zip.

A heavy workload provided a greater challenge to memory and CPU consumption because more applications ran in the background. Eight applications ran simultaneously; the type rate was 130 ms per character; and the idle time was only 40 seconds.

The second parameter was desktop resolution, which assessed network utilization during testing. “High resolution” was Full HD, 1080p, with p referring to the numbers of vertical lines displayed on the screen. “Low resolution” was XGA (Extended Graphics Array), a high-resolution video display mode that provides screen pixel resolution of 1,024 x 768 in 256 colors or 640 x 480 in high (16-bit) color.

Tests utilizing four combinations of workload and resolution were run to determine the impact on end-user experience. They were medium workload with low resolution, heavy workload with low resolution, medium workload with high resolution, and heavy workload with high resolution.

Two tools were used to ascertain a complete picture of end-user QoE. The Stratusphere UX virtual appliance, a software-based desktop monitoring tool housed on the Infrastructure Host, made a visual recording of desktop activity that allowed subjective evaluation.

Installed on a golden image of a virtual desktop, the Stratusphere agent pushed all data related to end-user experience to the Stratusphere UX for rating QoE. The overall quality was rated in the upper right (best) quadrant, indicating both best interactive experience and best quality of display rendering.

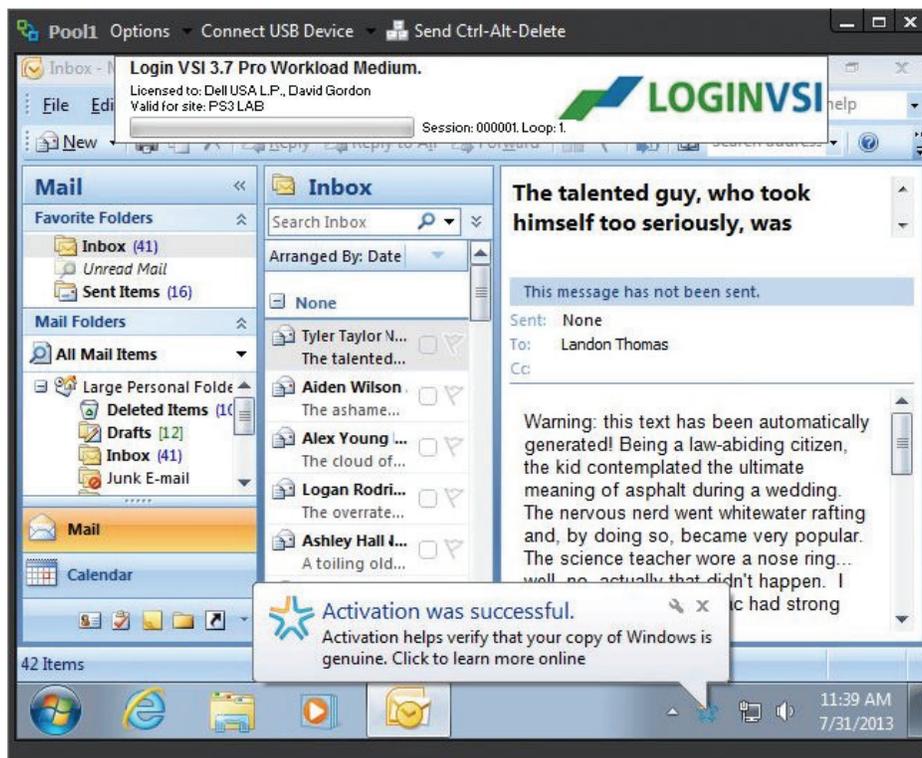
In addition, an objective evaluation of end-user experience was made using the OmniPeek network analyzer from WildPackets, Inc., which monitored network utilization during the test of the S6000 switches and the ESXi hypervisor resource. OmniPeek was placed on the link between a S6000 switch and the 6248 switch. It monitored traffic passing through the S6000 switches from the vSphere servers via the S5000 switches.

### Tests Combining Medium and Heavy Work Load with XGA Desktop

In a test that combined **medium workload with XGA (1,024 x 768)**, 16 Login VSIs launched multiple Horizon View clients, which logged into the virtual desktop at 60-second intervals. CPU capacity was verified to be near maximum.

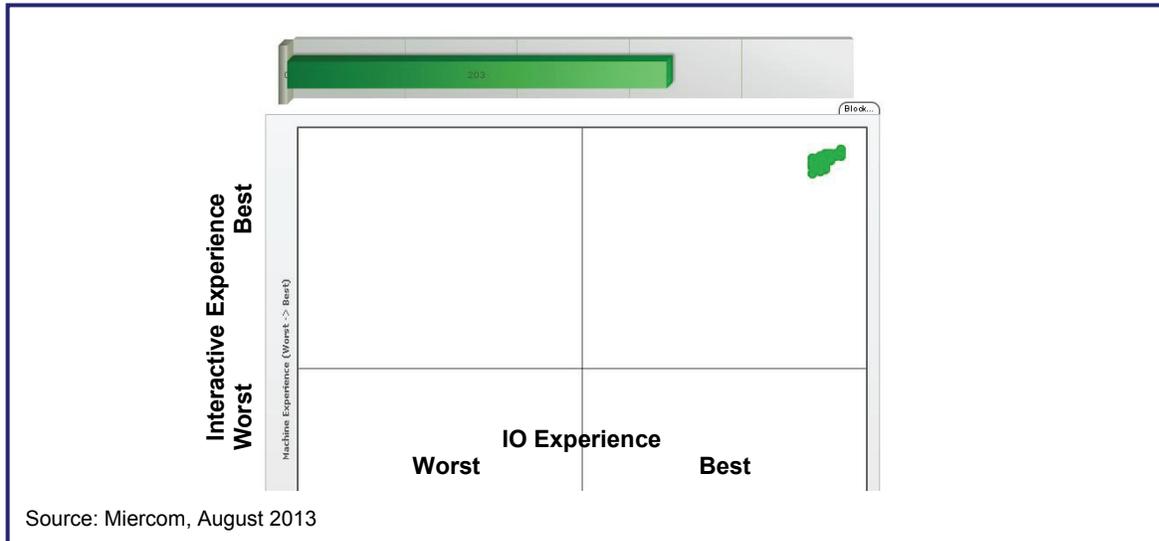
The end-user experience of all 203 virtual users was rated as fully satisfactory by Stratusphere UX. A S6000 switch was the backbone of a subnet on which all 203 users ran concurrently.

**Figure 3: Login VSI Simulates Realistic Desktop Activity of 203 Virtual Users**



The next test used the combination of **heavy workload with XGA (1,024 x 768)**. Again, Horizon View clients logged into the virtual desktop at 60-second intervals and the sample set was 203 clients. Stratusphere UX, which carried out real-time monitoring, scored the experience of all as fully satisfactory. The image from the Stratusphere UX interface is shown below.

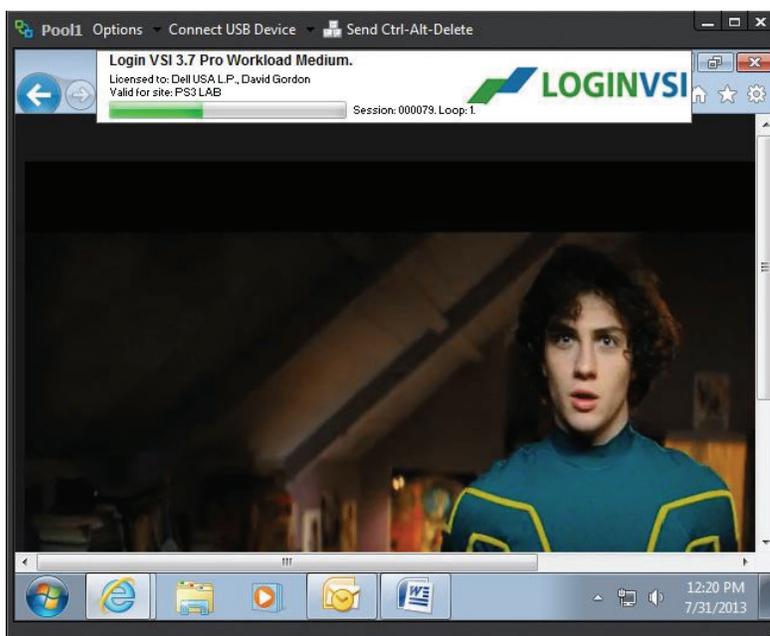
**Figure 4: Desktop Experience of All 203 Users Rated Stratusphere UX**



*The ideal location for end-user Quality of Experience on the Stratusphere UX interface is the upper right corner of the upper right quadrant. The green mark signifies that Stratusphere UX rated the experience of 203 virtual users as most favorable based on a combination of Interactive Experience (Y axis) and screen resolution (X axis).*

The quality of images visible on the desktop was excellent. Desktop operation was observed even while video was playing.

**Figure 5: Viewing Video during Heavy Workload with XGA**



*The S6000 provided traffic, including this video display, to 203 concurrent virtual desktop users in a test that combined medium workload and XGA (1,024 x 768). Subjective evaluation by Stratusphere UX rated the experience of all end users as best.*

## Tests Combining Medium and Heavy Work Load with Full HD Desktop

This portion of testing concluded with VDI clients emulating the combination of **medium workload with Full HD** and **heavy workload with Full HD**.

A total of 206 and 190 concurrent VDI clients, respectively, were launched. End-user experience in both tests was excellent.

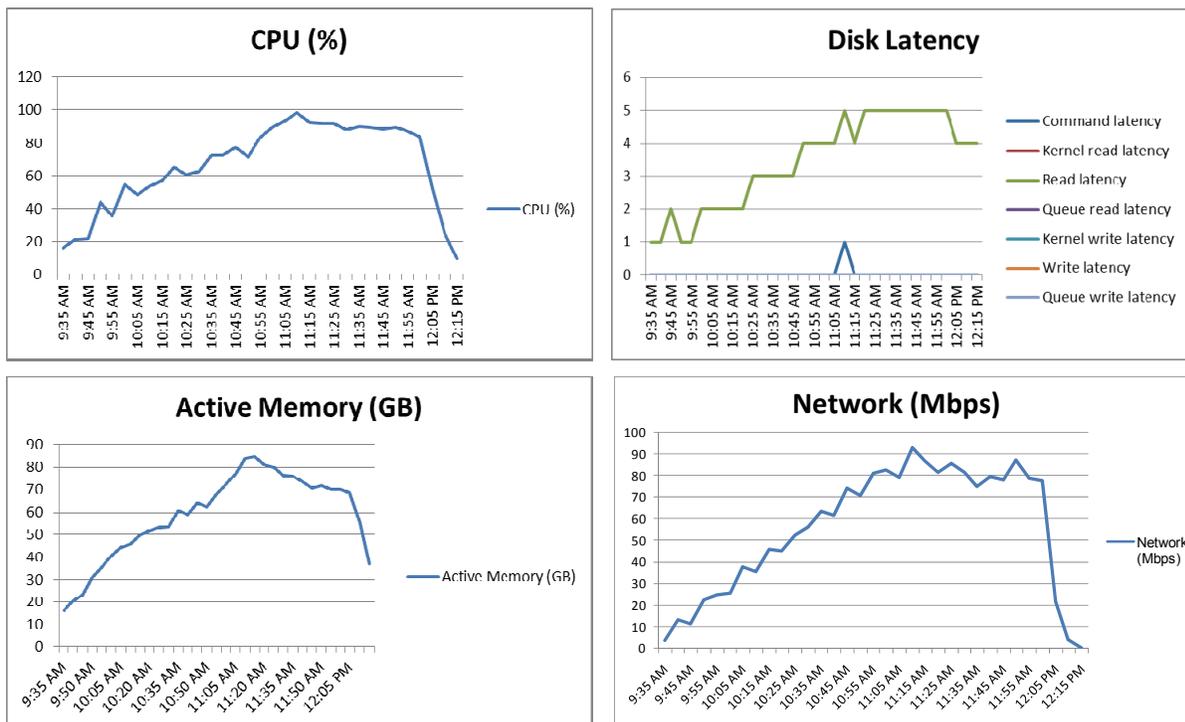
A full graphical depiction of the results of the test that combined heavy workload with Full HD, captured from the interface of an ESXi hypervisor, is below. The graphics show server resources consumed.

During testing, it became apparent that the S6000 was not a limitation to VDI scalability. The limitations were the VMware Horizon View server CPU and memory resources.

In the charts below, the line graph for CPU, Disk Latency and Active Memory was based on one ESXi hypervisor.

Maximum network utilization was observed to be 88 Mbps. The Network line graph (location) is based on two ESXi hypervisors.

Network traffic was about 460 Kbps per View Client. In this case, the View Clients were classified by the VMware Horizon View Architecture Planning Guide as Knowledge Workers. Characteristics of a Knowledge Worker, the second of four classifications in ascending order, includes a usage level of standard productivity and a virtual machine configuration of 1vCPU and 1GB RAM.



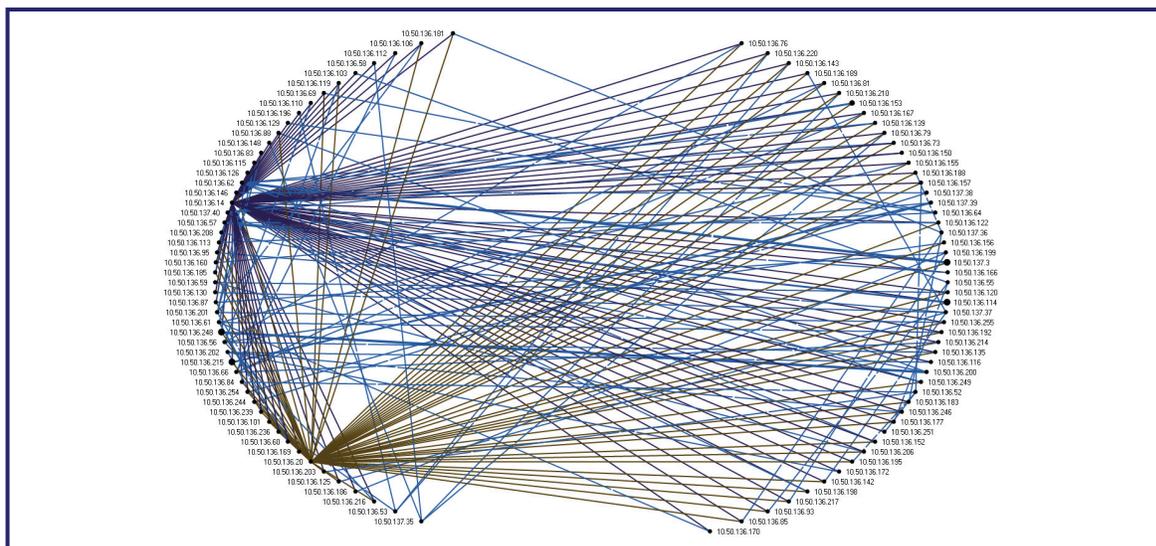
*The S6000 delivered excellent end-user experience to 190 concurrent VDI clients in a test that combined heavy workload with Full HD. Utilization of CPU, active memory and network utilization peaked nearly 90 minutes into the test, which lasted approximately two hours, 40 minutes.*

## 6.2 VDI Scalability Tests (10,000 Users)

The objective of the second part of testing was to verify the scalability to support up to 10,000 users in a VDI environment.

The traffic scenarios generated by Login VSI in the first part of testing (200 concurrent VDI users as shown below) were captured and replayed multiple times by traffic generation test tools, the Ixia XM12 and the BreakingPoint FireStorm. The scenarios consisted of traffic distribution data, frame size distribution and traffic capture (payload) that were emulated by the traffic generators.

**Figure 6: VDI Traffic Pattern (Peer and Mesh) through S6000 Switch, 200-User Quality of Experience Testing**



*The VDI traffic distribution in the QoE testing for 200 users had a point-to-multipoint appearance. This traffic distribution was used in modeling the traffic distribution used in subsequent scalability testing for 10,000 users.*

The VMware designation of a Power User (standard) was selected. It is the third of four user types in ascending order in the VMware Horizon View Architecture Planning Guide. Characteristics include a usage level of compute-intensive and a virtual machine configuration of 1vCPU and 2GB RAM.

For the purpose of comparison, Knowledge Worker, mentioned earlier in the report, is below Power User (standard). The classification above, Power User (heavy), has a compute-intensive usage level and a virtual machine configuration of 2vCPU and 3GB RAM.

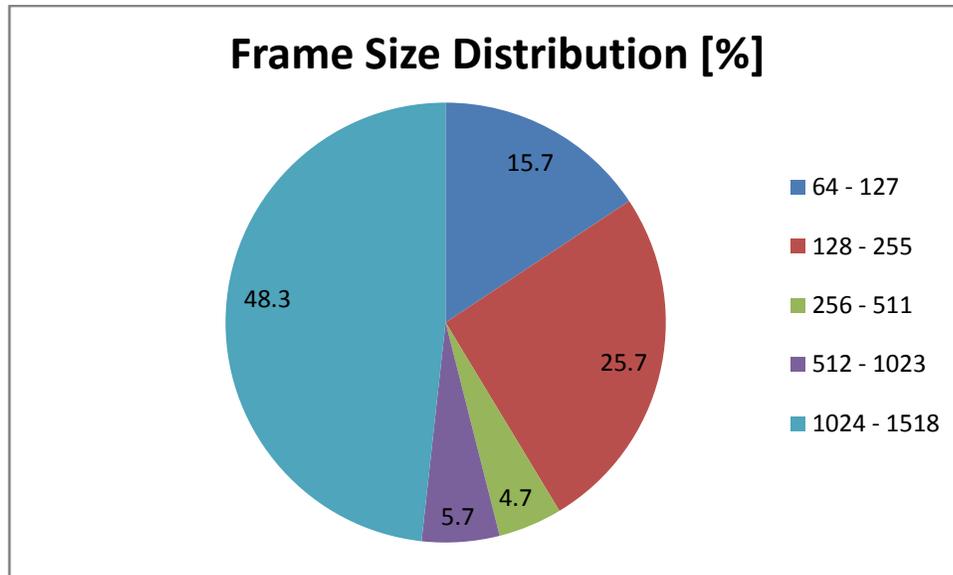
Thus, Miercom projected prior to testing that in order to accommodate a virtual desktop environment of 10,000 Power Users (standard), the S6000 would have to maintain at least 20 Gbps of traffic.

Miercom decided to verify three times this capacity, to at least 60 Gbps. Doing so required that seven of the 10 GbE ports on the S6000 be fully loaded with traffic.

In order to analyze the characteristics of the VDI traffic, the peer mapping function of the WildPackets OmniPeek network analyzer was used. It was confirmed that VDI traffic from all Horizon View clients to the vSphere hypervisors was meshed.

The distribution of frame sizes of VDI traffic handled by the S6000 is shown below. Because the VMware default frame size is 1300 bytes, the frame size of 1024-1518 is the largest portion of the pie chart that shows distribution of traffic by frame size.

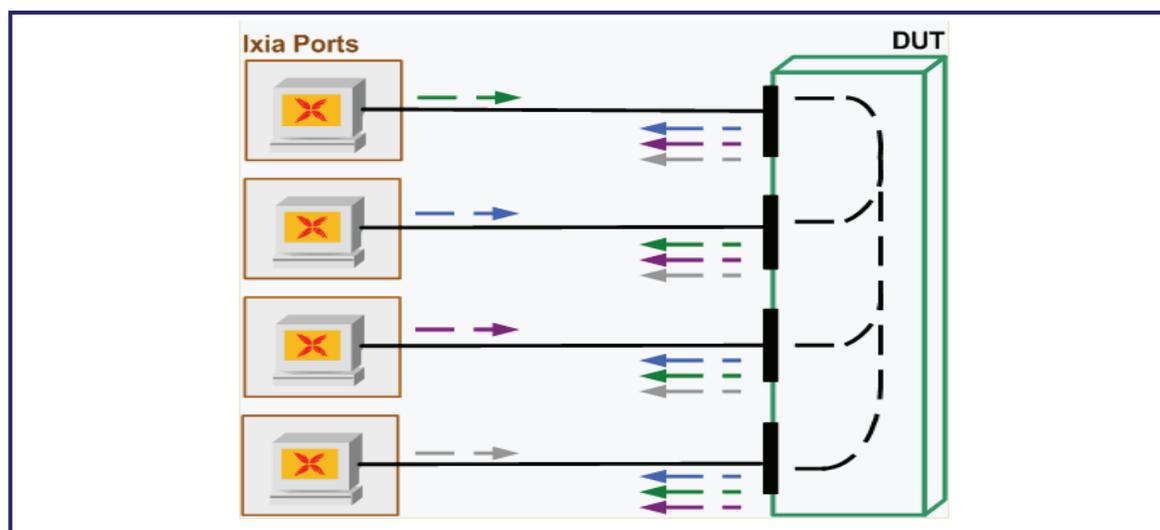
**Figure 7: Frame Size Distribution, 200-User Quality of Experience Testing**



*This was the frame-size distribution in the Quality of Experience testing for 200 users. Note that large packets, 1024-1518 bytes, make up nearly half of the distribution. This distribution was used in to construct the frame distribution used in scalability testing for 10,000 users.*

Then, the Ixia XM12 was utilized to inject fully meshed, custom IMIX traffic that was equal to or more than that needed to support 10,000 VDI sessions. The distribution of frame sizes was similar to that utilized in initial testing of end-user QoE for 200 users.

**Figure 8: Fully Meshed Traffic Generated by Ixia XM12**



*This diagram shows the path of fully meshed traffic between the Ixia XM12 traffic generation test and a generic Device under Test (DUT).*

Testing was repeated and verified with the line rate emulation of the previously captured and recorded QoE transaction traffic.

Using seven of the 10 GbE ports, the capacity of the S6000 was verified to be 63.2 Gbps of fully meshed traffic at 99.5% line rate with low latency. The distribution of frame sizes was similar to that in QoE testing. There was no frame loss and no network anomalies. See the table below.

The near-theoretical maximum of traffic throughput for these seven ports was achieved, far exceeding the amount needed to support a 10,000-user VDI environment. The slight difference from 100% line rate is attributable to the inter-frame gap (IFG) for the custom IMIX traffic distribution used in testing.

**Table 1: Throughput of Seven 10 GbE Ports, Fully Meshed Traffic with Similar Frame Sizes in Scalability Testing**

Tested Ports	Traffic type	Line rate (%)	Throughput (Gbps)
7 x10Gbps	Fully Meshed	99.5	63.20

The size of the ARP and MAC tables in the S6000 are crucial to its ability to scale to 10,000 users in a VDI environment.

In testing, the capacity of the ARP table was verified to be 52,251. This was more than double the target capacity for verifying the ability of the S6000 to support 10,000 users in a VDI environment, 20,000.

Also, the capacity of the MAC table was verified in testing to be 163,836. The target capacity was 160,000. The S6000 learned all of the MAC addresses in less than 15 seconds.

Based on the target capacity of the MAC address table, Miercom projects the S6000 can support in a VDI environment eight times more than the 10,000 users validated with emulated traffic.

**Table 2: Address Tables Verification**

Table	Target Capacity	Verified Capacity
MAC Address	160,000	163.836
ARP Address	20,000	52,251

## 7.0 Bottom Line

The Dell Networking S6000 high-performance 10/40 GbE switch offers exceptional performance and scalability, making it well suited for data center virtualization for years to come. A compact 1U top-of-rack/end-of-row switch, the S6000 can be just as important as an aggregation switch for an enterprise LAN and in a traditional Ethernet environment in which it is connected to 10/40 GbE rack and blade servers.

As the maximum speed in the network core continues to climb toward 40 Gbps, the S6000 is ready now with 32 ports of 40 GbE, which can be configured as 96 ports of 10 GbE and eight additional ports of 40 GbE. The latter configuration is available to save rack space and simplify the migration to 40 Gbps in the core.

The built-in functionality that future proofs the S6000 includes the MAC address table, the ARP table and the IPv4 and IPv6 routing tables.

In testing, the S6000 admirably met both objectives in a Virtual Desktop Infrastructure (VDI) environment. The switch used a fraction of its horsepower to provide excellent end-user Quality of Experience to approximately 200 virtual desktops. The same traffic distribution, frame size distribution and traffic capture (payload) then was re-used for emulation in scale to validate substantial scalability, to 10,000 users. However, scalability testing indicates the switch is capable of eight times that capacity.

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