

ESG Lab Review

Pivot3 vSTAC VDI-Simple Scalability for VMware View 5

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Abstract: This ESG Lab review documents hands-on testing of the [Pivot3](#) vSTAC VDI appliance, and looks at how Pivot3 can streamline and simplify the deployment, management and scale-out of VMware View 5 VDI implementations.

Desktop Virtualization Challenges

The use of server virtualization to consolidate server infrastructure, reduce data center floor space, and maximize utilization of existing assets has seen phenomenal growth over the past decade, but server virtualization's considerable success is dwarfed by the potential of desktop virtualization. Increasing variety and numbers of client device types, the mobilization of the workforce, "always-on" expectations for corporate IT services, evolving regulatory compliance mandates, tightening security policies, and a driving need to increase operational efficiency all combine to make desktop management a daunting task for even the best IT organizations.

A growing number of organizations are using VDI (virtual desktop infrastructure) technology to reduce the cost, complexity, and risks associated with desktop management while providing a high-quality, predictable, and productive computing environment. ESG research discovered that better integration among server, storage, networking, and virtualization technologies is the key development required for the continued adoption of virtualization.¹

Clearly, integration of disparate IT components is creating headaches for IT organizations as they look to provide cost effective solutions for virtual environments. Storage administrators viewed capital costs of new storage infrastructure (36%) and scalability problems (25%) as top concerns in supporting virtualization. Additionally, sizing the bandwidth required to support a virtual server environment is often an issue with 24% of networking professionals citing it as a primary concern with their organization's virtual usage.²

In response to these concerns, integrated computing platforms have garnered attention. These solutions promise to alleviate the challenges associated with virtualization by unifying technologies into one converged platform, eliminating the loosely coupled integration designs that exist today. While only 10% of organizations surveyed by ESG have already deployed integrated computing platforms, more than three quarters expressed interest in the technology, suggesting a trend in the design and deployment of dynamic virtual environments.³

VMware View Desktop Virtualization

VMware continues to expand its desktop virtualization offering. It has been rigorously simplifying its solutions and focusing on broadening the use case for VMware View. Simultaneously, the company is tightly focused on delivering an optimum end-user experience tied to a wide range of endpoint devices and end-user profiles. Often characterized as an enterprise solution—following the infrastructure cost-saving path of server virtualization—desktop virtualization with VMware View also has significant benefits for small and mid-sized organizations that are not as large in number or as complex as those in the enterprise IT segment. After all, smaller, less-complex organizations have many of the same challenges. But often, they must meet those challenges with fewer resources.

¹ Source: ESG Research Report, [The Evolution of Server Virtualization](#), November 2010.

² Ibid.

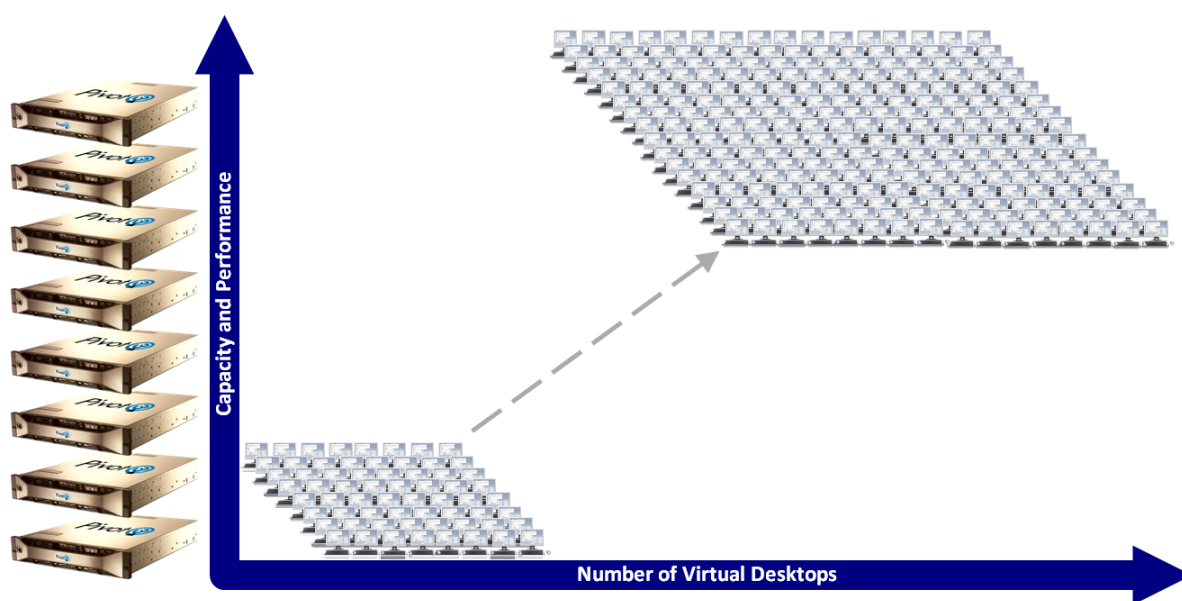
³ Source: ESG Market Landscape Report, [Virtual Computing Infrastructures](#), January 2012.

The goal of ESG Lab reports is to educate IT professionals about data center technology products for companies of all types and sizes. ESG Lab reports are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies. Our objective is to go over some of the more valuable feature/functions of products, show how they can be used to solve real customer problems and identify any areas needing improvement. ESG Lab's expert third-party perspective is based on our own hands-on testing as well as on interviews with customers who use these products in production environments. This ESG Lab report was sponsored by Pivot3.

The Solution: Pivot3 vSTAC VDI

The Pivot3 vSTAC VDI provides highly available virtual machines inside an IP SAN. This not only eliminates the cost, power, and rack space of discrete physical servers, but also provides failover and simplified plug and play scalability. vSTAC VDI Appliances deliver compute and storage services that scale in performance and capacity as appliances are stacked together, as seen in Figure 1. Each vSTAC VDI Appliance contains a performance optimized, VMware-certified vSphere environment supported by scale-out SSD and disk storage resources with advanced disk protection within and across appliances. A Pivot3 vSTAC array can scale from one to eight appliances dynamically to meet business demands while reducing both capital and operational expenditures for VDI deployments. vSTAC VDI is designed to be a predictably scalable, fully integrated virtualization platform that comes with everything an organization needs to deploy a VMware-based VDI.

Figure 1. Scaling Desktops Linearly with the Pivot3 vSTAC VDI Infrastructure



Pivot3 recently published a reference architecture document validating their approach and detailing testing in a VMware View 5 environment.⁴ Each appliance, called a vSTAC VDI, is a high performance server running both the VMware vSphere Hypervisor and the Pivot3 vSTAC Operating System. Up to eight vSTAC VDI appliances can be configured together. The limit of eight appliances is a VMware cluster limit and not a Pivot3 scaling limit. The Pivot3 VDI solution comes with the option to purchase a fully pre-configured starter appliance called a P Cubed which comes with all VMware View and Windows components pre-installed, including:

- A VMware View 5 Premier 100 pack 60-day evaluation.
- A Windows 7 Enterprise 90 day trial installed as the Golden Desktop image.
- VMware View 5 infrastructure virtual machines all running fully licensed Windows 2008 R2 installations which are used to provide VMware (vCenter View Composer, ViewConnection server), Microsoft (Active Directory, DNS, and DHCP), as well as Management Station (vSTAC Manager) services.

Microsoft Virtual Desktop Access allows users to access virtual desktops from PCs covered by Microsoft Software Assurance for volume licensing. Pivot3 asserts that with a P Cubed appliance, deployment of up to 100 virtual desktops can be completed in less than 1 hour.

Pivot3's integrated computing model provides unified storage and compute resources in an integrated IP SAN. The Pivot3 vSTAC operating system (vSTAC OS) manages distribution of data across vSTAC appliances. The Pivot3 vSTAC OS provides multiple RAID protection schemes that take advantage of the Pivot3 architecture and provide protection

⁴ [Pivot3 Reference Architecture for VMware View 5](#)

against up to five simultaneous drive failures. The following summary describes the various protection schemes and roughly maps them to combinations of common RAID architectures:

- **RAID 1e**—Is a mirror across appliances, and protects against a single disk or appliance failure (RAID 1+).
- **RAID 1p**—Uses mirroring within and across appliances and protects against 2 simultaneous drive failures or 1 drive and one appliance failure (RAID 1+1).
- **RAID 5e**—Uses parity across appliances and protects data against one disk or one appliance failure (RAID 5+).
- **RAID 6e**—Uses parity across appliances and parity within appliances to protect against up to 3 simultaneous disk failures or an entire appliance failure and 1 additional drive failure (RAID 5+5).
- **RAID 6x**—Uses parity across appliances with parity and datum within an appliance to protect against up to 5 simultaneous disk failures or an entire appliance failure and 2 additional drive failures (RAID 5+6).

ESG Lab tested the vSTAC VDI infrastructure for usability, performance, and availability with multiple advanced RAID levels and VDI environments from 100 to 800 simultaneous running desktops.

ESG Lab Tested

Getting Started

ESG Lab began with a pre-installed three-node Pivot3 vSTAC VDI cluster and storage array, shown in Figure 2, connected to the lab network with all infrastructure virtual machines powered on and all licenses activated. Five additional unassigned and unconfigured nodes were on hand and used later for expanding the cluster and additional testing.

Figure 2. The ESG Lab Test Bed with three vSTAC VDI Appliances

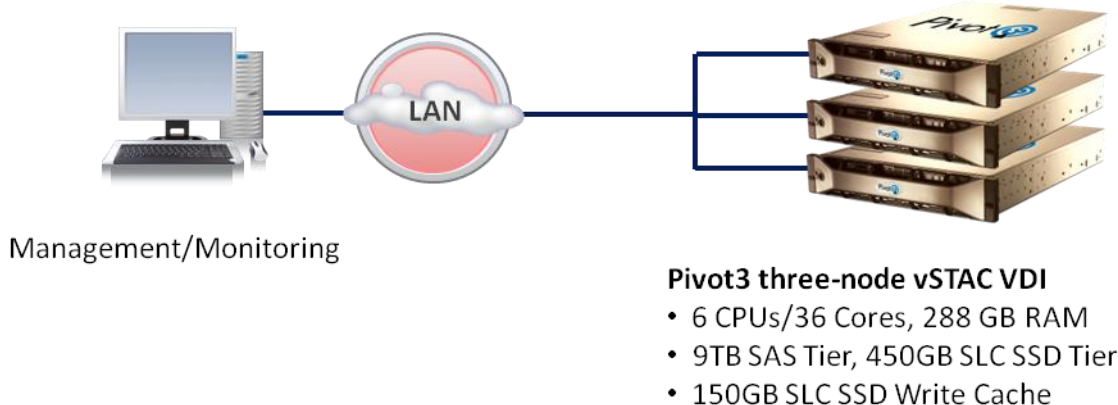
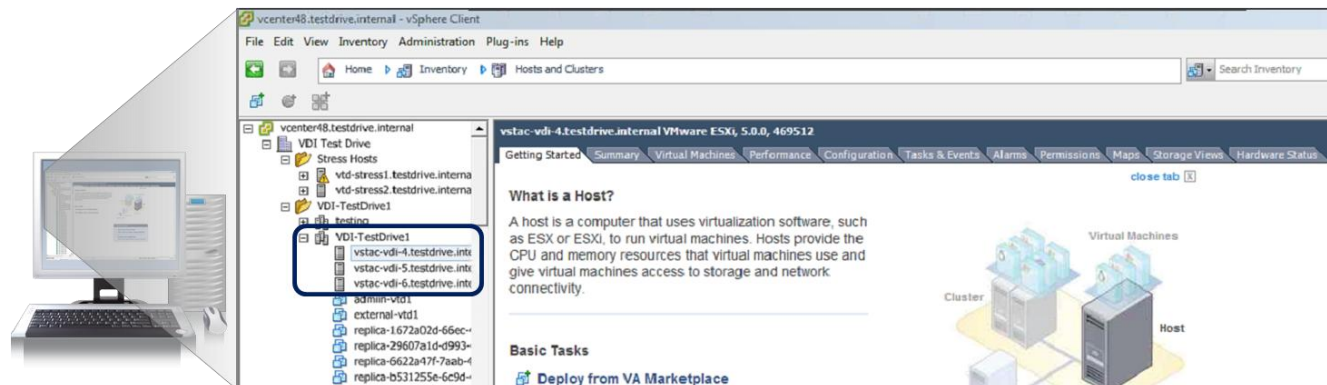


Figure 3 shows the three-node vSTAC VDI cluster being managed in the VMware vSphere Client.

Figure 3. Managing vSTAC VDI Appliances Logically in the vSphere Cluster



ESG Lab used the VMware vSphere client and VMware View Administrator to verify that the VMware View license was activated and that 100 Virtual Desktops had been cloned from the golden desktop image. Each Windows 7 desktop was an identical clone of a standard installation with typical desktop applications installed, including Microsoft Office and Adobe Reader.

Predictable Scalability

The goal of ESG Lab testing was to examine the performance of the vSTAC VDI architecture and examine how metrics like response time to users change as the cluster size grows and more active virtual desktops are added.

ESG Lab used a VMware virtual desktop workload simulation tool to test the vSTAC VDI. This tool is used by VMware partners to simulate user workloads in a Windows desktop environment. It is designed to characterize storage, network, and compute workloads, simulating multiple tasks that users perform, such as Internet browsing, archiving files with compression tools, composing and sending email, using various Microsoft Office applications and opening PDF files with Adobe Reader. The tool uses a system designated as the controller which builds the test configurations and stores the shares necessary for execution. View Client sessions are established and scripts are executed on each desktop to simulate active desktop users.

Figure 4. vSTAC VDI Performance for One Appliance and 100 Virtual Desktops

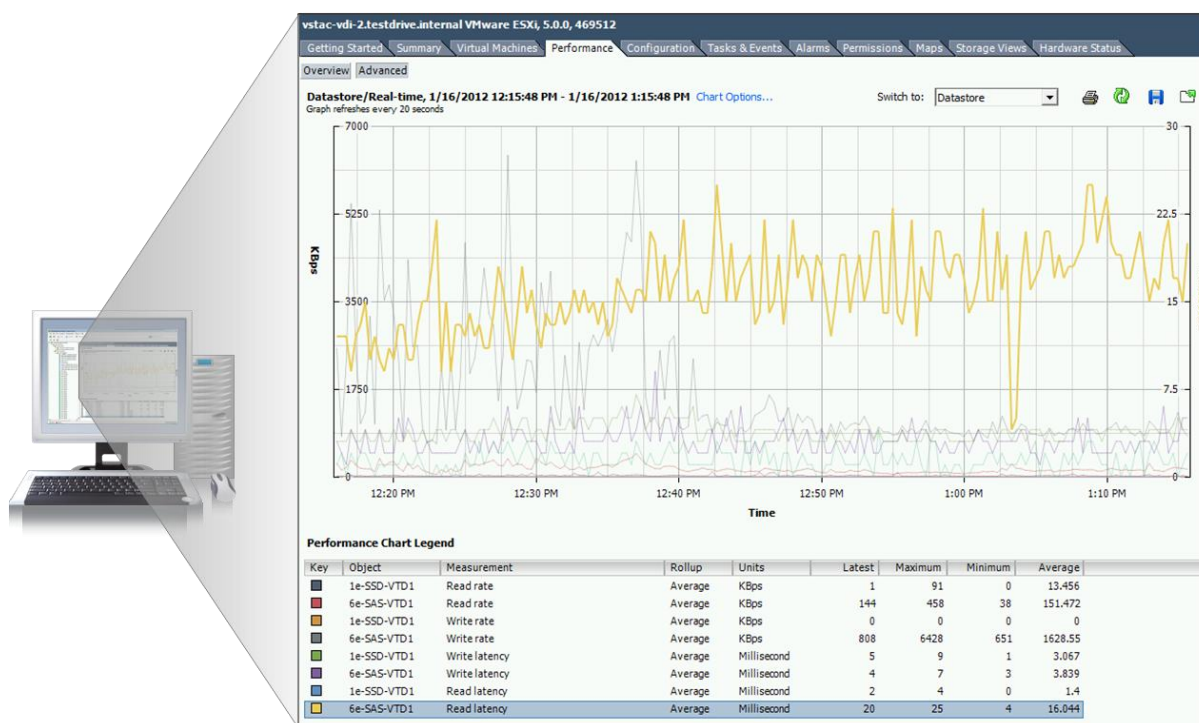
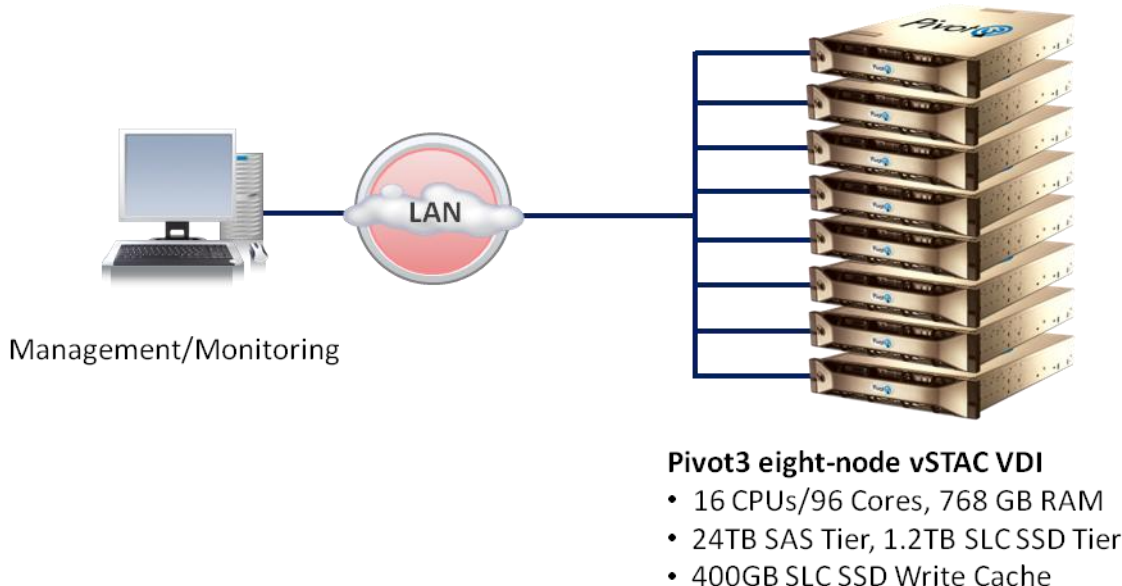


Figure 4 shows the vSphere client performance tab during the first testing session, with one appliance supporting 100 desktops after the test had run for approximately one hour. The yellow line represents disk read latency averaging between 10 and 20 milliseconds throughout the test.

ESG Lab used the same methodology detailed in the Pivot3 reference architecture for VMware View to run these tests with the following parameters:

- VMware View non-persistent virtual desktops were tested with one, three, and finally with eight vSTAC VDI Appliances in a Pivot3 unified storage and compute vSTAC, as shown in Figure 5.
- 100 Virtual Desktops per vSTAC VDI Appliance were tested.
- The task worker profile was generated utilizing a mix of Adobe Reader, MS Word, MS PowerPoint, MS Outlook, and MS Internet Explorer. An IO rate per desktop of 3-5 IOPs was targeted.
- A login storm was simulated by starting all client sessions within a set timeframe.

Figure 5. The ESG Lab Test Bed After Scaling to Eight vSTAC VDI Appliances



RAID configuration for the test used RAID 6e for the SAS Storage Tier and RAID 1e for the SSD Storage Tier. The Linked Clone pool placed Replica images in the SSD tier and Clones in the SAS tier.

It's important to note that in the published reference architecture, Pivot3 validated 115 desktops per node, 15% higher than the number of desktops per node tested by ESG

Figure 6. Performance Scales as Pivot3 Appliances are Added

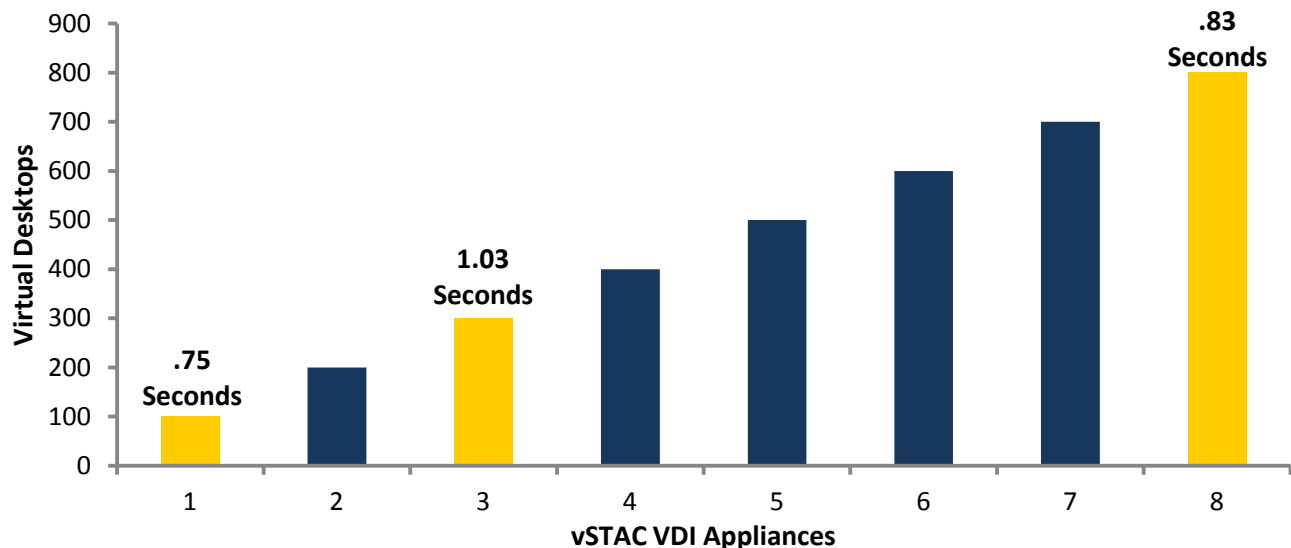


Figure 6 summarizes the results obtained by ESG Lab. The Yellow bars represent tested configurations. As can be seen in Figure 6 and Table 1, the average application response time was consistently low across all tests. This is the most important performance metric as it indicates the latency users would experience when performing typical tasks using a virtual desktop. The Lab also observed excellent IOPS, low disk latency and smooth memory and CPU utilization, across all appliances.

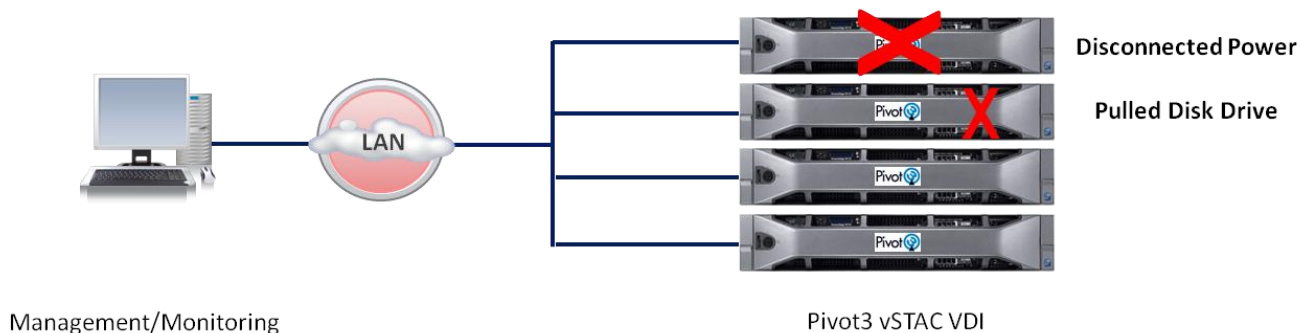
Table 1. Average Application Response Times for Virtual Desktops During Testing

Task	100 Desktops (Seconds)	300 Desktops (Seconds)	800 Desktops (Seconds)
MS Outlook Open	0.90	1.07	1.09
MS PowerPoint Open	0.37	2.30	1.83
MS Internet Explorer Open	1.71	2.56	0.37
PDF Open	1.74	3.27	1.85
MS Word Open	2.02	0.48	2.40
MS Word Save	0.16	0.19	0.21
MS PowerPoint Close	0.27	0.29	0.28
MS Internet Explorer Close	0.28	0.28	0.27
MS Outlook Close	0.28	0.29	0.29
PDF Close	0.28	0.36	0.28
MS Word Close	0.27	0.28	0.28

Reliability and High Availability

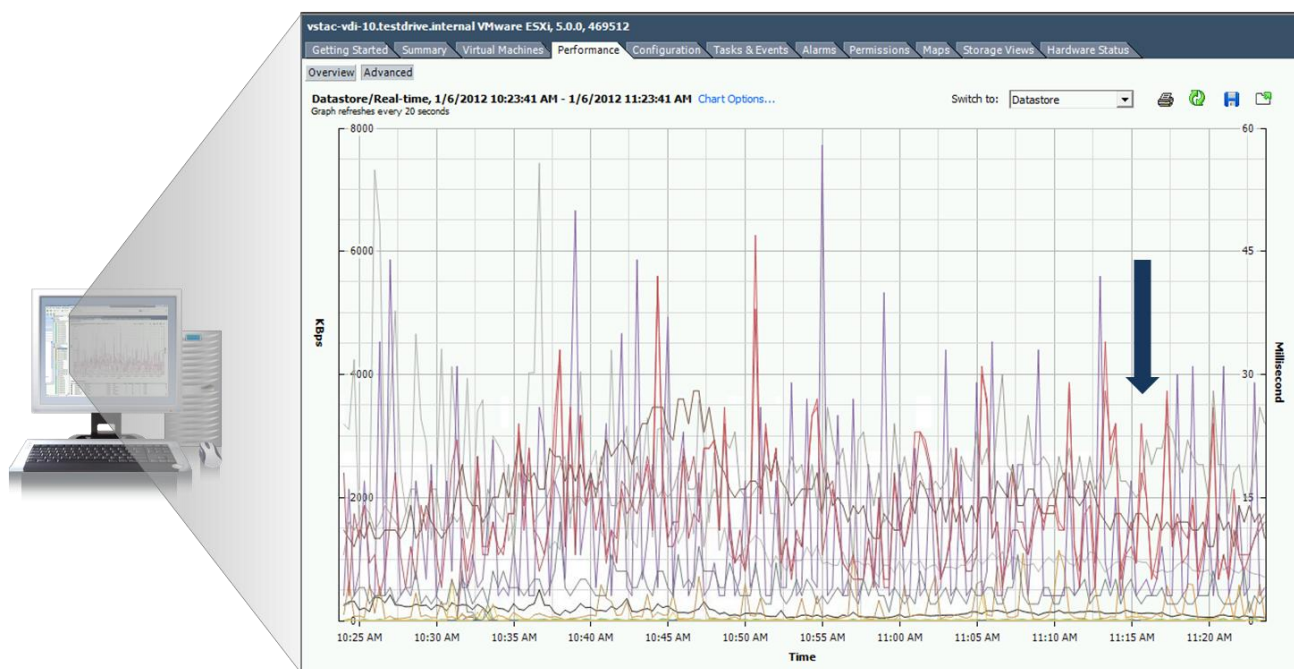
Next, ESG Lab tested the resilience and availability of a VDI environment running on Pivot3 vSTAC VDI by injecting faults into a four node cluster running a live workload. The four node cluster was configured with RAID 6e for the SAS Tier and RAID 1e for the SSD Tier, to test the ability of vSTAC VDI to survive multiple faults. Pivot3 Storage always provides a distributed global spare drive in each storage tier.

Figure 7. Injecting Disk and Appliance Faults Into a Running Array



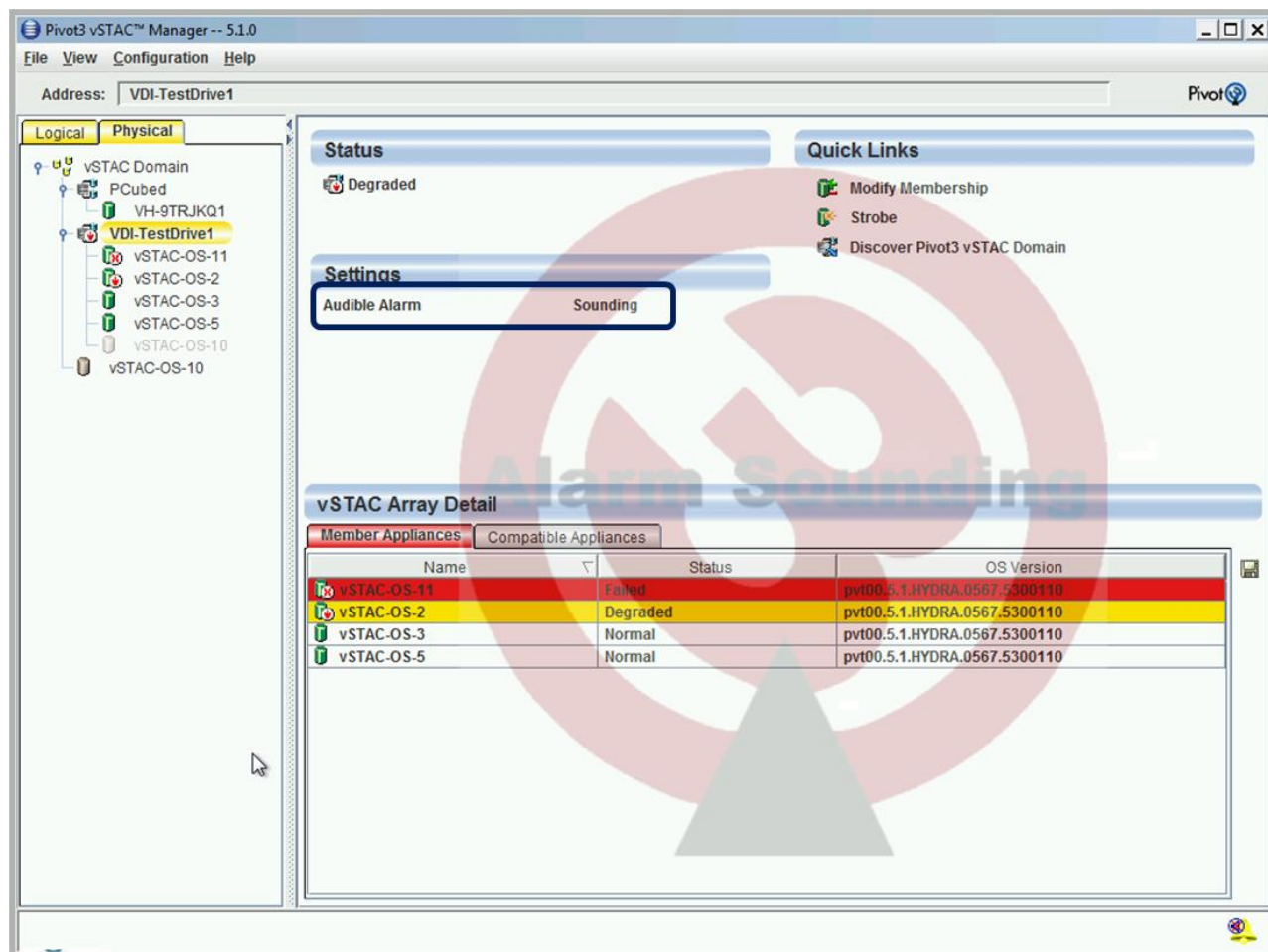
First, the Lab started the VMware workload simulator on the cluster against 400 virtual desktops. Once the 400 desktops had finished booting and the workload stabilized, ESG Lab pulled a drive from node VSTAC-OS-2. Almost immediately, the Pivot3 vSTAC Manager began sounding an audible alarm and displayed the node containing the pulled drive in yellow, indicating a degraded condition. Figure 8 is a snapshot of the vSphere Client performance tab, with the blue arrow indicating where the drive was pulled, showing no change in the workload and no interruption in service.

Figure 8. Workload Performance Unaffected by a Component Failure



Next, ESG Lab disconnected power on the node: VSTAC-OS-11. As seen in Figure 9, vSTAC Manager showed that the cluster was now running with only three nodes and one node was degraded due to a failed drive.

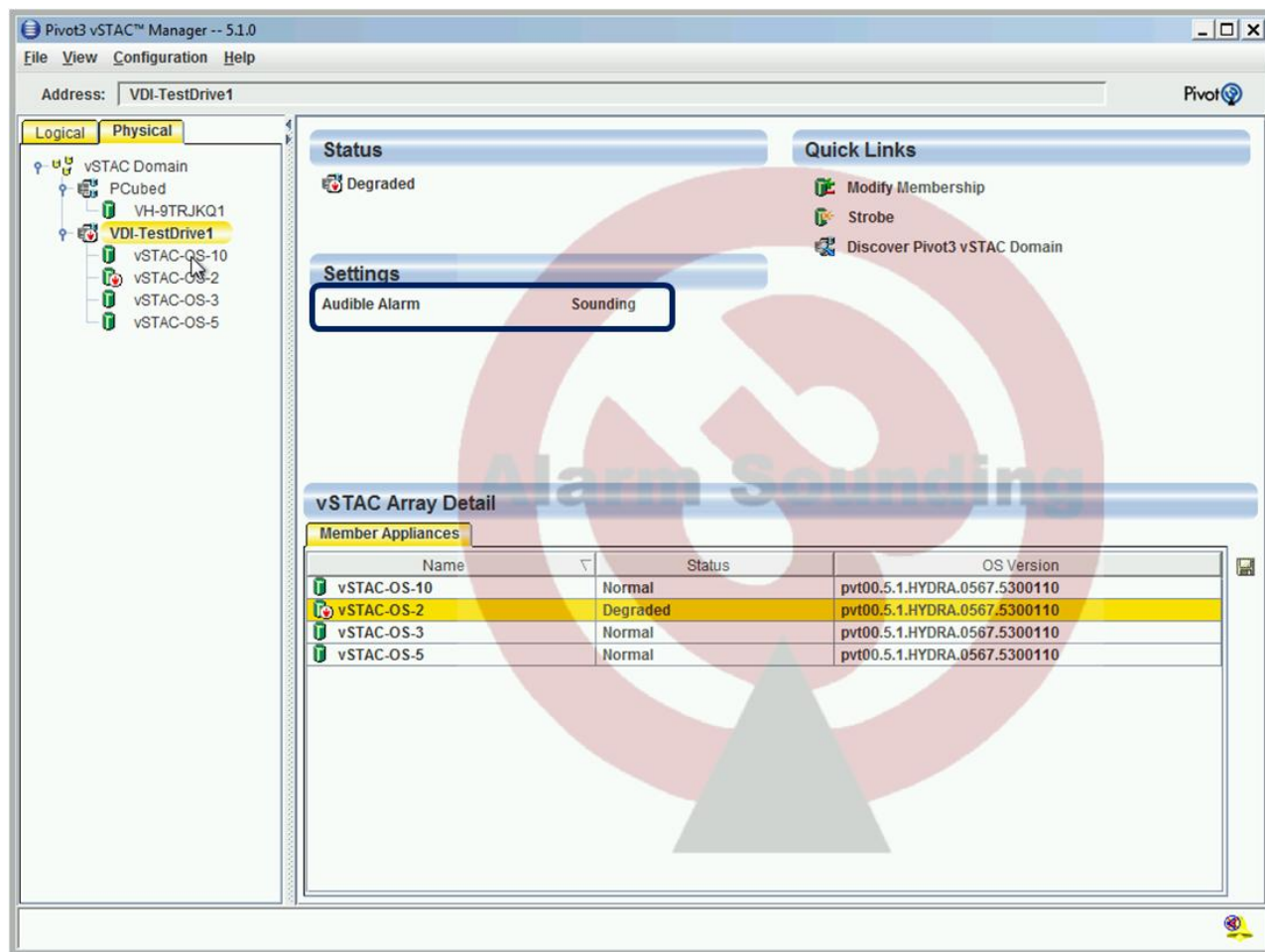
Figure 9. Virtual Desktops Protected Against Server and Storage Faults



It's important to note that when VSTAC-OS-11 was powered off, all virtual desktops running on that node stopped responding. As would be the norm in a production environment, ESG Lab performed these tests with VMware Distributed Resource Scheduler (DRS) and HA enabled. VMware HA is the feature that restarted virtual desktops on the remaining hosts in the array. DRS distributed the desktop load evenly across the remaining hosts using vMotion for hot redistribution. The test tool does not re-login to virtual desktops when a connection is broken, but ESG Lab was able to login to a virtual desktop that was redistributed from the failed node just as a user would in a production environment, with no intervention from an administrator required.

Finally, ESG Lab replaced the "failed" host VSTAC-OS-11 with a new host, VSTAC-OS-10. Replacing the host was simple and straightforward and Figure 10 shows the vSTAC Manager display after the new host was added. ESG Lab disabled DRS during the host add so that active desktop sessions would not be disconnected. In a production environment, VMware DRS could be used to redistribute desktops to balance between the active nodes.

Figure 10. Storage and Server Resources Returned to a Protected State



Why This Matters

Integrated platforms offer the potential to greatly decrease the cost of deploying and managing virtualization technology and infrastructure. A scale-out design allows customers to pay as they go not only for server resources, but also for networking and storage capacity, on-demand and as needed. Additionally, IT organizations can begin to realize true operational savings by simplifying and centralizing the management of those disparate resources.

The promise of integrated computing, however, can only be realized if these solutions support enterprise class data and system management functions. The Pivot3 vSTAC VDI appliance enables virtualization without requiring external networked storage and integrates multiple enterprise functions such as cloning, advanced RAID, snapshots, cluster management, HA failover, virtual machine migration, and tight integration with VMware’s hypervisor environment.

ESG Lab found the Pivot3 vSTAC VDI easy to manage with a very simple drop-in capability that enabled rapid installation of a cluster and expansion of the VDI environment by simply adding a pre-configured node with a few clicks. ESG Lab found the enterprise-class features quite effective in delivering smooth scalability and predictable performance in a highly available virtual desktop environment.

The Bigger Truth

Increasing numbers of clients and applications make desktop management an often daunting task. The number of applications supported tends to increase with organization size which compounds desktop management challenges. With increasing numbers of corporate applications to support, ongoing maintenance and management tasks directly translate into considerable IT staffing requirements and costs. Like server virtualization, desktop virtualization is establishing a foothold in the data center among IT staffs looking to optimize their current PC environments.

VMware adds significant value both from the technology specifically and from the company's unparalleled experience in delivering virtualization. VMware has developed solutions that help SMBs to save IT staff resources by automating routine tasks, improving productivity, and adapting more rapidly to changes in business conditions. VMware solutions also offer ease of deployment, strong security, data protection, and minimal downtime. At the server level, VMware solutions for SMBs can include features such as fault tolerance and built-in data recovery more typically found in enterprise-scale products. Via specific packages targeting this market segment, VMware has also lowered the bar for SMBs to buy and use these capabilities. In particular, VMware View provides a robust desktop virtualization offering that is easy to consume, adaptable and highly scalable to the IT generalist skill set often found in many SMB organizations.

The growing adoption of server and desktop virtualization is driving significant challenges to traditional IT infrastructure. IT is playing a game of catch up as they design new networked storage solutions to meet the high IO and throughput demands that high density virtualization creates. While desktop virtualization promises to deliver savings in capital and operating expenditures, these savings can be drastically affected by the costs of deploying and managing the complex networked storage systems needed to respond to these requirements.

According to ESG research, users report ease of management (44%), faster deployment times (37%), improved TCO (35%), and less time required for hardware and software integration (33%) as benefits of integrated platforms. Respondents also envision benefits associated with overcoming interoperability issues, enhancing application performance, and streamlined service and support.⁵

Pivot3 delivers a solution for virtual desktop environments that simplifies the deployment, and reduces the cost for deployments of 100 to 1000 desktops while providing enterprise class reliability, availability, and data management. ESG Lab was able to execute a rapid implementation of a 300 desktop VDI environment with excellent client performance, and then upgrade the environment to 800 desktops, hot and online, with no disruption to running clients. ESG Lab observed as the vSTAC VDI ran without interruption through multiple component failures, and recovered gracefully from a simulated node outage. Integration with advanced VMware functionality (vMotion, Distributed Resource Scheduler, and HA failover) was seamless.

It's clear that virtualization will continue to be a disruptive force, requiring IT to think about compute and storage environments differently as scalability and elasticity become critical. Pivot3 vSTAC VDI offers a solution that is simple to deploy and manage while providing near linear performance and scalability. Any organization with a growing and dynamic virtual desktop environment would be smart to have a look at the Pivot3 vSTAC VDI.

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⁵ Source: ESG Market Landscape Report, [Virtual Computing Infrastructures](#), January 2012.