Lab Validation Report

Virtual Instruments VirtualWisdom

A Big Window into SAN Performance, Availability and Utilization

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Contents

ESG Lab Reports

The goal of ESG Lab reports is to educate IT professionals about emerging technologies and products in the storage, data management and information security industries. 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 Virtual Instruments.

Introduction

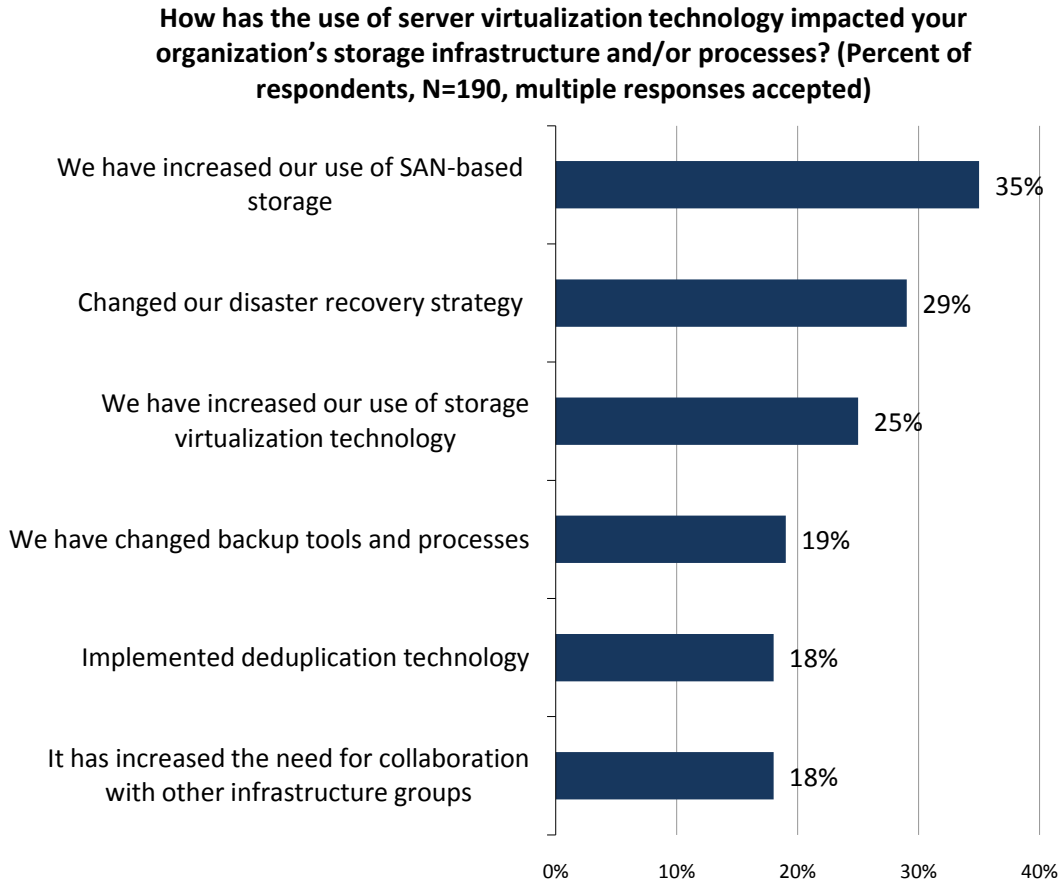
It's no surprise that server virtualization has had a significant impact on supporting infrastructure as IT organizations struggle to effectively manage, monitor, and scale resources to meet the needs of new, dynamic environments. Getting visibility into virtualized infrastructure remains a critical IT requirement. This ESG Lab Validation examines Virtual Instrument's VirtualWisdom product line and validates its ability to provide real-time, granular visibility of fibre channel traffic from virtual servers to storage within the data center.

Background

When IT organizations were asked about the impact of server virtualization on their storage infrastructure, 35% responded that it has increased their use of SAN-based storage.[1] This can be explained not only by the shear explosion of virtual servers that demand more storage resources, but also the trend towards moving more production resources to virtualized servers. This number will only grow as virtualization continues to move into the data center and support business critical applications.

One of the benefits of virtualization is that it obscures the physical complexity of the underlying hardware from applications. But that abstraction also obscures the causes of performance problems and outages, making it difficult to diagnose and resolve issues as troubleshooting requires input from multiple support teams in IT (applications, operations, server, networking, and storage).

Figure 1. Virtualization's Impact on Storage Infrastructure



Source: Enterprise Strategy Group, 2011.

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

VirtualWisdom

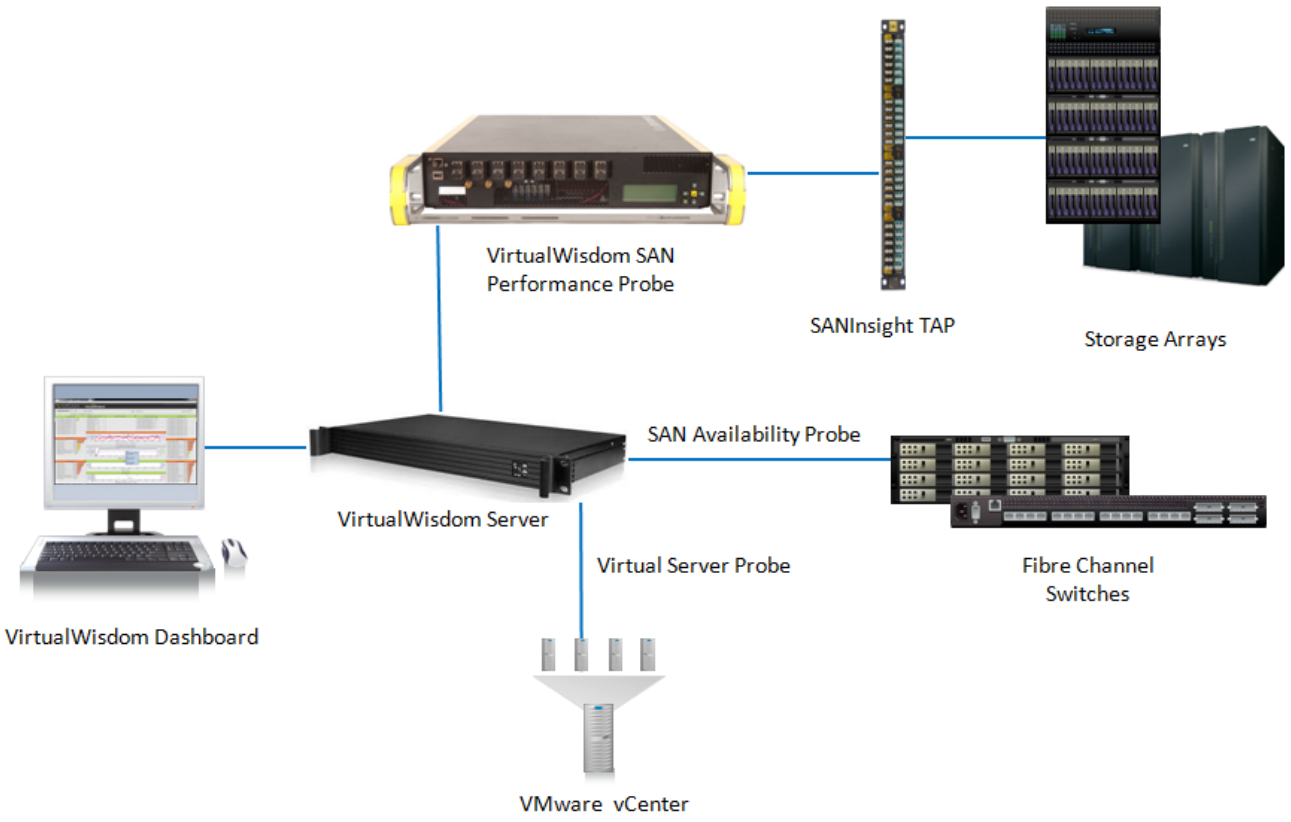
Virtual Instruments delivers a unique solution that provides real-time operational, utilization, and performance monitoring as well as root-cause diagnostics for the Fibre Channel SAN. VirtualWisdom passively mirrors traffic flowing across the SAN to examine an out-of-band copy of the traffic, combining the results with monitoring data gathered from both VMware ESX/ESXi servers and the SAN switches to present a comprehensive set of granular, accurate monitoring data.

As shown in Figure 2, VirtualWisdom deploys multiple data collectors, which Virtual Instruments calls "probes", both in hardware and software, to collect data from servers to SAN. The combined data is hosted on the VirtualWisdom server and provides a central store for analysis and real-time monitoring of the SAN infrastructure.

The VirtualWisdom probes include the following:

- **SAN Performance Probe** (ProbeFC8) is an appliance that monitors in real-time every frame header on a fibre channel SAN. Connected to the SAN via a SANInsight Traffic Access Point (TAP), the probe measures end-to-end SCSI performance and latency as well as errors at all layers of the FC stack: link, port, and device utilization.
- **SAN Availability Probe** (ProbeSW) is software that resides on the VirtualWisdom server and collects monitoring data from the SAN switches via SNMP.
- **Virtual Server Probe** (ProbeVM) is software that also resides on the VirtualWisdom server and collects VMware server information through APIs in vCenter.

Figure 2. The Virtual Instruments VirtualWisdom Product Line



Data is collected in a database on the VirtualWisdom server and can be accessed via two client applications. VirtualWisdom Views allows administrators to access SAN metrics in table form, either in real-time or playback mode. It also provides the interface to configure probes for the SAN environment.

The VirtualWisdom Dashboard is a configurable application that allows administrators to monitor multiple metrics in the entire SAN fabric. Each dashboard view can be customized to display metrics from various elements such as virtual servers, switches, and SAN links. Custom dashboards and views can also be created specifically for SAN administrators, server administrators, and application owners.

VirtualWisdom provides a solution that facilitates the following key benefits:

- **Virtual infrastructure optimization**. Performance metrics at not only the virtual server level, but also at the switch and storage array levels, helps virtual server administrators more accurately identify the causes of performance problems and provide a more intelligent plan for provisioning and load balancing applications deployed on virtual machines.
- **SAN optimization.** With a comprehensive view of SAN traffic and a historical data trail, SAN and storage administrators can quickly pinpoint the root causes of application service interruptions. This allows them to quickly determine if the SAN is the root cause of an outage or slow application performance.
- **Private cloud optimization.** IT organizations looking to move services to a private cloud can use the monitoring and reporting capabilities of VirtualWisdom to help fulfill service level agreements related to performance and availability and minimize the costs associated with providing the high level SLAs required for cloud services.

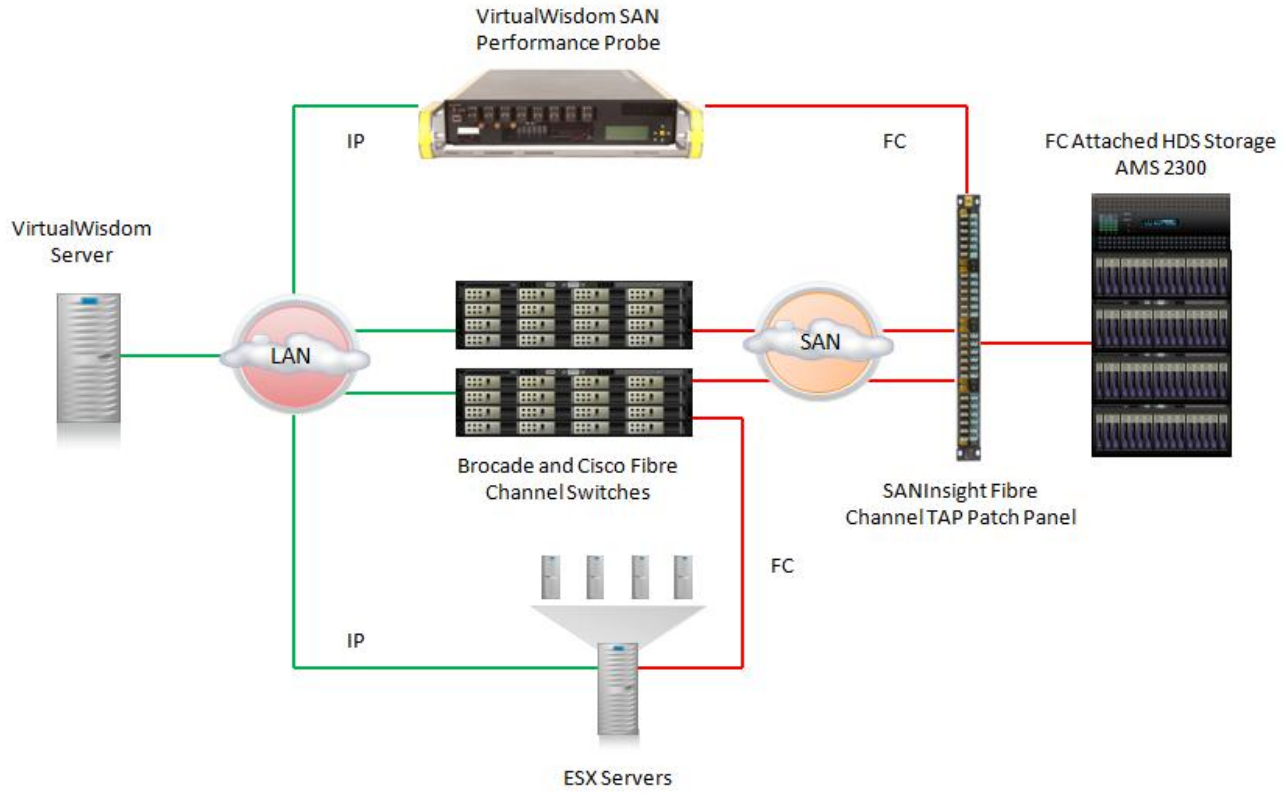
ESG Lab Validation

ESG Lab performed hands-on evaluation and testing of the VirtualWisdom product line at Virtual Instruments headquarters in San Jose, California. Testing was designed to demonstrate the capabilities of VirtualWisdom in ease of implementation and management, SAN utilization and performance optimization, and real-time monitoring and analysis.

Getting Started – Ease of Use

The test bed used by ESG Lab is illustrated in Figure 3. A VirtualWisdom SAN Performance Probe, Model ProbeFC8, was attached to a SANInsight Fibre Channel Traffic Access Point (TAP) to receive out-of-band SAN traffic for continuous monitoring and reporting. The data was sent to the VirtualWisdom server every second for collection and analysis. SAN Availability Probe and Virtual Server Probe software were installed on the VirtualWisdom server to monitor the Fibre Channel switch fabric and virtual server environment.

Figure 3. The ESG Lab Test Bed

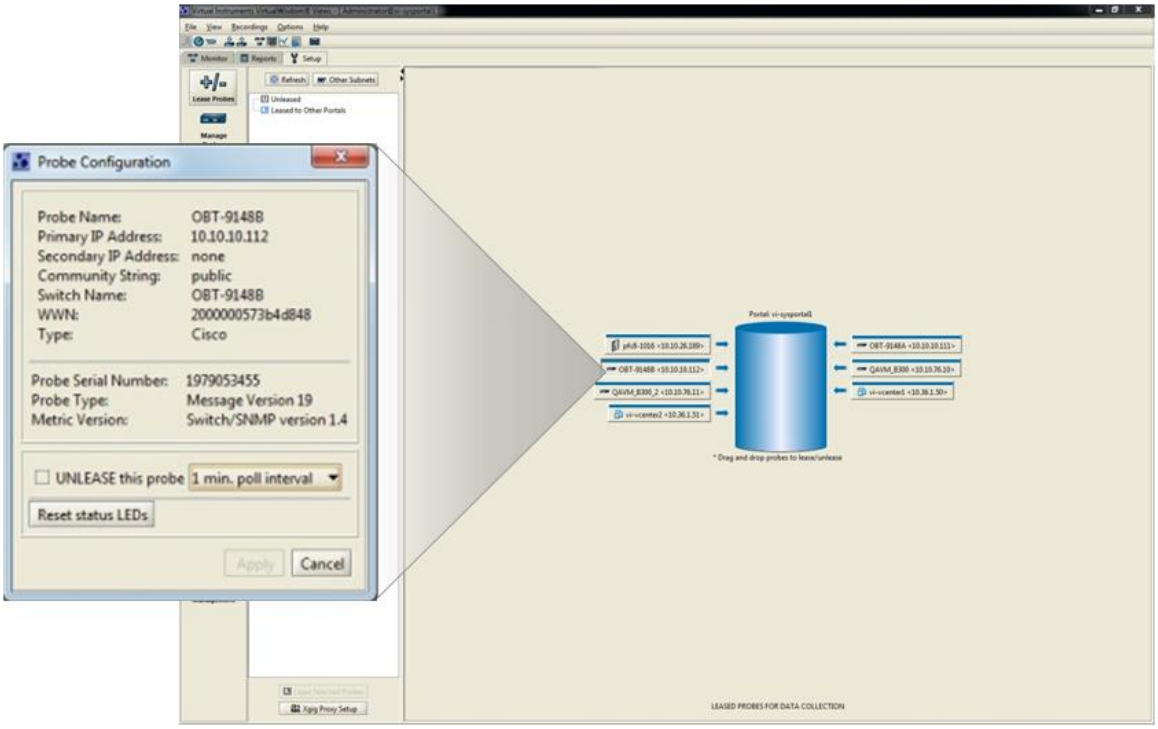


ESG Lab Testing

Installation of the server software is wizard-driven and designed to install and configure all software components including the VirtualWisdom server, software probes, and the VirtualWisdom database. ESG Lab was able use the wizard to install the software in only ten steps.

Once the server software was installed, ESG Lab used two programs, Views and Dashboard, to configure the SAN monitoring environment and examine SAN traffic metrics. Using the Views program, ESG Lab was able to see all available probes. As shown in Figure 4, ESG Lab leased (accessed) a probe for use with the VirtualWisdom server simply by dragging and dropping the probe name into the VirtualWisdom database.

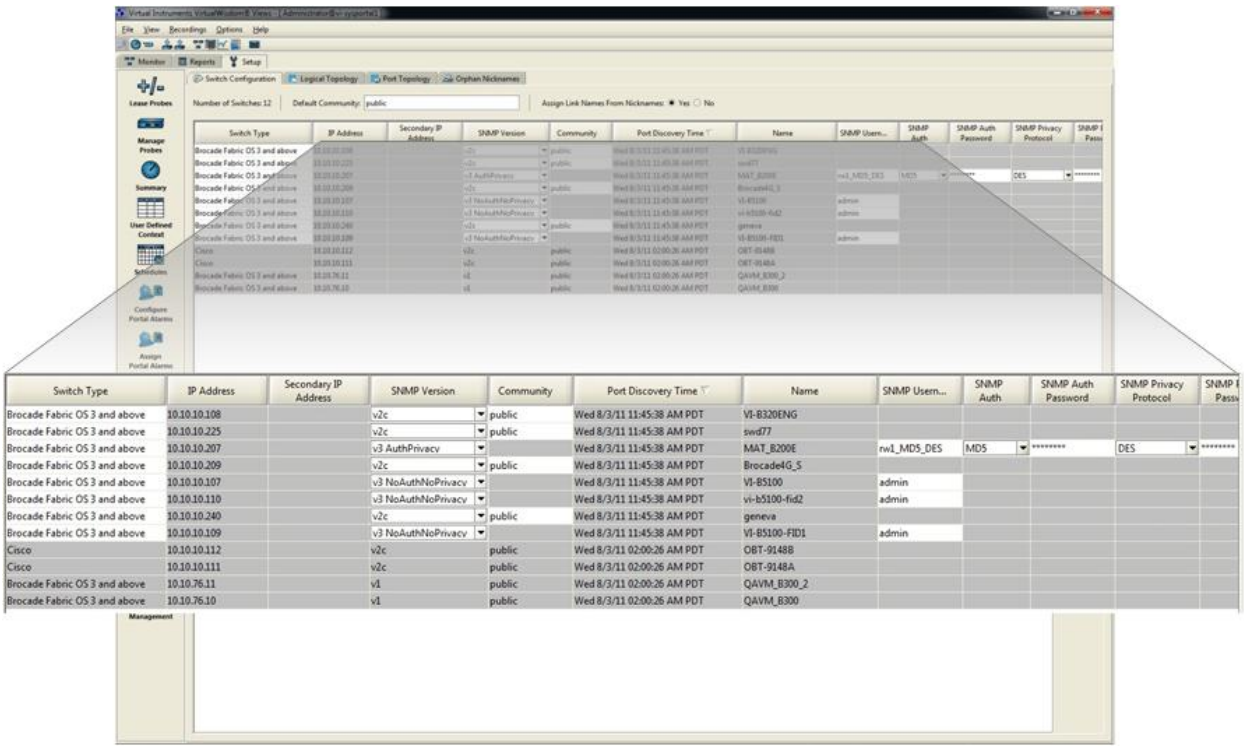
Figure 4. Leased Probes to VirtualWisdom Portal



SAN Performance Probes are visible immediately in the portal view. SAN Availability Probes for switches are configured using SNMP and need credentials to make the SNMP queries for each switch. Virtual Server Probes use vCenter APIs and require administrator credentials to communicate with them.

As shown in Figure 5, ESG Lab was able to successfully configure multiple SAN Availability Probes to access switches in the SAN fabric using the Switch Configuration view under the Fabric Management setup.

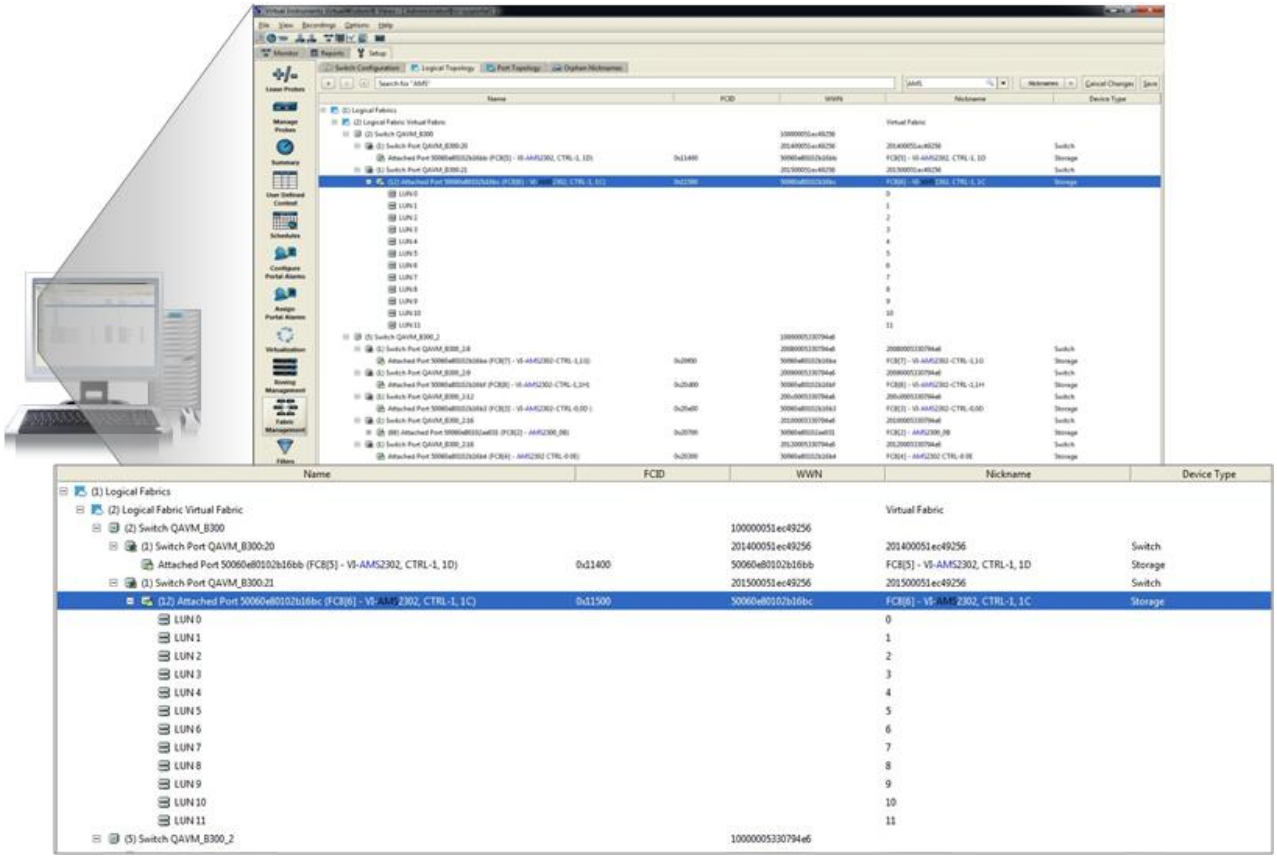
Figure 5. Switch Configuration



Once the probes were leased and configured as part of the VirtualWisdom server, ESG Lab was able to navigate to the Fabric Management section and examine the logical topology of the SAN fabric. Figure 6 shows the logical fabric from switches to storage controllers and configured LUNs.

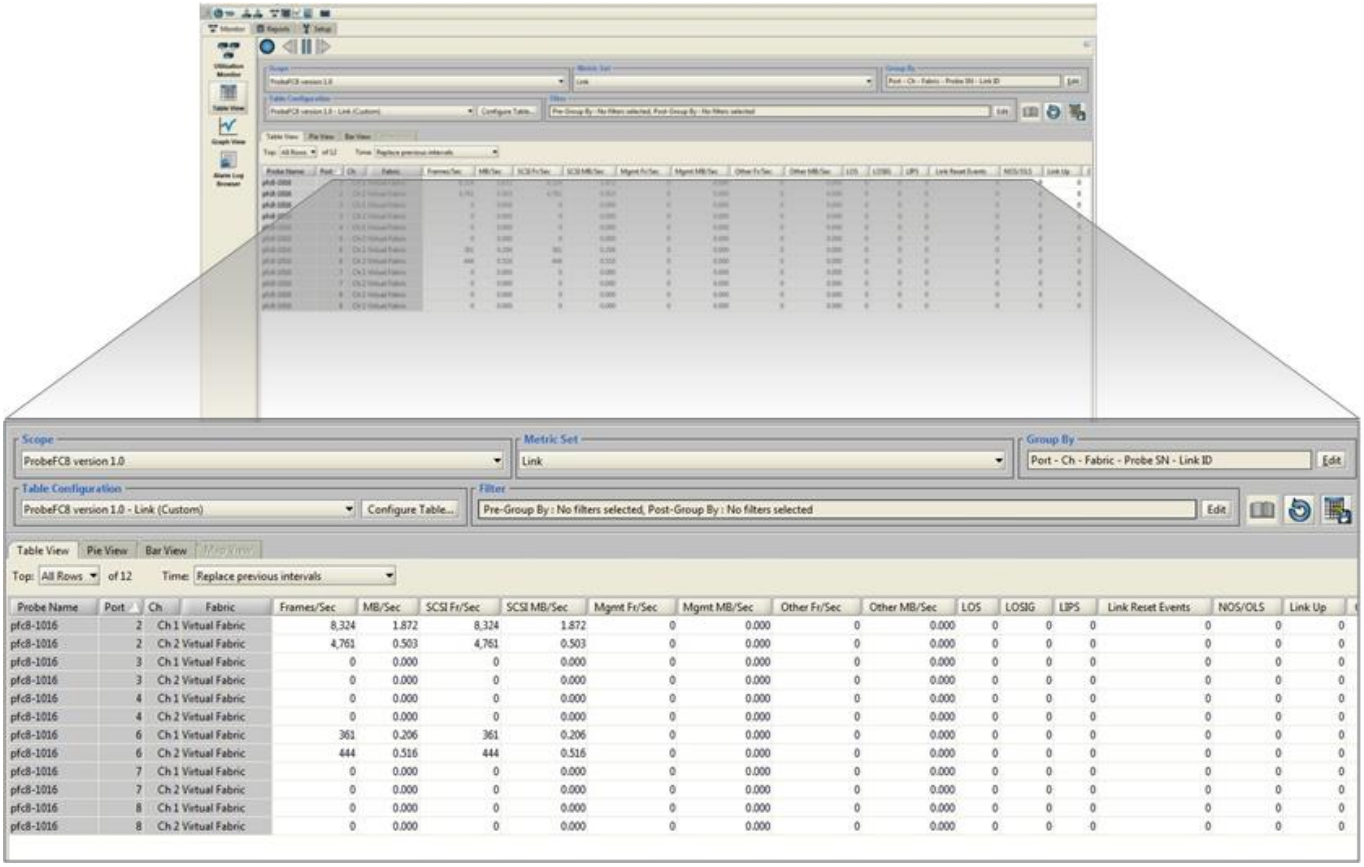
Since the devices in the view are editable, ESG Lab was able to create nicknames to identify devices more easily.

Figure 6. Logical Topology



Probes collecting statistics at the SCSI and physical link level sent data to the VirtualWisdom server every minute. Using the Views application, ESG Lab configured several tables to examine link and SCSI traffic. In Figure 7, ESG Lab configured a table view to show real-time link data statistics. Four ports on the probe were utilized for testing, and the table shows statistics for events such as link and SCSI frames/sec, loss of sync, loss of signal, and reset events.

Figure 7. Monitor Link Metrics



Why This Matters

Introducing monitoring and management tools into existing IT infrastructures can be a delicate task. These infrastructures didn't appear overnight and as a result they can be intricate and complicated. And, of course, they are the backbone of supporting critical applications that run the business—it seems obvious to say that any disruption in those services can be costly to the business. Accordingly, installing a solution to monitor an IT department's SAN environment must be non-disruptive and easy to maintain if it is to be effective.

VirtualWisdom components are simple and easy to deploy with software that installs in minutes. The probes are downstream from the traffic access points, and consequently create no impact on performance of the live links. IT departments can be monitoring their entire SAN infrastructure in a matter of hours.

ESG Lab confirmed VirtualWisdom's ease of installation and was able to quickly configure software probes and begin collecting data for analysis and reporting.

SAN Utilization and Performance Optimization

Visibility into performance metrics for a SAN is a crucial element in planning and responding to utilization and performance issues in a virtual server environment. Using the VirtualWisdom Dashboard, administrators can not only identify virtual servers with overutilization issues, they can also quickly assess the traffic load placed on the SAN infrastructure to discover storage that can absorb additional virtual server resources.

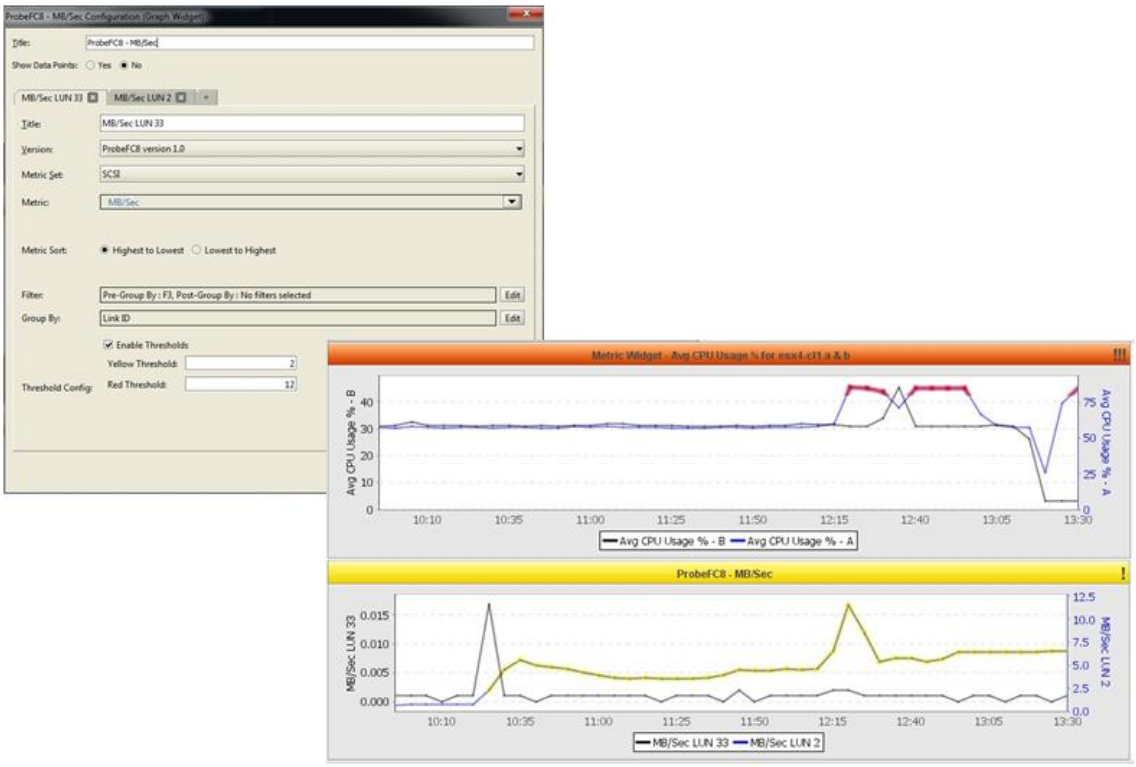
ESG Lab Testing

ESG Lab tested the performance of the virtual server environment by first creating a widget, which is a Dashboard component, to measure the CPU utilization of two virtual machines on two separate storage LUNs. As shown in Figure 8, virtual server esx4-cl1a exceeding the threshold for CPU utilization with an average utilization of 84.68%, while esx4-cl1b was within acceptable limits utilization at 30.76%. ESG Lab used vMotion to move a virtual machine, ESX4-VMotionTestVM-XP, to another virtual server on another storage LUN to alleviate the high CPU utilization.

Figure 8. Virtual Machine Overutilization

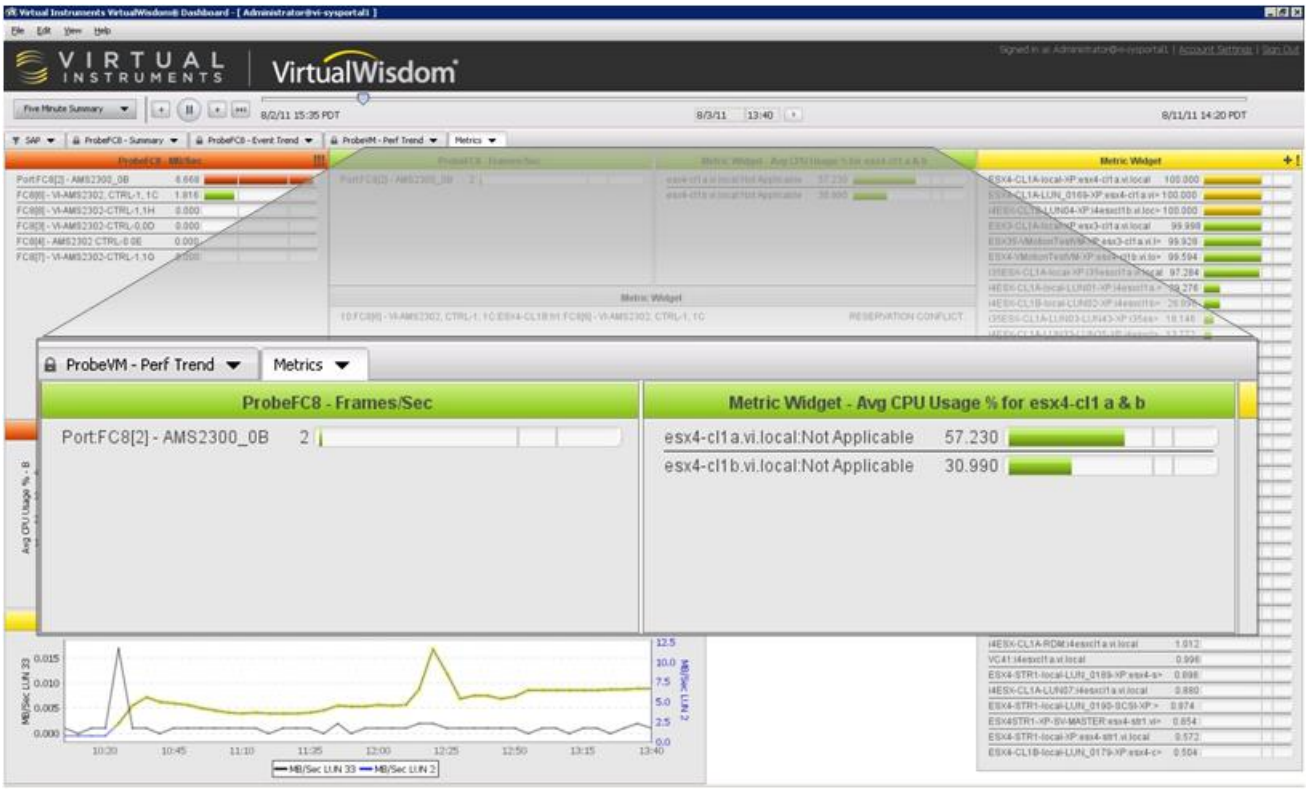
Mapping the two virtual servers back to the storage LUNs (LUN 2 and LUN 33), ESG Lab created a widget that monitored the MB per second as vMotion was used to move the virtual image. As Figure 9 shows, spikes in MB/sec can be seen on LUN 33 as vMotion was started.

Figure 9. LUN MB/sec and VMserver Utilization



ESG Lab examined the average CPU usage on both esx4-cl1a and esx4-cl1b and found both were to be under the acceptable threshold at 57.23% and 30.99%, respectively, after a successful move of virtual image. Figure 10 shows the new metrics for both virtual machines.

Figure 10. Virtual Machine Moved to New Storage



Why This Matters

Companies looking to expand their virtual environments need visibility into the performance of the SAN environment in order to gain a perspective into the cause and effect between the IO and virtual servers from which that traffic originated. Without that view, companies play a guessing game as they attempt to expand SAN capacity to accommodate virtual server growth. That guessing game becomes costly from a CAPEX point of view.

VirtualWisdom's visibility into all SAN traffic allows IT departments to be smarter about planning storage capacity and enable them to respond to performance issues that arise in a virtual server environment.

ESG Lab was able to identify virtual servers with high utilization using VirtualWisdom's dashboard application and effectively move a server image to a storage LUN with lower IO, effectively solving virtual server performance issues without additional storage.

Real-time Reporting and Analysis

VirtualWisdom Dashboard is an application that provides a real-time summary of virtual and physical infrastructure, including metrics collected from the three types of probes. Bringing this data together into a consolidated view allows administrators to quickly identify and isolate performance bottlenecks Fibre Channel traffic errors related to a LUN, HBA, server, or application.

ESG Lab Testing

ESG Lab examined the dashboard application which provides a comprehensive view of performance metrics for the SAN environment and found numerous data points associated with traffic originating from the virtual servers to the storage LUNs. The dashboard is preconfigured with multiple tabs that summarize all three probe types and trends for the SAN Performance Probes. ESG Lab was able to configure widgets to examine multiple metrics for the SAN, switches, and virtual machines, and set thresholds to determine where potential performance problems occurred.

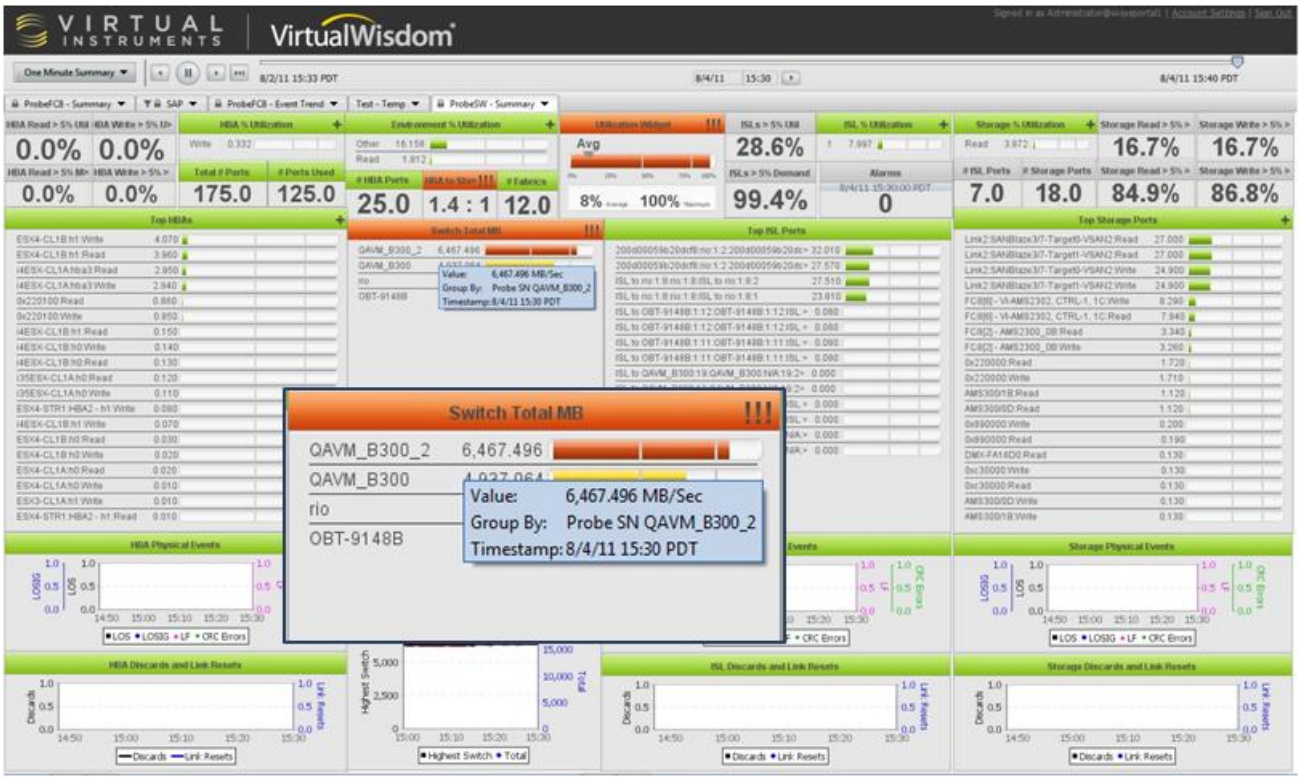
As shown in Figure 11, ESG Lab was able to observe the top LUNs for Read Exchange Completion Time (ECT), showing LUNs that are exceeding the acceptable threshold even if virtual servers associated with those LUNs didn't show unacceptable latencies. In addition, ESG Lab examined data that collected other metrics such as reservation conflicts, maximum pending exchanges on SAN links and HBAs, and top read and write ECTs on HBAs.

Figure 11. SAN Performance Probe Summary

Next, ESG Lab examined the performance trends for the fibre channel switches, shown in Figure 12. ESG Lab was able to monitor not only HBAs with the highest reads and writes, but the same traffic on ISL and SAN ports.

Using the metrics in the switch summary page, ESG Lab was able to quickly identify a switch, QAVM_B300_2, with IO traffic above the acceptable threshold. ESG Lab was also able to examine errors in physical links and SCSI traffic including loss of sync, loss of signal, high discards, and link resets at the HBA, switch, and SAN ports.

Figure 12. Fibre Channel Switch Performance Trends



ESG Lab created a custom tab in the dashboard application that examined performance of the SAN infrastructure from an application point of view. Using SAP as an example, ESG Lab was able to see metrics on the server such as average CPU and memory utilization. In addition, ESG Lab measured buffer to buffer credits and frames/sec on the switch attached to the virtual servers. On the storage side, ESG Lab saw multiple metrics from MB/sec on the ports to errors such as aborts and busy. Using a custom view, as seen in Figure 13, ESG Lab was able to gather a wide variety of metrics focused only on the portion of the SAN fabric serving the SAP application.

Figure 13. SAP Application Reporting

Why This Matters

In order to identify problems with SAN performance, it's important to have the complete picture of traffic in the SAN environment; that includes applications, servers, switches, and the SAN itself. Without that comprehensive view, IT departments spend precious time tracking the source of performance issues and service outages causing financial loss to the business. This process is not only repeated with the next incident, but the approach itself is reactionary and costly.

VirtualWisdom allows all constituents, from application owners to virtual server and SAN administrators, to see errors before they become outages and engage proactively to identify the sources and mitigate them.

ESG Lab looked at multiple metrics tracking data flow from servers to SAN ports and was able to see a complete picture of fibre channel performance and quickly identify and isolate errors, whether on a link port, a switch port, or a server. Building a customer application view, ESG Lab was able to monitor specific traffic linked to the application for errors and performance issues.

ESG Lab Validation Highlights

- ☑ Installation and configuration of hardware and software probes was quick and easy, and ESG Lab was monitoring SAN traffic in minutes.
- ☑ Using the Views application, ESG Lab was able to monitor physical link and SCSI metrics starting from the virtual servers and ending at the storage LUNs.
- ☑ Identifying and remediating high utilization on virtual servers was simple and easy. With a view of underutilized storage, virtual images could be moved to spread processing load without adding new storage resources.
- ☑ The VirtualWisdom Dashboard provided a holistic view of a SAN environment and presented comprehensive metrics that allowed administrators to see end-to-end traffic and identify the causes of high latency.

Issues to Consider

- ☑ TAP installation is the only disruptive step of implementing VirtualWisdom, as the live links must be interrupted while the TAPs are inserted. Multi-path capabilities for failover can help mitigate this interruption. However, best practice would be to plan for insertion of TAPs at the same time as patch panel installs, as new switches and new storage is deployed, or during normal maintenance cycles.
- ☑ Configuration of dashboard summaries that target specific metrics takes a significant amount of training. Professional services could be required to help customers best understand all the configuration requirements and how to collect and present the data desired.

The Bigger Truth

Investments in storage infrastructures have experienced tremendous growth over the past few years, and the pace of that growth is likely to accelerate. ESG research found that half of all IT organizations plan to spend more on storage infrastructure over the next 18 months.[2] One of the main drivers behind this emphasis on storage is the adoption of server virtualization. Where once virtualization was confined to development environments and light processing servers, it has moved into the data center and become a serious consideration for mission critical applications along with services in the cloud.

The increased demands on virtualization have a ripple effect on other parts of the infrastructure, and storage is no exception. The solution, however, can be costly as companies pour more capital resources into storage investments to accommodate the data requirements created by virtualization. In fact, 36% of IT organizations cite the capital cost of new storage infrastructure as their primary challenge relating to virtualization.[3]

Companies that find themselves in a never-ending catch up game of acquiring storage to meet virtualization demands can alleviate those budgetary drains with the SAN instrumentation solution provided by VirtualWisdom. Understanding the end-to-end performance of a SAN environment can help companies not only better utilize existing resources and plan more effectively for storage growth, but help mitigate risks from outages that can impact the business.

ESG Lab examined all the components provided by VirtualWisdom, and found a comprehensive solution that was not only easy to implement, but provided a unique end-to-end view of a SAN infrastructure. The wealth of data elements captured and collected in easy to read views was impressive, all while creating no performance impact on the SAN environment itself.

Bringing all the elements of a SAN environment together (link monitoring, switch monitoring, virtual server monitoring), Virtual Instruments has built a complete SAN monitoring solution that effectively provides the visibility needed to proactively and intelligently manage SAN resources. Application owners, virtualization administrators, and storage administrators can all benefit from the holistic approach to performance optimization provided by Virtual Instruments, and return real capital savings back to the business.

[2] Source: ESG Research Report, *2011 IT Spending Intentions Survey*, January 2011.
[3] Source: ESG Research Report, *The Evolution of Server Virtualization*, November 2010.

Appendix

Table 1. ESG Lab Test Bed

VirtualWisdom Server	
Server OS	Windows 2008 R2
Software	VirtualWisdom 3.0
	Virtual Portal
	Virtual View
	Virtual Dashboard
VirtualWisdom Probes	
SAN Performance Probe (hardware)	3.0
SAN Availability Probe (software)	3.0
Virtual Server Probe (software)	3.0
Traffic Access Point	
SANInsight	TAP Patch Panel
Fibre Channel Switches	
Brocade 200	FabOS 5.3.0
Brocade 300	FabOS 6.2.0, 6.3.1a
Brocade 5100	FabOS 6.3.1a
Cisco 9148	5.0(1a)
Virtual Servers	
VMware	ESX 3.5.0
	ESXi 3.5.0
	ESX 4.0
	ESXi 4.0
	ESX 4.1
vCenter	4.0
vSphere	4.0
SAN	
HDS AMS2300	09A0/J-F

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