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WHITEPAPER

Understanding Successful VDI Implementation

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Introduction

As companies continue to push strategies that provide more business speed, flexibility and control, bringing order to the chaos that often exists in end-user computing can be a top priority. Huge efforts are often required to achieve only moderate security, manageability, and control. Many companies are looking at implementing a [Virtual Desktop Infrastructure](#) (VDI) as one approach to achieving those goals as well as improving business speed and flexibility. Historically, many VDI projects have not been successful at making it past the pilot phase, typically due to scalability, cost, and performance issues. While a new generation of VDI technologies is helping to overcome many of these historical challenges, projects that don't have the right level of initial planning and back-end management can still end up in trouble.

More than just understanding when and how to get started, you have to get insight into the entire VDI framework and be ready to meet the challenges and issues that may crop up along the way.

Before committing to any VDI initiative, you need to make sure you know the answers to the following questions:

1.   What are the key elements of my VDI infrastructure?
2.   What are the key factors that affect the size, capacity, and performance of this   infrastructure?
3.   How do I monitor and manage this infrastructure to ensure reliability and performance?
4.   How do I optimize storage for VDI?

This white paper will help you understand the answers to these key questions so you have a thorough understanding of not just your VDI infrastructure, but also the problems that it may pose along with effective tactics for monitoring and resolving them.

Comprehensive Virtualization Management – From VM to Spindle

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#1 VDI Basics – Key Elements of VDI Infrastructure

When you think about VDI, you have three key consistent components: Servers, Storage, and Network. It's how you work with your VDI vendor to design, size, and manage the infrastructure that can be the difference between success and ongoing headaches.

Servers: The servers required for VDI are industry-standard x86-architecture servers. Local disk storage is recommended for the servers. However, you can use any physical form factor including blade servers. VDI works best when multiple servers are clustered together to meet the capacity needs of thousands of desktops. In addition, clustering buys you load balancing and high availability. You want the servers to be stateless so there is no loss of critical data if the server goes down.

In addition, it is ideal if the servers themselves scale horizontally much like a Web server farm. As your capacity needs grow, you simply add more servers to the cluster since the same software component runs on every server. The local storage can be attached via standard IDE or iSCSI interfaces. Dual 1 Gig-E network cards are recommended on the servers. These network ports are treated individually for different types of traffic or can be teamed or bonded together.

Storage: In a VDI implementation, the cluster of servers is connected to shared storage which is the persistent repository of all data. The storage is NAS-based, and the servers rely on file-based access to the shared storage. Additionally, both NFS and CIFS file protocols are supported.

It should be noted that storage can be a considerable capacity and performance bottleneck with VDI and can lead to significant frustrations. Shared storage using Storage Optimizer technology can alleviate this and reduce the performance requirements. The key to this technology is the ability to leverage the local disks on the servers for almost all real-time operations. The IOPS on the shared storage is reduced 4-5 per VDI session even for persistent desktops.

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Network: This is another critical aspect of the VDI infrastructure. It is primarily the network that connects the access or client devices to the VDI sessions running on the servers. Typically, this part of the network is a WAN. Most VDI implementations worry about optimizing WAN bandwidth and latency. Make sure to consider the reliability of the network and remember that VDI requires a persistent network connection.

#2 Factors Affecting the Performance & Capacity of VDI Infrastructure

Maintaining the health and performance of your environment is critical to a successful VDI deployment. Virtual desktop loads have more peaks and are more transient than virtualized servers, so administrators have to be more vigilant about monitoring their environment, and even more proactive in anticipating growth before it happens.

Before moving to VDI, you need to understand and measure the OS and applications you want to run for various desktops throughout your organization. Once you understand the loads and add-in room for growth and redundancy, you can effectively size the servers, network, and storage you need. After you start moving users to their new virtual desktops, your carefully laid out infrastructure and plan will encounter variables you did not consider or could not emulate. You will need to make adjustments quickly by measuring performance, determining the current core issues, and anticipating changes and growth of the business. Specifically, you should focus two key areas: managing performance today while anticipating the capacity requirements of tomorrow.

Performance Management

Managing VDI virtual machine performance focuses on the issues you have right now. Successfully squeezing all your desktops into shared resources requires deep visibility into the infrastructure so you can see where bottlenecks and latency exist. For example, a common issue is boot storms, when users all "turn on" their virtual desktop in the morning, overwhelming the virtual infrastructure as the OS and applications are loaded for the first time—causing users to wait. The contention for resources can become a self-reinforcing feedback loop, causing high latency and slowing everything to a crawl.

In general, you will encounter contention in the following areas:

- **Hosts (CPU & Memory)** – Sharing CPU means that some processes will have to wait until others finish. Sharing memory can force OS to swap space, effectively writing it to disk until memory becomes available.

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- **Storage I/O** – The slowest part of delivering data to a virtual infrastructure is storage, and the load from VMs compounds this problem by randomizing the I/O (the hardest type of I/O to handle). When you add more load from memory swapping, your storage becomes your biggest bottleneck.
- **Network** – The packets from all your virtual desktops are now squeezed down into fewer wires and ports, and often have to go through additional protocol layers to work in a virtualized environment.

Overall, contention of resources will be one of the biggest issues of a VDI implementation. Being able to measure, monitor, and respond rapidly to it to alleviate bottlenecks will be crucial to having your environment running well.

Capacity Management

Capacity management for hypervisors such as VMware®, Hyper-V®, Kernel-based Virtual Machine (KVM), or Xen® focuses on how you can optimize your current environment, how current resource consumption is trending, and evaluating what-if scenarios to understand what happens when there are changes in your environment.

Optimizing or right-sizing your environment can occur in several areas, but in general you will both reclaim and adjust resources according to their historical need. Over-allocated virtual desktops are assigned resources that it tends not to use that could be put to better use for other VMs. Under-allocated VMs, on the other hand, struggle to get the resources they need, which can lead to various types of bottlenecks. With virtual capacity monitoring tools like SolarWinds® Virtualization Manager, you'll have reports that will identify these VDI problems and offer corrective actions to fix them.

Once your environment is optimized, you need to be able to trend and forecast resource depletion. First, this forecast should define which resource you will run out of first based on your current growth, telling you where you will need to budget dollars to increase resources. Second, this forecast should show you how many more VMs you can add to your current environment, enabling you to understand both your expandability and redundancy. For example, in order to budget properly, you can justify host purchases by understanding that CPU is your current constraint as you are at 50% utilization today and

will hit 70% utilization in 6 months, which means you won't have the necessary redundancy to migrate additional desktops for future projects.

Finally, you should evaluate "what-if" scenarios in your environment to prepare for future needs and disaster recovery. Some of these scenarios would include:

- How many hosts could I lose and still function reasonably well?
- For the next project, can I add "N" virtual machines with current hardware, or do I need to buy more?
- Can my environment survive an increase in peak load?

Managing performance and latency in a virtual environment is a demanding job because of the transient spiky nature of the loads. Administrators have to carefully measure and plan their infrastructure, but then also monitor it so the loads are being handled properly. This way, they can see that capacity is optimized and has enough room to grow in both short- and medium-term.

#3 Key Considerations to Get your VDI Right

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VDI Performance Monitoring and Management Tools

Below are 10 tips to ensure your VDI project is primed for success and ready from the onset through project completion.

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1.   **End user analysis is essential.** Evaluate not just how many users will be on the system, but more importantly, how many desktops each user needs and what type of activities they will be conducting. For example, an admin or knowledge worker typically only needs a single desktop, but developers often need multiple desktops. Likewise, some users will conduct low bandwidth work, where others will engage in multimedia viewing. Consider how many different locations exist and how spread out they are. Together, these considerations will allow you to properly size your infrastructure, understand user experience implications, and establish reasonable SLAs.

2.   **"Where" matters as much as "Who."** When you look at access clients and protocols, make sure to consider where the users are located, how often they will require remote access to their VDI session from across a WAN, and how much multimedia will be used in the environment.

3.   **Take a holistic approach with your storage considerations.** Start with a comprehensive understanding of your users (including types of users) and move through the entire implementation, carefully considering the design for both scaling and cost. Evaluate your storage needs independent of vendors' products. And then consider using monitoring software such as SolarWinds Virtualization Manager to keep the storage vendor honest. Keep in mind that you will most likely have to work with different types of users in your environment: task, knowledge, and/or power users. Ensure use cases are set up accordingly.

4.   **Cluster to improve reliability.** Clusters of host/server machines can improve both scaling and reliability. From a VDI scalability standpoint, the cluster allows you to more effectively load balance virtual desktops for better

performance. When we look at reliability, clustering eliminates the concerns of having a single point of failure, while also leaving spare capacity in case of failure.

5.   **Guest OS can replace a desktop.** VDI done right eases the migration burden on the end users and IT staff associated with such upgrades. In fact, this has been so successful that many enterprises are turning to VDI to streamline the time-sensitive upgrade from Windows XP to Windows 7 (and for some, the planning stages of the anticipated move to Windows 8). In this case, the guest OS is the actual desktop OS that the users are interacting with in their VDI session, essentially replacing their desktop.

6.   **Applications drive user productivity.** An assessment of the application landscape is critical to the success of any VDI implementation. Applications drive user productivity and typically include a mix of commercial and in-house apps. Most typical commercial apps will become part of the Gold Master image, a common set of OS and base application configurations shared among a group of users, and centrally managed, while the specialized, in-house apps may be packaged and associated with particular user's desktops (e.g. a factory floor worker). If custom in-house applications are widely deployed, they can live in the Gold Master as well. Applications typically included with the Gold Master are: MS Office®, Adobe® Reader®, Flash®, and custom browsers (e.g. Google® Chrome™ or Mozilla® Firefox®).

7.   **The most up-to-date USB devices work best.** It's important to review the peripherals that will be used in the VDI sessions. Most up-to-date USB devices work well in the VDI environment as the USB is redirected from the physical client to the VDI session. Typical devices utilized in VDI environments might include printers, scanners, and thumb drives. Special case or niche devices may need special consideration. Keep in mind, USB devices work best over a LAN connection.

8.   **Client devices offer flexibility and mobility.** Thin clients are typical replacements for the legacy PCs in use and offer a number of advantages including excellent power efficiencies (often enough to offset their costs over a 3-

"Virtualization Manager (formerly Hyper9) has proven a godsend in streamlining the environment and saving management man-hours."

Thomas Fairfield, Elliott Health System

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5 year payback period), superior security, and much longer life. Other physical clients may include thick clients, iPads®, and other tablets used in BYOD scenarios. The same virtual desktop can be accessed from multiple clients and allows the end-user to be mobile without having to be tethered to a specific client device.

9.   **Make sure it scales.** Infrastructure choices, including servers, storage and networking, should be scalable up to a maximum theoretical deployment. While you may start with a small, initial roll-out, you should plan with the maximum intended size in mind. At the same time, ensure you can migrate with minimal downtime in the case that you do outgrow your current availability.

10.   **Keep cost in perspective.** Storage and other VDI costs should be thought of as marginal cost per user, not overall cost. For example, if you are planning a 6,000 user deployment and looking at a $230,000 NAS set-up to support it, the number that really matters is $38/user, not $230k.

#4 Storage Optimization for VDI

Storage is the biggest [performance bottleneck](#) in a virtual infrastructure, and VDI can compound that with its spiky, transient nature. But capacity can be a problem, too, with VMs taking up space—as do the files, logs, snapshots, etc.

The first thing with storage in a VDI environment is to make sure you properly evaluate your storage needs. Starting with storage too slow to meet your environments demand will start you down the wrong path.

The challenge of storage inefficiencies is widely acknowledged. Traditional VDI requires excess amounts of top-tier storage, which is costly to purchase and complex to manage—often making large-scale VDI deployments too expensive and slow to be practical. Some vendors offer third-party solutions to address storage issues, but they add expense and integration headaches and can fail to solve the problem.

However, other integrated storage optimization solutions (such as Virtual Bridges [VERDE Storage Optimizer](#)) can help address the storage cost issue. By approaching caching at the local level on VDI nodes, this type of solution can reduce traffic over the storage area network by 90 percent or more, often resulting in a dramatic reduction in traffic and Tier 1 spindle counts. Regardless of how you address your storage needs, it's very important to have the baseline performance you need for your environment.

When monitoring storage performance, the first key is to understand that this is a shared resource, split across dozens or hundreds of VMs, and the disks in the array are trying to read and write data fast enough to meet the requests coming from the hosts. All of the requests are like an I/O blender when compared to traditional physical environments, and can cause contention on both the virtualization and storage side. Without visibility into both domains, you are running your environment with one eye shut.

When you have a performance problem, it's critical for you to be able to drill down and immediately find the source of the issue. Sometimes, it will be on the host side and

Multi-Vendor Storage Performance & Capacity Planning

[**Storage Manager**](#)
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sometimes on the storage side. For example, high memory utilization on VM1 can lead to swapping, which puts a load on the shared storage, which slows down VM2.

Looking at VM2, nothing appears to be wrong—it's just slow and hard to diagnose. A good storage performance management tool will give you a single view to both sides of the story, allowing you to pinpoint VM1 as the source of the issue, not the storage.

A second problem in virtual environments is storage capacity monitoring and management. Storage presented to a virtual infrastructure is then thin-provisioned, sliced and diced into many pieces, snapshotted, cloned, etc., and in some cases can move on its own. Often, storage usage grows at a rapid clip as VMs are easy to create. In general, without virtual and server tools, there is no visibility into end-to-end capacity, how fast is it growing, and when you will run out. If you do use thin provisioning, you will need to pay special attention to how much you are over-provisioned; the more you are, the more risk you incur.

An ancillary consideration to capacity is the optimization story, sometimes called right-sizing. Knowing where you have capacity that you can reclaim, whether a VM with too much disk capacity, an orphaned VM file, or an unmapped or unformatted LUN, there is almost always storage to be reclaimed and repurposed before you consider buying additional disks.

Storage is the biggest challenge in virtual server and desktop environments and requires good tools to understand how storage is being used, where there are performance issues, and when you should buy more. Tools like SolarWinds Storage Manager and VERDE Storage Optimizer can reduce your storage costs and provide great visibility into your storage performance to help you address these concerns.

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Conclusion

VDI can be a powerful technology, but it can also operate on a model that data centers are not used to. Careful execution at the planning, implementation, and operational phases is critical to the overall success of the project. With the appropriate architecture and capacity plan in place, technical implementation and operational monitoring and management tools can address and eliminate most common problems.

Ultimately, it is the balance between operational cost and end-user satisfaction that determines if a VDI implementation succeeds or fails. As a result, it pays to make sure your upfront planning for all phases of the project is as effective as possible.

About SolarWinds

SolarWinds (NYSE: SWI) provides powerful and affordable IT management software to customers worldwide - from Fortune 500 enterprises to small businesses. The company works to put its users first and remove the obstacles that have become "status quo" in traditional enterprise software. SolarWinds products are downloadable, easy to use and maintain, and provide the power, scale, and flexibility needed to address users' management priorities. SolarWinds' online user community, http://thwack.com, is a gathering-place where tens of thousands of IT pros solve problems, share technology, and participate in product development for all of the company's products. Learn more today at http://solarwinds.com.

For additional information, please contact **SolarWinds** at 866.530.8100 or e-mail **sales@solarwinds.com**.

To locate an international reseller near you, visit **http://www.solarwinds.com/partners/reseller_locator.aspx**

About Virtual Bridges

Providing a fresh perspective on Virtual Desktop Infrastructure, Virtual Bridges helps organizations escape from the constraints of physical computing, simplifying desktop management, improving security, and increasing business agility. Virtual Bridges offers the industry's only purpose-built VDI solution. Virtual Bridges VERDE is affordable, adoptable and adaptable, and produces the results others can't. Founded in 2006, Virtual Bridges is based in Austin, Texas. Learn more today at http://www.vbridges.com/home.php

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