

Virtual Desktop Infrastructure Planning Overview Whitepaper

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What is Virtual Desktop Infrastructure?

Virtual Desktop Infrastructure or VDI is the name given to a collection of technologies and processes that dramatically extend the concept of a remote desktop. The point of VDI is to address the spiraling costs of managing large numbers of physical desktops across an enterprise, without compromising the overall end user experience.

VDI enables a user's desktop to run on centralized infrastructure, with just the building of the screen image left to the machine sitting in front of the user. All profile settings, installed applications, patches and the client operating system are stored and managed centrally.

The concept of desktop instances running on a central server is nothing new; companies such as Citrix and Microsoft have enabled remote access to desktops for over 10 years. Yet these early implementations have not been universally adopted – some of the reasons are as follows:

- Poor performance – since most mouse movements, clicks and keystrokes require a server roundtrip, network contention and server delays can have an undesirable impact on the interactive experience of users who are used to the instant response of locally running applications.
- Low-consolidation ratios – traditional remote desktop implementations that support multiple-users within a single operating system instance are unable to support particularly high-levels of concurrency. Consequently, hardware cost-benefits are often eroded as multiple high-specification servers are needed to support modest consolidation targets.
- Increased user mobility – access to remote desktops outside the firewall requires complex VPN systems to be implemented and can be further impacted by poor network performance.
- Lack of support for rich media experiences – early implementations of remote desktops have negligible support for media streaming and highly interactive environments such as Flash and Multi-media intensive applications like PowerPoint.
- Application incompatibility – having multiple users, with varying application needs coexisting within the same operating systems instance can lead to application or profile incompatibilities; this often leads to compromises in user flexibility and customization. Often referred to as “DLL hell”
- Reliability – due to the shared nature of the environment can lead to reliability issues. If one application fails catastrophically, it is quite possible that the operating system will crash and all users sharing that OS instance for their remote desktops would be disabled.
- User personalization – users typically want to be able to customize their applications and environment to match their needs and business requirements. This is one of the key differentiators between VDI and Terminal Service computing environments.



The advent of ubiquitous broadband connectivity, hardware virtualization and domain specific security and systems management for VDI has set the stage for this promising idea to fulfill its potential.

Why Migrate from Physical Corporate PCs?

Corporate PCs have provided tremendous benefit to organizations since they began to supplement mainframe computing over 20 years ago. As their use has grown, and they have achieved a mission-critical position within an organizations technology landscape, vast sums have been invested in their management. Scalable, through its WinINSTALL® product line, offers many tools to make the remote management of traditional desktop and laptop computers a streamlined experience. However, addressing software installation, patch management, OS provision, backup and personality migration is only part of the challenge:

- Walk off security - Rapidly increasing laptop use, to support remote or traveling employees, has created a security exposure; lost or stolen machines can put corporate data or credentials into the hands of the unscrupulous and most public broadband networks do little to prevent security breaches.
- Centralized Management - Physical provisioning of new hardware, either complete machines or memory upgrades often requires an in-person visit from an expensive MIS employee. Such upgrades are usually required to support the peak resource utilization from new applications or the mobility demands of employees that work mostly outside the firewall.
- Utilization - Despite upgrades to support the peak requirements of certain workloads, studies have shown that most corporate PCs have average utilization rates of less than 5% despite being switched on (in conjunction with the screens) for at least 8 hours a day.
- Life Cycle Management - Upgrade cycles, and their impact on depreciation rates, make corporate PCs a very expensive asset to purchase and maintain.

The Benefits of VDI

Various technologies are used to implement VDI but almost always there will be a hardware virtualization layer on the server, a desktop remote network protocol such as Microsoft's Remote Desktop Protocol (RDP), Citrix's Independent Computing Architecture (ICA), Teradici's PCoIP technology and new remoting protocols are making an appearance each year. In addition, a range of proprietary management technologies are deployed in conjunction with the base components to enable rapid desktop deployment, load balancing and other service and security features. VDI can address the shortcomings of the traditional physical desktop corporate PC model, and the early remote desktop attempts identified at the beginning of this document.

- Centralizing the desktop images, applications and files makes data security a more manageable task regardless of whether an employee is accessing the virtual desktop from outside or within the corporate environment.
- VDI eliminates any physical management issues for desktops. Since all resources (CPU, memory, storage etc) a virtual desktop can exploit are managed centrally, visits by a trained IT employee to increase a machines capacity no longer occur. In addition, the challenges of deploying and patching software over a network are also eliminated.
- VDI enables a true 'golden master' desktop environment to be built. This is in direct contrast to managing physical desktops where device-driver issues often dilute the effectiveness of application-layer golden-master initiatives.
- Operating System isolation enables an authentic personal desktop experience. Users are free to configure their environment to the extent permitted by organizational policies, rather than the artificial constraints often imposed by traditional shared remote desktop systems.
- Continued improvements in bandwidth, optimizations in remote desktop protocols, such as the Citrix HDX ICA enhancements; the collaboration between VMWare and Teradici to add the Teradici PC over IP stack into the VMWare VDI stack; and server technologies such as Calista (acquired by Microsoft in early 2008), have brought the user-experience of interacting with virtual desktops much closer to that of physical desktops.

In addition to the list above, most organizations look at VDI as a way to dramatically drive down the total cost of cost of ownership of the desktop estate. ***However hard-dollar savings, while potentially substantial, can evaporate rapidly without careful planning.***

Why isn't everyone moving to VDI?

One of the biggest inhibitors to widespread VDI adoption is the combination of back-end complexity and cost of the hosting infrastructure. This is also true for as a the software service model(SaaS), because whilst the total cost of ownership can be reduced through streamlined support, image management and improved walk off security, not all users or use-cases benefit from VDI. By attempting to rollout VDI for all users can actually lead to an increase in overall management and IT life cycle costs associated with VDI for those users.

Traditionally, the main target user audience for VDI is call center users and/or task workers. Other target users include developers, contractors, knowledge workers, development & testing, remote sites, training and extreme working environments are also good candidates for VDI adoption.

The reality is that many Fortune 1000 companies to-date don't have the tools in house to obtain the information they need to make a tangible business case for VDI. Fundamentally the question is which users are a good fit for VDI? The answer is generally I don't know; we need to spend money on one or more POCs to figure that out. Even after multiple POCs have been conducted, the answer is typically ambiguous without detailed reporting metrics on the individual users and their end-user experience in conjunction with before VDI and after VDI snapshots.

So what makes a user an ideal candidate for VDI? A good VDI user profile would include the following attributes: The user would run a small subset of applications, would not consume a significant amount of disk storage (based on their profile location), would not require a significant amount of memory (> 2GB is not considered a good candidate even with memory page consolidation technologies from VMware), would use low CPU utilization based applications (dependant on the current platform architecture), would be located in a centralized location or have access to suitable network connectivity (high bandwidth/low latency < 100ms) between the proposed back-end and their thin client device. Any form of multimedia usage would need to be analyzed because even with next generation remoting protocols overall bandwidth consumption can exceed 3-5Mbps per user session in certain scenarios. In additional multimedia application utilization combined with a remote desktop session can significantly drive up the networking costs in some locations and impact overall network performance for other users.

Ultimately, dynamic desktops or a desktop that can be recycled when a user logs off is the most cost effective way to deliver VDI. Traditional VDI has focused on static desktops where one individual is allotted a single permanent desktop and that desktop could not be utilized by other users unless manually allocated. This is an outset of taking a computing environment and simply virtualizing it. With dynamic desktops, desktops can be treated as deposable objects that are not tied to any single user.

The challenge is how do you determine whether a user is a good fit for a dynamic desktop? Do you need dynamic desktop building tools such as AppSense – profile virtualization, Atlantis ILIO – dynamic desktop composition technology, ThinPrint – unified print driver with network acceleration technology?



The bottom line is, without any kind of business intelligence data, making decisions about whether a user is a good candidate for VDI or even thinking about dynamic desktops as a solution is fraught with risk and may turn into being a costly headache down the road.

Planning for VDI

In order to maximize the potential ROI benefit from deploying VDI, while ensuring the user community has a good user experience in moving to a virtual infrastructure, an organization must thoroughly understand its software and hardware usage profile ahead of designing and implementing VDI.

A typical VDI implementation is often regarded as one of the most complex IT projects that an organization will undertake. It involves many moving parts and many different departments within an organization. Planning successfully for VDI is paramount if an organization wants to realize any cost savings and ensure that users are satisfied with the end result.

One of the key cost metrics attached to any VDI project involving Microsoft client operating systems is the Vista Enterprise Centralized Desktop (VECD) license. Depending on whether you have an SA agreement with Microsoft or not will make a difference of paying \$23 per virtual desktop access device per year up to \$110 per virtual desktop device per year if you do not have an SA agreement in place. For more details on how Microsoft licenses desktop operating systems see the references at the end of this whitepaper.

If you have an SA agreement in place the cost isn't as significant but if you don't you may want to consider what the benefits of SA are. In addition, you have licensing fees from the VDI vendor and if you decide to do it yourself you will need to factor in the following costs: VMware View/Citrix XenDesktop client license - \$150-\$350 per concurrent user/named user, 20% maintenance for support and upgrades on all VMware/Citrix software, Storage costs (NAS/SAN) and software licenses if you use de-dup/clustering capabilities can add up to over \$300,000 for just 12TB of storage.

Physical VMware/Citrix hypervisor servers(\$8,000-\$20,000 each) which can serve between 32-128 desktop images per physical server depending on the configuration per server (assuming Intel Nehalem architecture – 8-12 users per core), management infrastructure (2 servers at least per 1000-1500 users), network equipment including switches, data center space, power/cooling and it doesn't stop there. Personnel training costs and 3-4 year life cycle costs attached to the back-end infrastructure are all important aspects of VDI planning that need to be assessed.

On top of basic VDI infrastructure costs, desktop engineering software solutions will need to be considered in order to address personality virtualization, application virtualization, dynamic desktop imaging and universal printing solutions. Desktop migration costs should be factored in and questions such as how am I going migrate users to VDI? Need to be answered.

Typical "do it yourself" VDI implementations will generally cost \$500-\$1200 per user per year amortized over 3 years. With this cost in mind, many large fortune 500 organizations have streamlined their IT



operations to the point where it is difficult to justify implementing VDI without a compelling business driver.

By focusing on real application usage and the impact on underlying desktop hardware utilization, it is possible to build up an accurate profile of those desktops that can be easily moved to a virtual desktop environment. Furthermore, information on utilization within the existing physical estate ensures that server hardware specifications are capable of supporting the migrated workload.

The net result of a well architected VDI implementation is a tangible reduction in TCO, streamlined IT processes and most importantly of all, an equal or better end-user experience to the target user groups.

Using Survey

Scalable's Survey product has been designed to analyze the intensity and profile of desktop hardware and software usage. Trying to successfully plan for a migration from a physical to virtual desktop infrastructure, without knowing the extent to which the physical environment is being used prior to the migration, is like trying to size an ERP system without knowing how many people will use it.

No other technology provides the depth and focus on desktop hardware and software asset utilization as Survey can. The following screens and annotations give a sample of the considerable benefits to the success of your VDI migration that can be secured by implementing Survey.

Survey allows visibility into real world usage of desktop PCs, applications and peripherals. From local/network printers to USB devices and even what kind of monitor and screen resolution can be enumerated.

Survey can answer the following questions with real quantifiable answers:

Which applications are my users using?

While it's important to know what's installed, understanding what applications users are actually spending time in will help an organization understand how to prioritize and build new VDI images. Survey can track applications that aren't being used, are being used and how.

How are my users interacting with those applications?

Is the user simply browsing a website or are they actually writing content? Survey can differentiate between a reader and writer user and make recommendations based on actual usage. This also has an impact on the end user experience, typing vs. scrolling are two very different end-user requirements.

How big are my actual desktop images?

With block-level storage de-duplication, linked-cloning, dynamic desktops and image management, virtual machine sizing doesn't seem to be such a big deal anymore. However it is still important to understand how much user/machine-content is stored so any potential migration issues including offline folder, offline mail, personal files and so forth can be identified readily. Survey can help understand how

desktop storage is being utilized. In conjunction WinINSTALL can then be used to move user profiles onto the new infrastructure.

How much memory is being consumed by the average user?

Memory is one of the significant components of VDI costs. Understanding if a user is a power user, or needs to be trained more effectively i.e. they open up 6 sessions of Internet Explorer instead of using tabs will provide an invaluable insight into memory consumption. VMware being the market leading hypervisor vendor, features a novel memory page de-dup feature which allows up to 50% over provisioning of desktops on a single hypervisor provided they are all running the same OS family and similar applications. This doesn't mean much if all of your users are consuming more than 1.5GB of memory consistently throughout the day. Problem applications such as applications with memory leaks, abnormal application usage trends and peak/average memory loads can be readily identified and tracked by Survey down to the minute. Specific thresholds can be set for alerting and detailed snapshots of a user environment to facilitate root cause analysis. This allows user's to be grouped onto infrastructure servers more effectively, leading to better utilization rates and improved user experience.

How much CPU time is being consumed by the average user?

Survey can show how a machine is being utilized at the process level and overall CPU time %. Dependant on the machine architecture, this can be used to accurately gauge perceived improvements in the end-user experience based on newer back-end VDI hardware as well as potential issues with very heavy users. Survey can also take snapshots when CPU utilization reaches a pre-defined value allowing for detailed analysis and problem resolution for application and usage anomalies.

Is the user running multimedia intensive applications?

Multimedia support is still regarded as VDI's biggest weakness. Technologies from Wyse (VDA) and Citrix have made great strides in addressing this. However bandwidth is still a factor and if a person is in training using videos or working with graphics, they may not necessarily be a good fit initially. Multimedia applications including Java applets, individual websites and even network bandwidth can be monitored with Survey.

Which printers/USB devices are attached to a given machine?

Do I need a universal print driver? Do I need USB virtualization support? Questions that generally go unanswered until a VDI POC has been ran and results gathered. Providing support for local printers and USB virtualization are very subjective to end-user experience and configuration costs. Survey can answer this for you through detailed network and local printer utilization metering.

How are locally attached printers being used?

Can we retire one or more local printers? Do we need to support them within a virtual environment? Do we need a unified print driver or is the print volume so low it doesn't matter? Survey can provide detailed information as to what is attached to a given machine, how is it being used and historically are

there any trends indicative of increase or decrease trends. Recommendations can also be made in regards to redeployment of printer assets to further improve printer utilization and reduce TCO.

Do I need to provide dual monitor thin client support for my users?

One of the most overlooked aspects of VDI is multi-monitor support. Most remoting protocols support spanned mode and there are 3rd party solutions that enable true multi-monitor support. Do you need a thin client with dual monitor support and who is using two screens? Survey can accurately tell you which users are using two screens and what resolution they are running at on top of which applications they are using. Providing thin-client support and identifying real users of multi-monitors is absolutely essential to a successful deployment of VDI.

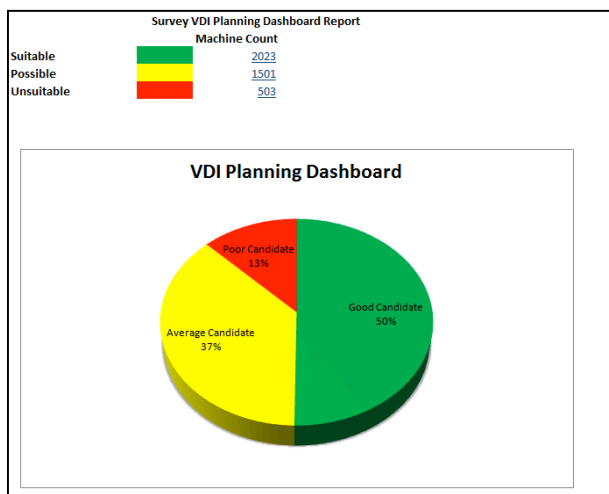
Can I migrate all of my target users from Windows XP to Windows 7?

Because Survey can tell you which applications are being used, this means you can make an informed decision as to whether application virtualization may be required for older legacy applications or not or whether to move an application at all. Incidentally Windows 7 features RDP 7 technology which provides significantly improved VDI experience which is another reason to consider the move. Windows XP capabilities are available in Windows 7 but are not recommended for use in a large scale enterprise environment. The other question is how should I size my VDI environment with Windows 7? With a combination of performance reporting and actual application usage, Survey can help an organization figure out what is ultimately the best fit machine size for my Windows 7 or XP deployment.

Which users are good candidates for VDI?

The last question really is a summation of all of the points above. Survey can provide invaluable quantifiable data identifying candidate users and problem environments well and truly before a VDI pilot is even deployed. This allows designing and implementation of a VDI pilot to be more effective, productive and product better results for the end-user and the organization.

Included on the following pages are several examples of Survey's capabilities around VDI planning.





Virtual Desktop Infrastructure Planning Overview

Machine Name	Candidate Status	Remark
SFTX417A (David Cymbala)	Suitable	Machine meets VDI base-line selection criteria
SFTX417B (David Cymbala)	Suitable	Machine meets VDI base-line selection criteria
SFTAASSANTENC6400 (Andre Assante)	Suitable	Machine meets VDI base-line selection criteria
SFTXGERBRNC6400 (Adam Gotb)	Unsuitable	Heavy Multimedia Application Usage, Remote Location, > 20GB disk utilization
SFTXALACAVA1 (Fred LaCava)	Suitable	Machine meets VDI base-line selection criteria
SFTXAPOLVINO (Andrew Polvino)	Suitable	Machine meets VDI base-line selection criteria
SFTXASNOWNC6400A (Adam Ragnoz)	Unsuitable	> 2 monitors, > 1600x1200 Resolution, Non-VDI Compatible Application Usage
SFTXARHRBOUGH6400 (Andrew Rohrbough)	Suitable	Machine meets VDI base-line selection criteria
SFTXASPEROWNC6400 (Amy Sperow)	Suitable	Machine meets VDI base-line selection criteria
SFTBCANFIELD1 (Beth Canfield)	Suitable	Machine meets VDI base-line selection criteria
SFTDCANFIELD-HOME (Beth Canfield)	Unsuitable	Physical Memory > 2GB, Physical Memory Utilization > 85%, User Data Storage > 10GB..
SFTBCLARK (Bryan Clark)	Suitable	Machine meets VDI base-line selection criteria
SFTBCHIEFER1 (Bobbie Chief)	Unsuitable	Non-VDI Compatible Application Usage, 3D Accelerator Detected, > 85% CPU utilization
SFTBDPUJ1 (Bobbie Valerio)	Suitable	Machine meets VDI base-line selection criteria
SFTBDRINKWATER1 (Bill Drinkwater)	Suitable	Machine meets VDI base-line selection criteria
SFTDBFLANNERY (Barbara Flannery)	Possible	Non-Mass Storage USB Device Usage, Local Printer Usage (~1 page per day)
SFTBHOLDEN910P (Blake Holden)	Suitable	Machine meets VDI base-line selection criteria
SFTBMERSEREAU (Barbara Mersereau)	Suitable	Machine meets VDI base-line selection criteria
SFTBNILSONNC6220A (Ben Nilson)	Suitable	Machine meets VDI base-line selection criteria
SFTBWHITE (Bill White)	Suitable	Machine meets VDI base-line selection criteria
SFTCCAPPELGARTH (Charles Applegarth)	Possible	2 Monitors, Non-Mass Storage USB Device Detected
SFTCCARLSON1 (Christopher Carlson)	Suitable	Machine meets VDI base-line selection criteria
SFTCCOSTIGANI (Cecilia Costigan)	Suitable	Machine meets VDI base-line selection criteria

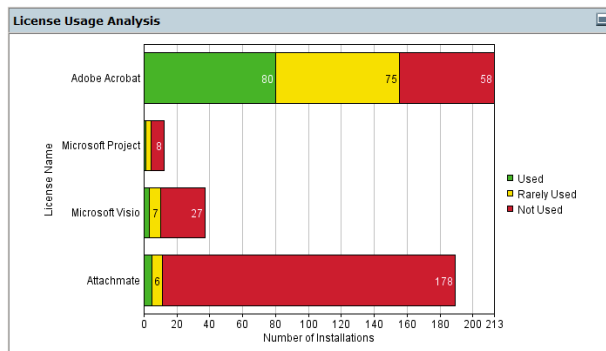
Survey Examples

License Planning

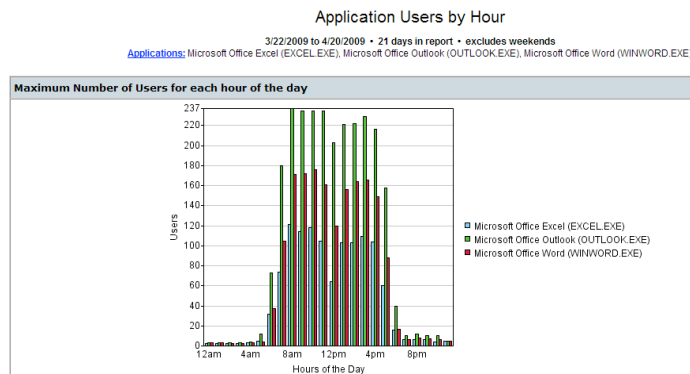
Identifying real application usage in an automated and reliable fashion is the only way to

accurately size the license requirements of the virtual estate. As previously stated, licensing in a VDI environment presents the organization with opportunities to move from a licensing model based on potential usage, to one based on actual usage.

License Name	Purchased	Installed	Used	Used Rarely	Not Used	Percentage Low Usage	Purchase Cost	Cost Impact
Adobe Acrobat	185	213	80	75	58	62.4%	\$351.00	\$36,855.00
Microsoft Project	50	12	1	3	8	91.7%	\$656.28	\$32,157.72
Microsoft Visio	18	37	3	7	27	91.9%	\$370.34	\$5,555.10
Attachmate	25	189	5	6	178	97.4%	\$90.00	\$1,800.00
Total Cost Impact:								\$76,367.82



These cost benefits can only be realized if an accurate understanding how the applications are used on the physical desktop is achieved prior to establishing the basis for VDI licensing. Survey has unique facilities to not only identify the exact number of licenses, but also offer guidance on the cost benefit. This information can be used to assist in justifying the move to VDI. The screens shown here give a glimpse of how easy it is to identify the cost savings from software licensing alone that moving to VDI can realize.



Managing licenses in preparation for migration to VDI is not the end of the story. Since most migrations result in the original physical workstations being used as thin clients to the virtual desktop, there is plenty of scope for physical software deployment to creep back into an organization in the event certain user groups are dissatisfied with their virtual desktop experience.

Failure to be vigilant for such conditions can create unexpected liabilities in the next software license true-up event. Survey has facilities designed to identify such conditions. The report shown here directly identifies those workstations, enabled for virtual desktop exploitation, that maintain and use local copies of applications.

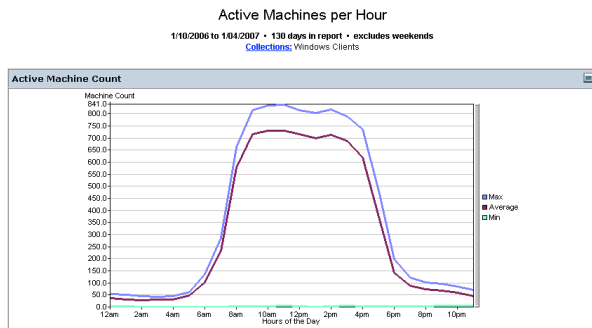
Failure to be vigilant for such conditions can create unexpected liabilities in the next software license true-up event. Survey has facilities designed to identify such conditions. The report shown here directly identifies those workstations, enabled for virtual desktop exploitation, that maintain and use local copies of applications.

Hardware Sizing

VMware has provided a detailed document “VDI Server Sizing & Scaling” which is located at http://www.vmware.com/pdf/vdi_sizing_vi3.pdf, which explains in detail the impact of certain desktop workload profiles on server resource consumption. Results were shown from a VMWare test harness and the conclusions reached show a very clear and direct correlation between the nature and type of



desktop workload, not simply the number of users, and the amount of resource required to provide a satisfactory experience to the user community. Survey provides the information necessary to complete this analysis in advance of the specification of the VDI hardware.



This summary report shows the number of active workstation machines during the course of the day. In this context active means machines that have individuals sitting in front of them typing or using the mouse – both of which impact the resource needs of the network and VDI server environment. It is possible from this display to drill-down to the detail of which machines are active, and the extent

to which they are being used in terms of CPU and memory activity. Importantly, this information can be aggregate across the collection of machines being considered for migration. This gives an accurate picture of the likely CPU demands on the virtual server of the migrated workload.

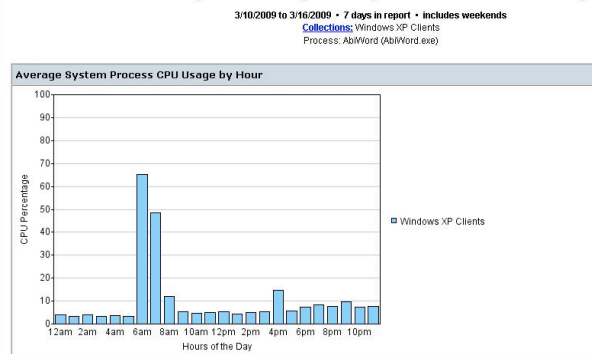
Furthermore, detailed hardware inventory is available that helps understand the resource requirements of each of the heavily used desktop machines; clearly a desktop being used for 60% of the time with 8gb of memory and quad-core chip, will have a higher impact on the virtual

environment than a machine with 512mb and a 1.3ghz P4. A similar report can be used to identify those machines that are rarely used further refining the sizing exercise. This data can be used to build VDI profiles, for use within the VDI configuration, which ensure that correct resources are applied to right machines at the right time of day.

As a further refinement, it is possible to review concurrent application use at various times during the day. With this analysis an organization can determine if there will be resource issues on the virtual server based on concurrent use of resource hungry desktop applications.

A snapshot is not always an ideal tool for planning purposes but useful for identifying issues at point in time occurrences. Survey provides extensive trending on an application by application basis. Using these tools it is possible to plan for the impact of new or recently introduced workloads.

VDI Migration Planning Summary - Concurrent Hardware Usage





Summary

Virtual Desktop Infrastructure can yield significant benefits to organizations in terms of service provision, manageability, security and cost. Yet these benefits can only be fully realized with adequate planning. Much has been written on this subject by many VDI commentators, and all agree that accurately understanding the type and intensity of desktop application use, and its impact on the underlying hardware, in the physical desktop environment prior to specifying the VDI environment is essential. Survey's unique asset utilization technology provides exactly the information necessary to support the VDI planning process.

Visit <http://www.scalable.com/solutions/vdi> to learn more and download a free evaluation

Microsoft VECD Licensing Overview

<http://www.microsoft.com/windows/enterprise/solutions/virtualization/licensing.aspx>

Microsoft VECD Licensing Guide

http://download.microsoft.com/download/D/3/B/D3BDC684-7A7A-4847-9A8C-4A4C8907C38E/VECD_Licensing_Guide_English_090208.pdf

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