Designing School Labs with VMware® View™ 4.5

WHITE PAPER

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In the past decade, PCs, laptops, tablets, netbooks, and mobile devices have proliferated at academic institutions. Students and teachers alike want to use the device of their choosing to access their data and applications—from any location across campus and beyond. To address these changing dynamics, educational IT organizations are shifting away from traditional approaches to device-centric computing and moving towards a user-centric model where data and applications are securely provisioned and readily available on demand, regardless of the user's location or the device being used.

Virtualization is the catalyst that makes user-centric computing a reality. IT administrators are leveraging the benefits of this technology—particularly in on-site and mobile labs. In a school's computer lab, a variety of applications help educators meet broad curriculum requirements for diverse groups of faculty and students. For example, a K-12 environment may need profiles for different user types, including faculty, staff, students and administrators, each with a unique set of application requirements. IT administrators can use virtualization to easily manage and maintain dozens of applications and ensure they operate at acceptable performance and service levels.

This document discusses desktop virtualization with VMware View 4.5 in an educational environment and outlines a general reference architecture for a lab configuration that can accommodate up to 80 computers. The paper also calls out pertinent and useful features for this use case, including kiosk mode and anti-virus protection.

VMware View 4.5 Overview

VMware View 4.5 is the leading desktop virtualization solution, built for delivering desktops as a managed service—from the platform to the protocol. With desktop and application virtualization, IT organizations can unlock a user's data, applications, and operating system from the end device and manage these components centrally in the datacenter. This allows the IT organization to provide a secure and customized desktop to users—with a superior end-user experience—from any location, on any compatible device.

New in VMware View 4.5

The latest features of VMware View 4.5 include:

• Full Microsoft Windows 7 support

• A new administrative console with support for role-based authentication, and a dashboard that provides a quick view of the virtual desktop environment and troubleshooting capabilities

• Application assignment for deploying VMware® ThinApp™ applications to VMware View desktop pools

• Tiered-storage support in VMware View Composer for increased storage flexibility and reduced storage costs

• Local mode, which enables a virtual desktop to download locally onto physical PCs or laptops and execute locally (security policies remain intact and only changes are checked back into storage servers or datacenters)

• Kiosk mode, which enables multiple users to share a published virtual desktop from a kiosk

Typical VMware View 4.5 deployments consist of several common components, illustrated below. The graphic shows VMware View components as well as other components commonly integrated with VMware View.
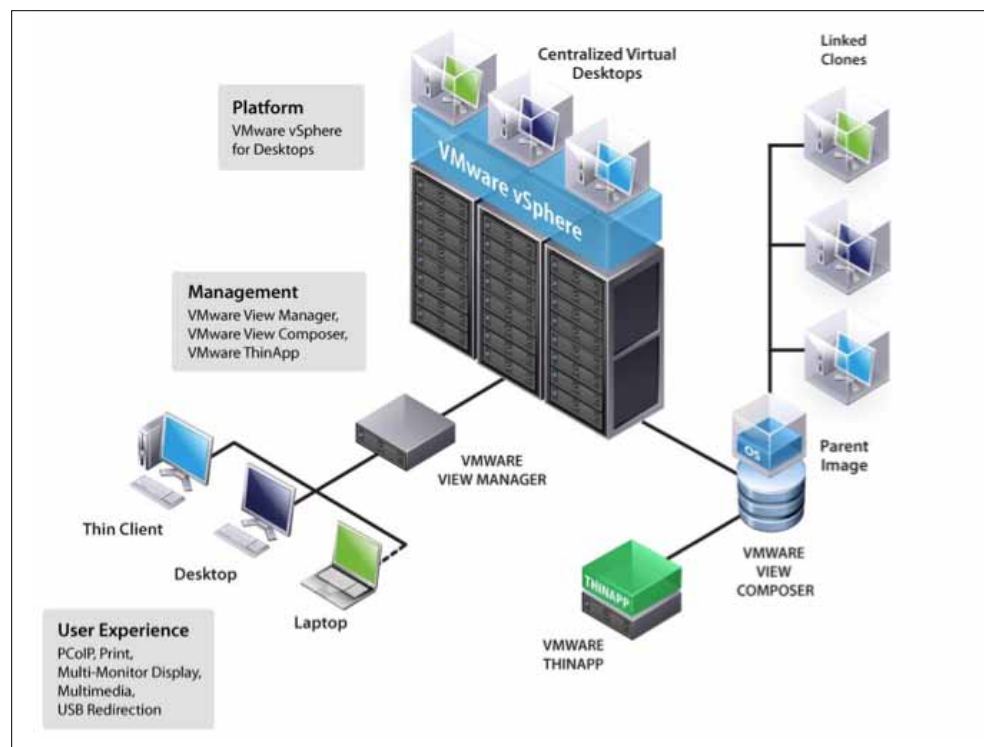

Figure 1: VMware View components

VMware View starts with a back-end server for hosting the virtual desktops, which run as guest operating systems on top of the hypervisor VMware ESX® or VMware ESXi™ Server. VMware vCenter™ helps manage server memory, processor, and I/O utilization.

In a typical virtual desktop deployment, VMware vCenter can support up to 80 virtual machines (virtual desktops) per host. As a general rule, systems can support from four to 10 virtual machines per physical CPU core. For more information, see http://www.vmware.com/files/pdf/VMware-View-45-Stateless-RA-brief.pdf to review the reference architecture summary for stateless virtual desktops with VMware View 4.5.

Storage is a significant aspect of a desktop virtualization deployment, because all data that was once stored on local PC hard drives is now stored centrally in the datacenter. Consider using solid-state drives (SSDs), which can improve overall performance or using other storage architectures and technologies to centralize end-user data and desktop images, including network-attached storage (NAS) and low-cost storage area networks (SANs) built on protocols such as iSCSI. VMware View Connection Server provides authentication, connection management, traffic load balancing, security, encryption and other services necessary to tie together the physical end-user device to the virtually hosted desktop.

Virtualizing the Academic Desktop: Solution Overview

Before attempting to virtualize a desktop environment, a good understanding of application and network load profiles, and how available bandwidth and capacity can affect the environment, is critical. For example, in a lab setting most users try to log in at the same time, placing a significant initial load on the network and the server. Media-rich applications can also place heavier loads on the infrastructure. The best approach here is to create a classification of user profiles, for example, lower-grade elementary students versus upper level high school students.

To help illustrate the solution, this document discusses a lab setting with no more than 80 LAN-connected devices, such as laptops and desktops. The information in this section is adapted from the VMware Reference Architecture for Stateless Virtual Desktops with VMware View 4.5.

VMware View 4.5 enables the centralization of virtual desktop environments, allowing for an extremely low cost per user. This reference architecture leverages VMware vSphere™ 4.1 and VMware View 4.5 software, and compute and storage devices to optimize performance and scalability and drastically reduce storage costs.

VMware View provides plenty of headroom and scalability to operate in large environments with thousands of users. Additional information about larger deployments is available at http://www.vmware.com.

VMware View can be deployed in a highly modular and cost-effective fashion. A stateless desktop virtualization environment designed with VMware View 4.5 with tiered storage can scale from a few hosts to hundreds of hosts, while providing the lowest cost per desktop in the industry. This design provides linear scalability across both compute and storage.
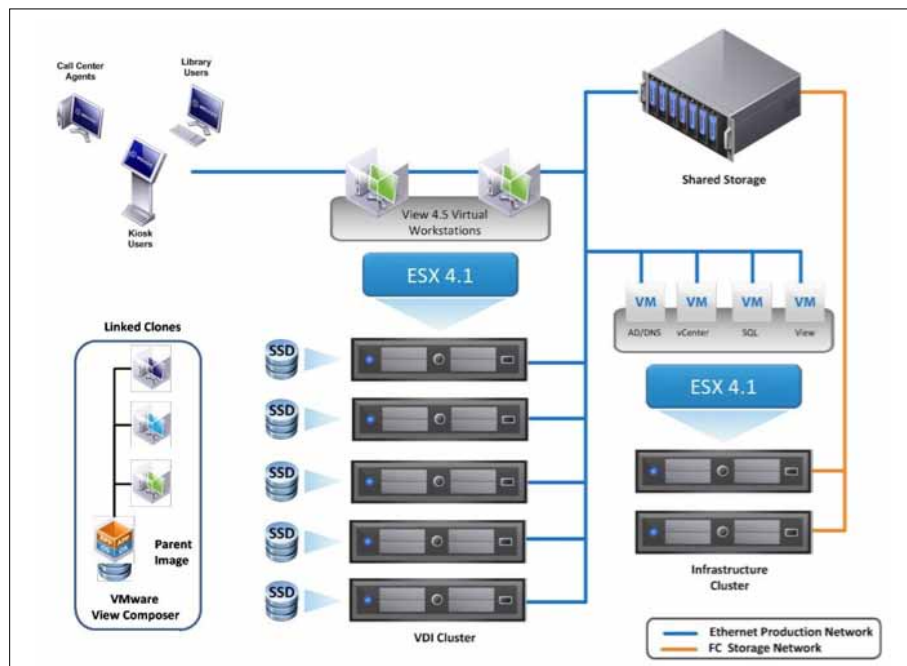

Figure 2: VMware View 4.5 architecture for stateless virtual desktops

The figure above shows a typical desktop deployment. In a school lab, a single rackmount server or compute blade with sufficient memory, storage and network I/O can be used. This configuration is capable of being scaled to support thousands of users, and can be configured for high availability (HA). For details on the sizing, please refer to VMware View 4.5 Reference Architecture.
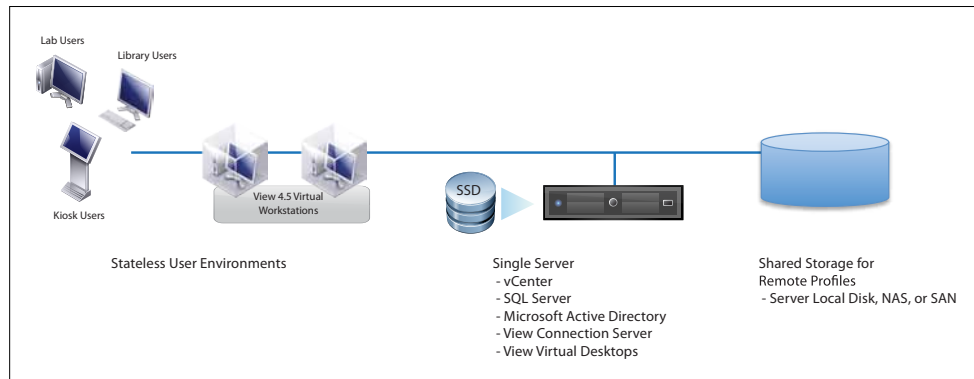

Lab Users

Library Users

View 4.5 Virtual
Workstations

Kiosk Users

SSD

Stateless User Environments

Single Server
- vCenter
- SQL Server
- Microsoft Active Directory
- View Connection Server
- View Virtual Desktops

Shared Storage for
Remote Profiles
- Server Local Disk, NAS, or SAN

Figure 3: A simplified architecture for smaller VMware View deployments

Physical Component Configuration

The following table is a sample configuration for illustration purposes, and should not be considered a product recommendation.

VMWARE VIEW DESKTOP 80 USER CLUSTER	
QTY	**Description**
1	PowerEdge R610 Intel Xeon 2.93GHz/8 Cores/96GB Intel Xeon-based blade servers with 8 cores each For HA consideration, configure qty 2
1	96GB RAM total per host, such as Kingston 8GB DDR3-1333, Part #KTH-PL313/8G
1	Optional SAN or NAS storage
1	Solid State Drive (Intel X25-M 160GB SATA)
1	Broadcom Corporation NetXtreme II 57711E 10Gbit Ethernet
1	VMware vCenter Virtual Machine Windows 2008 Server R2 64bit 2 – vCPU 8GB – RAM 30GB Virtual Disk
1	Microsoft SQL 2008 Server Windows 2008 Server R2 64bit 2 – vCPU 8GB - RAM 40GB Virtual Disk

List of Prerequisites

• VMware vSphere 4.0 Update 2 or vSphere 4.1. / VMware Infrastructure 3.5 Update 5 and VMware Virtual Center Server 2.5 Update 6

• Windows XP Deployment Guide: www.vmware.com/files/pdf/XP_guide_vdi.pdf

• Windows XP media, volume license key

• Windows Server 2003 or 2008r2 media, license key

• Windows 7 media, license server

• Windows Sysprep Media: kb.vmware.com/kb/1005593

• Shared Disk Storage (SAN) 200-400GB. SAN is an optional component. SAN or local Disk is required for ESX. There must be at least one VMFS volume to store virtual machine disk files.

• Active Directory: View Manager uses AD to authenticate user accounts and to store VMware View desktop machine accounts.

• DHCP: Automatic IP configuration is required to automatically provision VMware View desktops.

• DNS: VMware View Connection Server and Security servers should have DNS entries, and a DNS alias for the VMware View Infrastructure

Note: Additional servers can be deployed for HA. While SAN offers many benefits, deploying without it can reduce storage costs.

Stateless Desktop Design

Virtualized desktop can be configured in two ways: persistent or stateless. Persistent desktops are assigned to individual users and stay that way until an administrator makes a change. Properly entitled users may also check their desktops out for offline usage. This type of pool is best suited for users who want to store local data and customize their desktops by installing local applications.

Non-persistent desktops are recommended for smaller academic environments. Also known as stateless desktops, they are allocated to users temporarily and used on a one-off basis. Once the user has logged off, the desktop goes back into the pool and becomes available for the next user. When properly architected, this type of pool provides extreme flexibility between the operating system, application and user data layers. When all desktop operating system images are exactly the same, there are significant storage capacity and performance benefits.

A stateless design using a single non-persistent image also offers the ability to efficiently address multiple use cases, with different user profiles and applications. Users can still manage their own data files.

An important part of this deployment architecture is the use of solid-state disks (SSDs), which are significantly faster than conventional hard disk drives. Using SSDs can be an advantage in an educational setting, where there can be rapid turnover between classes. Before the start of each lab, new desktops can be prepared and deployed right away to meet the student's need. As users log off, the floating desktops can be deleted (as SSDs can quickly deploy new desktops as needed). If speed is required for rapid turnaround, SSDs offer a less expensive solution than more complex storage architectures, and will improve overall ROI (return on investment).

VMware View Connection Server also provides a set of power management policies that control energy usage and free up computing resources for unused desktops.

To accommodate different user profiles in a stateless desktop, user information can be handled by redirecting key folders to network-based file shares using roaming profiles. The actual desktop should be viewed as "disposable" if at all possible. Stateless architectures, as described in the VMware View 4.5 Reference Architecture, are only able to deliver their benefit when the user data is dealt with properly.

An alternative is to use a vendor solution such as Unidesk to maintain different images for the labs. Typically, many labs across the campus have similar desktops, but others may have custom desktops with specialized AutoCAD or other high-end applications that can't be easily virtualized. Maintaining different images for the labs can help reduce the cost of managing student, faculty, and staff desktops, which typically require a high degree of customization.

A key to successful roaming profiles is keeping the size of the profiles as small as possible. Using extensive folder redirection, especially beyond the defaults that are found in standard group policy objects, means roaming profiles can be stripped down to a bare minimum of files.

Examples of recommended folder redirections include:

• Application Data

• My Document

• My Pictures

• My Music

• Desktop

• Favorites

Locking down the desktop, and specifically not allowing the user to save data locally, is especially important with stateless desktops, since the data on the desktop can be completely deleted when a user logs out of the system.

Profile Definition

Computer users in academic settings can be loosely divided into the following groups:

• **Task users:** Users who follow step-by-step instructions from an instructor

• **Power users:** Users who are completing task-oriented lessons, such as using Adobe Photoshop to create a design, Adobe After Effects to edit multimedia, or an integrated development environment to create a software module

• **Knowledge users:** Users who are performing general activities, such as web browsing, using Microsoft Word to write up a homework question, and so on

Note that today, nearly every type of user and environment is using more multimedia, which increases the demand for compute and network resources. VMware View 4.5 provides technology and management capabilities that can be configured to deliver optimal performance for nearly any environment end user profile.

VMware View 4.5 with PCoIP protocol provides real-time delivery of a rich user desktop experience using the UDP network protocol. In a campus LAN environment, network planning for the various user profiles must take into consideration graphics intensity, image quality, interactivity (as opposed to static viewing) and overall network requirements for "power users." Increasingly, students and teachers are using multimedia applications, which places heavy demands on compute and network resources. Because many people use computers concurrently in a lab setting, capacity planning for peak bandwidth usage is critical.

With VMware View 4.5, IT administrators can leverage VMware ThinApp™ to deploy applications as single, virtualized executables that run completely isolated from each other and the operating system for conflict-free execution on end-point devices.

With VMware View 4.5, IT administrators can now stream ThinApp application packages to virtual machines from the datacenter. Network-based application streaming of virtualized applications increases efficiency in the campus LAN environment, since the actual applications only occupy disk and memory space on the host servers, and not on individual end-user devices. Additionally, the VMware model gives lab managers easy access and management control to a range of applications and makes these applications available for particular desktops or pools using VMware View Manager.

Kiosk Mode

Kiosk-mode computing can be very useful in campus environments. A typical use case in a computer lab provides access to remote desktops and applications directly without requiring dual login prompts. VMware View Kiosk mode bypasses all possible errors and Windows events. This simplifies endpoint client device maintenance and minimizes required campus IT resources.
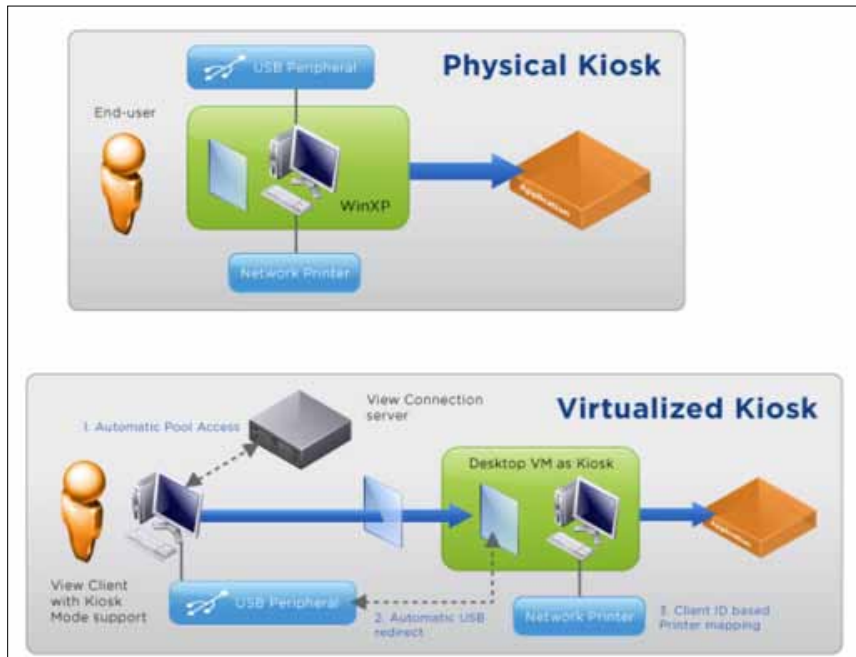

Figure 4: Physical and virtualized kiosks

With VMware View, It's also possible to configure an Active Organization Unit (OU) for each grade or lab. The connection is established in the command line to a virtual desktop, seamlessly using the endpoint device MAC address or client ID. No username or password is required. Kiosk mode is ideal for simple, stateless usage such as a campus directory or information center. For more information, see "Kiosk Mode with VMware View 4.5," available on the VMware.com web site.

Location Based Awareness For Network Printing

VMware View 4.5 associates network printers with the endpoint thin client, PC MAC address, or user group. For more information, see "ThinPrint GPO Configuration for Location-Based Printing" information on the VMware.com web site.

Malware and Virus Protection with Agentless Design

VMware View incorporates features from the VMware vSphere platform. Instead of maintaining the anti-virus or firewall policy within each guest virtual machine, VMware vShield™ Endpoint can be deployed to each individual ESX host and create secure zones. This simplifies anti-virus protection dramatically and helps to keep each desktop as small and efficient as possible.

This design offloads the required daily routine associated with patching and maintaining individual virtual machines, and provides a central monitoring point for the security health dashboard.
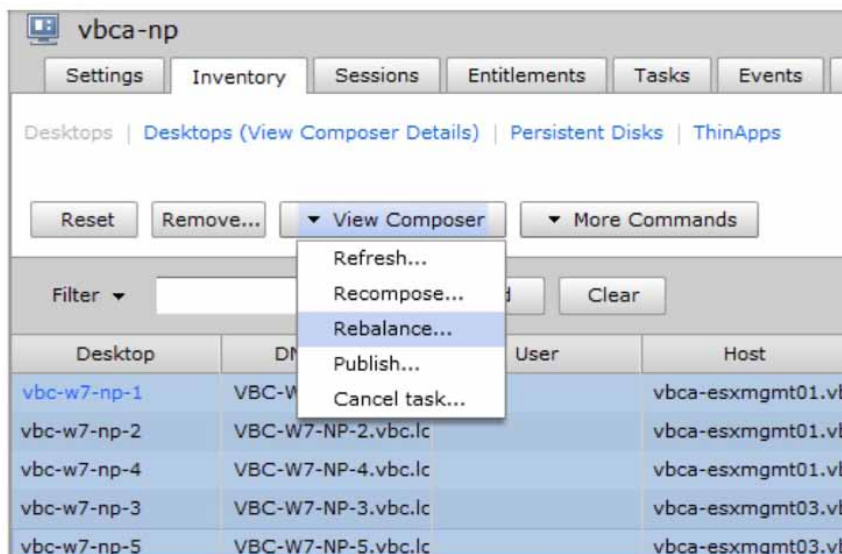

Figure 5: The security health dashboard

Anti-virus security vendors have integrated their products with VMware VMsafe™ and the VMware vCenter API to provide agentless real-time scanning. The solution triggers a notification to the AV engine on file (open/close) and provides access to file data for scanning. The solution can also send commands to perform agentless manual and scheduled scans. All on-demand scans are coordinated and staggered to prevent a resource storm.

Figure 6: Security protection practice options

In the event that a desktop image becomes infected or corrupted, VMware View provides an easy recompose operation to sync back with the linked clone parent image snapshot.

Figure 7: The recompose option simplifies synchronization with the linked clone parent image snapshot

USB Peripherals Policy Control

The stateless nature of desktop in the typical campus lab enables administrators to allow or deny USB access from the desktop with a simple configuration in View Manager. If USB access causes corruption or other unauthorized issues, VMware View 4.5 provides an easy refresh, rebalance and recompose operation for the linked clone desktop.
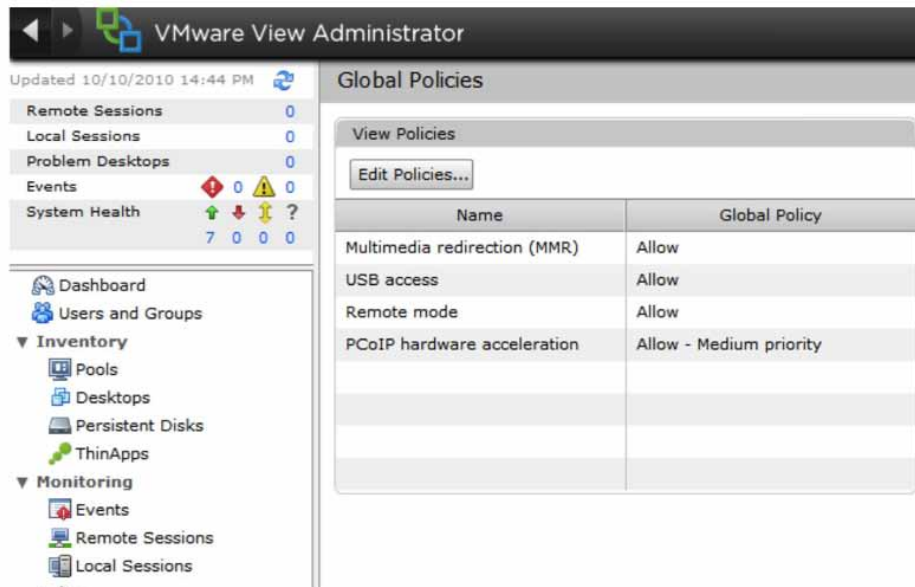

Figure 8: Refresh, rebalance and recompose operations via the View administrator screen

Administrators can decide when extra precautions are needed and restrict students or other users from connecting their personal USB devices with a simple allow/deny switch. When deploying stateless desktops, IT administrators should consider enabling USB access for students to allow them to save their coursework.
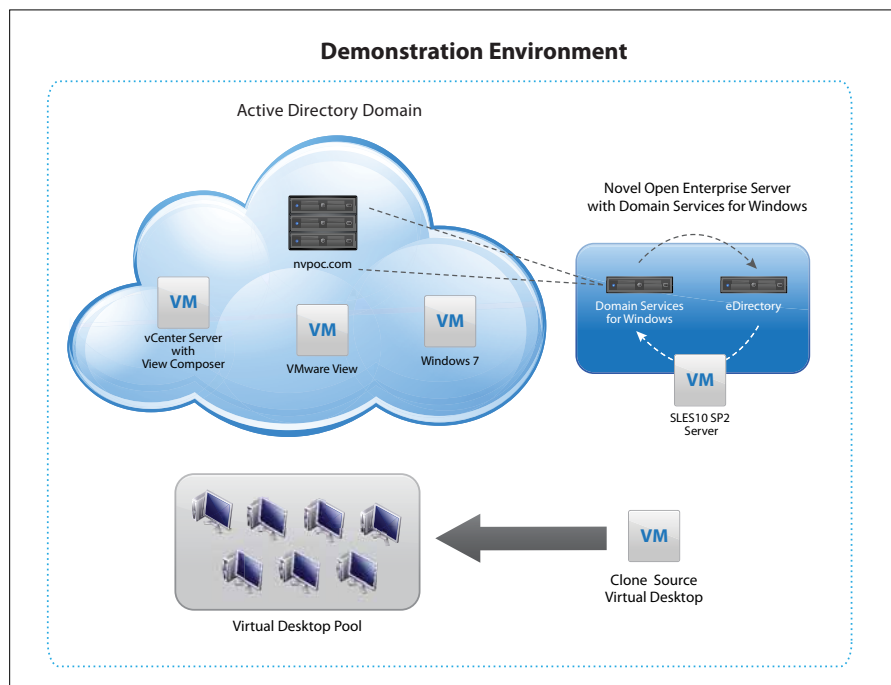
Lab IT professionals can allow USB devices by enabling the USB redirection policy to work with academic applications and devices (such as interactive white-boards, remote student response systems, or clickers with the endpoint device) via USB interface—or deny any personal USB device access or copy-and-paste actions.

Authentication through Active Directory (AD) and eDirectory

Many schools have consolidated user identity information across departments, simplifying network access and file sharing. Novell Domain Services for Windows (DSfW) is widely used in such scenarios. DSfW behaves like Microsoft's AD, and there are many VMware installations that leverage Novell's product.

DSfW can function in an AD environment by creating an emulated AD front-end, which interacts directly with Novell directory services. It is important to note that there is no actual Microsoft AD implementation. All directory interaction happens directly with the Novell directory. DSfW's AD emulation function provides an alternate presentation of native Novell directory services. VMware View uses a local copy of Microsoft Active Directory Application Mode (ADAM) to store all configuration information but uses AD for all authentication as well as extended management functionality such as Group Policies.

For an overview and implementation, visit Novell's site at http://www.novell.com/documentation/oes2/oes_implement_lx_nw/?page=/documentation/oes2/oes_implement_lx_nw/data/dsfw.html

Demonstration Environment

Active Directory Domain

nvpoc.com

VM
vCenter Server with View Composer

VM
VMware View

VM
Windows 7

Novel Open Enterprise Server with Domain Services for Windows

Domain Services for Windows

eDirectory

VM
SLES10 SP2 Server

Virtual Desktop Pool

VM
Clone Source Virtual Desktop

Summary

School labs are typically labor-intensive. Each class can require a different application, or professors may need test applications or other last-minute software to be installed to meet course requirements. Today, schools across the globe are rolling out desktop virtualization to address campus IT challenges. With VMware View 4.5, IT administrators can streamline the time, resources, and ultimately the cost associated with provisioning and managing desktop environments—while ensuring that students have ubiquitous access to their applications and data whenever and wherever they need it. Taking the time to properly plan and profile the applications and users in advance will help to maximize the success of your virtual desktop environment and ensure that you are well positioned to scale out this environment as you move forward.

Additional documentation and information on the topics discussed in this paper can be found at
http://www.vmware.com/products/view/resources.html

About the Author

Cynthia Hsieh is responsible for solution management for End User Computing Group at VMware. She focuses on application integration, proof of concepts and security subjects. Hsieh's previous background includes product management positions at Wyse, Trend Micro, Oracle, and Yahoo.

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