



Top Five Considerations for Choosing a Zero Client Environment

*Realizing the benefits of desktop virtualization without
sacrificing security, cost, or performance*

TECHNICAL WHITE PAPER

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Introduction

The real value in converting to a virtual desktop environment is realized only when a variety of seemingly conflicting requirements are met: a) the end users are happy, b) the corporation's needs for security and compliance are met, c) the IT organization has the control it needs without having to add costly resources, and d) the overall system performance and cost of ownership are improved.

When selecting a desktop virtualization solution, one of the first considerations for IT administrators is how to get the best overall user experience while keeping management costs and time to a minimum. A key driver in this decision is on which type of hardware client the virtual desktop will be used. The options range all the way from larger thick clients to small footprint zero clients that are nothing more than an LCD display with minimal hardware and physical space requirements. Many organizations prefer to use the smallest, easiest, most cost effective device at the endpoint, a zero client.

One of the key enablers to virtual desktops being accessed by zero clients is the ability to process graphical information quickly and cost effectively. The processing of graphical information can either be performed by the server located in the datacenter, referred to as host rendering, or it is done locally using the user's desktop, referred to as client rendering. Host rendering utilizes the power of the server to generate the graphical images, compress them and then send the information across the network to the client where they are uncompressed and displayed. Client rendering sends the entire image across the network where it is processed and displayed at the client.

Some amount of processing has to be performed for graphically intense applications and it becomes a matter of choice where it is done. One of the benefits of processing the images on a server in the datacenter is that the end client can be the smallest, most cost effective device.

There are several solutions in the market that promise to provide the best bandwidth or promise to provide the highest fidelity, but at what cost? And, can users get high fidelity while network administrators get optimal bandwidth consumption? What about end user experience, ease of management and application compatibility? All are important decision criteria that often go unaddressed by narrowly focused point solutions.

This paper addresses these concerns and takes a look at the top five most important criterion for determining whether or not a zero client infrastructure is right for your organization.



Criterion #1: Achieving the Best End User Experience

An important consideration for selecting host rendering versus client rendering is the quality of the end user experience. End users care about the image display quality and experiencing no perceptible delay in image rendering. They also care about the response time or latency of the system they are using. They expect their desktop to provide nearly instantaneous responses for any query regardless of the type of information being retrieved – just like a laptop. Host rendering and client rendering can both provide users with a quality experience and reasonable response times for most environments. The difference is in which can provide the best experience for the changing network conditions. This will help to determine which approach is more suitable for your environment.

VMware View is the leading desktop virtualization solution that provides high quality end user experience through the use of both host rendering and client side rendering. View with PCoIP provides the most optimum user experience for the broadest set of end user configurations and network conditions.

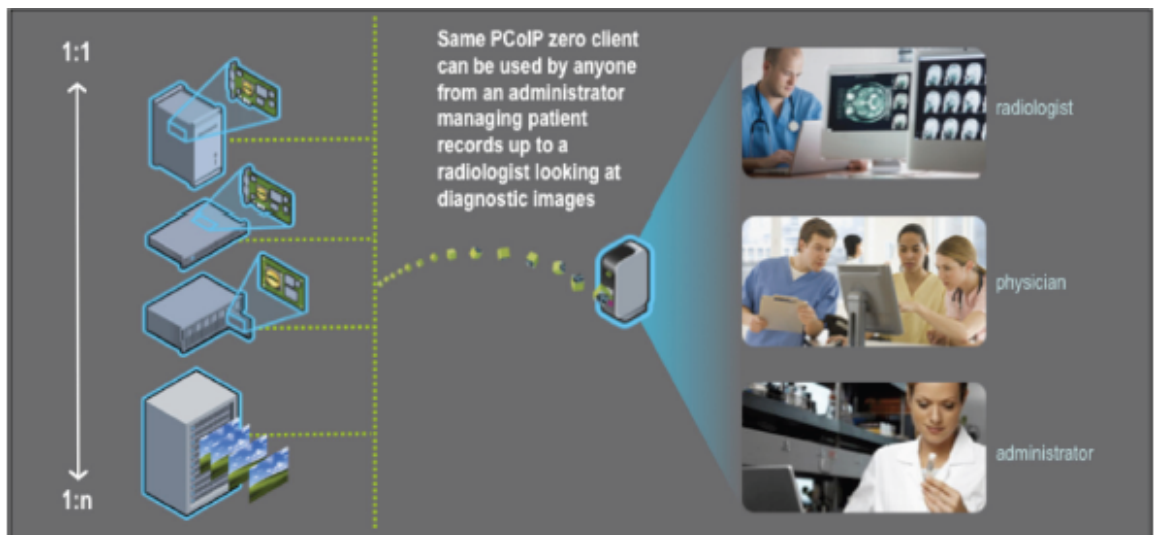


Figure 1: Host rendering does the graphics processing in the datacenter for optimum end user experience for the broadest set of network conditions.

When using host side rendering, the first step in the process is to encode or compress the information to be transmitted. With VMware View this step takes place in the datacenter where compute intensive resources are readily available. The advantage of host rendering in this case is that the data is highly compressed before sending to the client.

VMware View with PCoIP (PC-over-IP) includes multiple encoding algorithms for the various types of information being displayed. Different imaging algorithms are applied depending on the type of information being encoded. For instance the algorithm used for



text is different than the algorithm used for motion video, or photos, or graphics, or icons. Although one might think that there is a single best way to encode all information, the reality is that each format is very different and has specific characteristics that determine how the image is perceived. Consequently, View with PCoIP intelligent encoding handles each type of content in the most appropriate and efficient way.

View with PCoIP's approach of taking the display image from the frame buffer and compressing different content within the frame with the appropriate encoder provides low latency encoding to ensure desktop responsiveness. View implements a local mouse and sends other human interface device (HID) information from keyboards, trackballs, and joysticks, etc., over a separate prioritized channel to further improve response time for user interactions.

View with PCoIP is able to build to lossless which means a pixel perfect image will be displayed. Other technologies can only build lossy images that don't contain all of the information from the original file. They have to do this because sending all of the data down to the endpoint would be bandwidth and performance prohibitive. With VMware View, users don't have to sacrifice image quality for performance or network bandwidth. They can obtain pixel perfect images all the time.

An example of a View deployment is at Ontario-Montclair School District. The District now offers 40% more desktop devices without expanding their operating budget by running VMware View and PCoIP. With VMware View, desktop images are created centrally and deployed to multiple machines. This allows them to upgrade hundreds of clients with minimal effort adding up to lower managements costs.

"With PC over IP support, the quality of video with VMware View is perfect for use in the classroom," says Jeremy Wood, Technology Planning Coordinator, Ontario-Montclair.

Another example is Stefanini TechTeam who had already virtualized its datacenters with VMware vSphere and wanted to extend the resulting cost and operational advantages to the desktop. They chose VMware View to transform desktops into a centralized managed service. With VMware View, Stefanini TechTeam was able to avoid building multiple datacenters around the world. The company manages the helpdesk infrastructure from just two co-location facilities, with View delivering excellent desktop performance over high latency connections. The solution enables Stefanini TechTeam to speed application upgrades, reduce repair overhead, ensure data security and support helpdesk agents in providing outstanding customer service.

"End users notice the difference, thanks especially to PCoIP. And when IT improves service delivery to end users, they in turn improve their service to Stefanini TechTeam customers," says Daniel Chapiewski, TechTeam director of global infrastructure. "A double benefit is that you can have people work from home with the same tools they have at the office. As for repair, we don't have to go to their house. If you have a failure, you just log off and start up again."



Criterion #2: Making Your Organization Secure and Compliant

Many corporations have made security and compliance their top requirements when deploying a server hosted virtual desktop environment. The need for better security has been demonstrated numerous times with the theft of laptops containing customer account information and other mission critical data. The risk of corporate confidential information getting into the wrong hands has never been higher.

A related concern is that of corporate compliance. Government regulations such as SOX, GLBA, HIPPA and other regulations have mandated corporations following specific measures and auditing practices in protecting customer, patient and employee information.

How does VMware help with these concerns? View provides maximum security and centralized control for server hosted virtual desktop environments. Absolutely no data has to be sent to the end user client, graphical information for display purposes only is all that is transmitted. Sensitive corporate data stays protected in the data center.

VMware View provides an ultra secure environment with its host rendering option. All data remains locked down in the datacenter, centrally protected and managed. All pixels are host rendered and encoded in the datacenter then delivered to simple, decode-only devices known as zero clients.

View also offers secure client side rendering for organizations that have a laptop/desktop environment. Depending on whether the endpoint has a zero, thin, or thick client, View can be configured to provide the best user experience.

AGAR Supply, New England's largest independent food distributor, selected VMware View because it would allow users to access their desktops regardless of location, while at the same time simplifying overall IT administration. Since the company had already had great success using VMware vSphere to virtualize its datacenter, they felt comfortable extending this technology to their desktop environment as well. "The integration between vSphere Virtual Center and VMware View Manager is incredibly tight," says Steve Weber, network administrator at AGAR Supply. "I think the key word here is 'seamless'."

"Thanks to VMware View, we don't have to panic if someone's laptop is stolen or something like that," says Weber. "The equipment we give our employees has nothing more than a shortcut on their desktop with a login to get to their virtual desktop. So if the laptop is lost or stolen, there's no loss of data, no company secrets compromised, no nothing." says Weber.



Criterion #3: Realizing Zero Software Management at Physical Endpoints

Managing operating system updates, application updates, firmware changes, and more at the end user's desktop is a full time job for most IT administrators. In an environment that relies on full laptop and desktop support, organizations can spend \$2,000 or more per year on maintaining each device. The IT organization typically has to have someone assigned to be physically onsite in case one of the users has an issue. Centralized management is only an option for a well-managed PC environment and, the restrictions that this implies, is not practical for most organizations. The inefficiencies and escalating costs of managing PCs at the endpoint are well documented. For reference, Gartner Report: "Total Cost of Ownership Comparison of PCs With Hosted Virtual Desktops, 2011 Update" itemizes these costs and compares them to a server hosted virtual desktop environment. Most CIOs agree that zero management at the client is the most efficient, easiest, lowest cost and most secure implementation for virtualizing desktops.

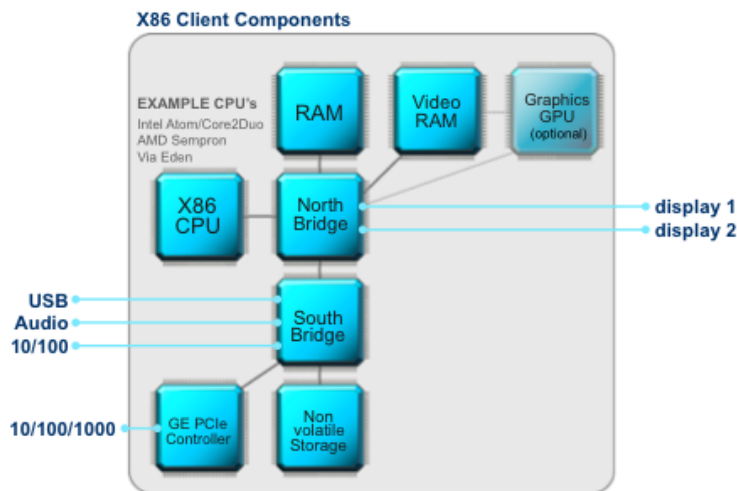


Figure 2: Traditional components at the client

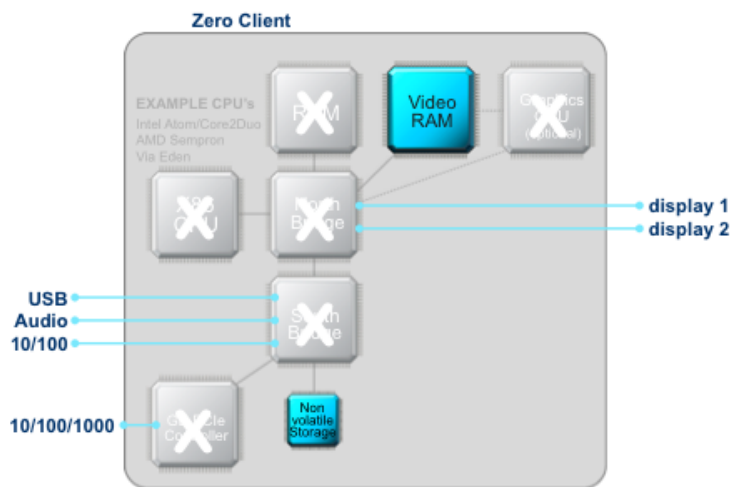


Figure 3: Utilizing a zero client eliminates many costly and difficult to maintain components

Another management savings of using zero clients is there are no hardware media CODECs to support. All components are virtualized using software to decode the graphical information. The use of a zero client architecture based on software CODECs frees up the IT team to focus on other more pressing matters. Most organizations prefer to simplify their management infrastructure and they choose zero clients to help them accomplish this.

Aledo Independent School District (ISD) of Texas, Technology Help Desk Manager Brooks Moore did a little math of his own: growing demand + commitment to excellence × limited budget = desktop virtualization with VMware View. The VMware View solution provides fast application deployment and imaging flexibility to suit Aledo's institutional needs. The district uses persistent images for faculty and administrative staff; settings and changes are preserved to allow end users to retain modifications made to the virtual desktop. Student devices use non-persistent images; all changes are deleted at logout and each user gets a fresh image every time he or she logs on. Centralized management in the datacenter and the use of zero client endpoint devices allows Moore to deliver great customer service without increasing IT staff.

“There are so many single points of failure in the traditional desktop PCs, such as fans, hard drives, RAM, system boards and processors,” he says. “In contrast, there’s hardly a single point of failure with the zero clients; they’re solid state pieces of equipment. We won’t have to devote IT staff time to running around troubleshooting device failures. And with VMware View, the more zero clients we have out there, the more we can manage devices centrally from the Technology office.”

Criterion #4: Gaining Freedom from Application and Video Format Dependence

Desktop virtualization doesn't tie the user to a specific version of an application or a specific video format. It frees the user and the IT organization from specific hardware and operating system requirements and concerns that impact application versions. In this type of environment future applications just work since specific hardware is not needed at the client. Host side rendering allows desktop virtualization to accomplish. For client-side rendering this flexibility is lost because client side rendering requires specific CODECs at the endpoint for video. Future video formats are not guaranteed to work with client side rendering without IT intervention and upgrade at the endpoint.

Host-side rendering is completely application and video format independent which provides a virtualized environment with no dependency on any additional software or hardware. Client side rendered environments struggle to keep up with the latest application user interfaces. To future proof your investment, and have a low maintenance solution, a solid, host-rendered environment makes an excellent investment choice.

VMware View with PCoIP offers a host side rendering option and therefore supports any current or future video format and any current or future application. View provides exceptional application and video format support in a server hosted virtual desktop environment. View provides a virtualized desktop environment that provides fast application deployment, imaging flexibility and requires very little maintenance,

Columbia Memorial Hospital in Hudson, New York, updated its desktop environment with VMware View to create and manage virtual desktops that provide physicians with access to a wide array of health care applications.

"We can roll out any application we want to the virtual desktops just by updating the master desktop image," says Michael LaForge, network administrator at Columbia Memorial. "That's a far cry from having to physically visit the remote locations to install the application." In addition to simplifying desktop management, this capability puts more tools in the hands of health care providers. "With VMware View, our physicians don't just have access to lab reports," says Crowley. "They can see actual X-ray images, access emergency department records and even monitor biofeedback if a patient's in a critical care situation. All the applications they need are right there at their fingertips, giving them a more global picture of their patients than ever before."



Criterion #5: Optimizing Network Bandwidth Consumption

Network bandwidth is at a premium during peak hours in most organizations. Network Administrators need devices accessing the network to use the available bandwidth wisely. Peak hours don't happen 100% of the time and in fact account for less than half of daily operations. During non-peak hours, administrators desire network devices to use bandwidth optimally while still providing the best user experience. The real goal of an IT organization is to use network bandwidth and resources intelligently, i.e., during peak hours use less and exhibit a "fair share" policy, and during non-peak hours use as much as bandwidth as needed and expand to provide the best possible end user experience.

During non-peak hours, there are fewer users making fewer demands on network resources and much of the network bandwidth is available. Older generation display protocols don't know how to take advantage of network resources and end up wasting bandwidth. Leading technology will make an informed decision on how much bandwidth to consume given the current amount of traffic. As traffic changes, the intelligent protocol either scales out or retracts depending on the circumstance.

VMware View with PCoIP is an intelligent protocol that dynamically adjusts image quality and frame rate based on available bandwidth on the LAN or WAN. Maximum bandwidth can be capped to limit bandwidth utilization while fairly sharing bandwidth when multiple user sessions are active. View includes adaptive networking and progressive image refinement capabilities that accomplish these state-of-the-art adjustments.

Adaptive Networking is a dynamic image quality adjustment that will automatically reduce image quality on congested networks and resume maximum image quality when the network is no longer congested. System responsiveness is maintained by reducing the screen update frequency during peak times.

The following examples demonstrate the adaptive nature of View with PCoIP by looking at three users on a network. The users have different workloads and enter the network at different times. User 1 comes online first with a larger workload and therefore uses a larger amount of bandwidth. Then User 2 comes online with less workload that causes User 1 to relinquish some of the bandwidth in a matter of milliseconds. Likewise, when User 3 comes online both User 1 and User 2 adjust until all three users are sharing the network bandwidth equitably based on their workload.



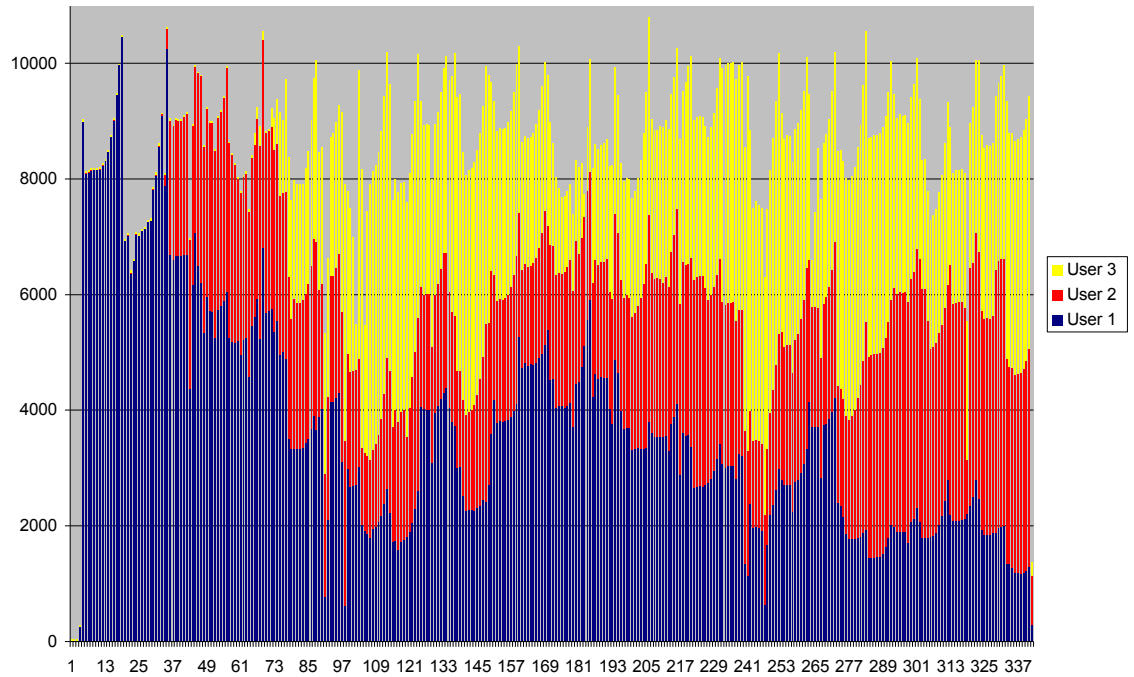


Figure 4: View with PCoIP efficiently shares the network

Another example below shows that when all three users have the same workload, the available bandwidth is equally shared between them:

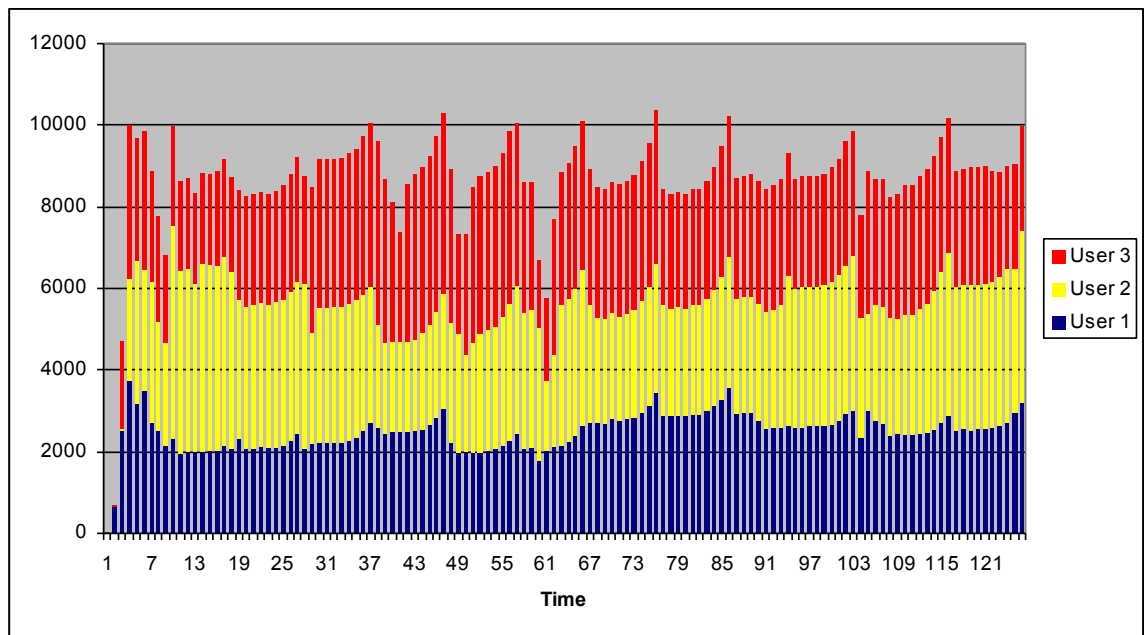


Figure 5: Three users with same workload available bandwidth is equally shared



For View with PCoIP sessions, the average bandwidth for an active office worker may be in the 80-150 Kbps range (depending on the scenario). A proper network assessment taking into account desktop workloads will help determine how to configure and optimize the environment for optimal performance on a WAN. Customers implementing optimizations that match their assessment are achieving reduced average bandwidth utilization and greater WAN performance using View with PCoIP.

View includes traffic shaping which means it will monitor the network and adapt the encoding compression levels (imaging, and audio) and bandwidth usage. For higher network efficiency, View will send only changed pixels resulting in just bursts of network traffic with large screen changes.

Established in 2009, Centaur Fund Services is a fast growing hedge fund administrator providing services to the hedge fund industry. Centaur wanted a 'future-proof' IT infrastructure that would give them the flexibility to grow, without a significant initial investment. They used VMware View with PCoIP to provide a high-performance and rich graphical experience for users, a key requirement as Centaur staff use web-based applications where performance and response times are crucial. In addition, by avoiding a dependence on PC hardware, Centaur is able to avoid the significant costs of regular PC refresh cycles. Another major benefit Centaur Fund Services has enjoyed is the ability to access applications remotely.

"While our staff work primarily in the office, many also need to be able to access the office applications from home or at client sites," says Karen Malone, Managing Director, Centaur Fund Services. "With VMware View 4, accessing my applications remotely is identical to being in the office. Even from abroad the experience logging into the system is very good. This also helps us with our business continuity. For example, when we had major snowfall in Ireland the heavy travel disruption made no difference to our business as every employee could work from home and have access to all the IT resources they required."

Summary

The decision to "go virtual" at the endpoint is not always a simple one. It represents a departure from the PC-centric mindset that has been prevalent in the industry for the past 30+ years and move toward a more user-centric model. Many different variables need to be considered and the cost/benefit tradeoffs analyzed. This paper attempts to simplify the decision for organizations that wish to implement a smaller footprint endpoint solution. It presents considerations for selecting a zero client environment with host side rendering versus utilizing thick clients and client side rendering.

The solution and examples presented illustrate that making the choice based on zero client support and host rendering will reap many benefits. Zero clients require very little ongoing maintenance and provide the highest security. Realizing the full benefits of a zero client environment requires a desktop virtualization solution that has excellent host



rendering capabilities and can provide a consistent user experience across the broadest set of network conditions.

Client side rendering is often used in environments with existing laptops/desktops (aka, thick clients). For many organizations, thick clients help leverage their existing hardware investment. Client side rendering does have its limitations such as lack of future proofing applications and video formats as well as requiring special network acceleration equipment and being subject to security breaches from data stored locally. The most valuable desktop virtualization solution will provide the option to have both host side rendering and client side rendering for the broadest set of endpoint configurations.

The specific solution offered by VMware View with PCoIP provides all the advantages of zero clients and host side rendering as well as providing client side rendering capabilities for mixed or predominantly laptop/desktop environments. VMware takes a balanced approach to graphical rendering in order to successfully address the diverse desktop environments found in most organizations.

Regardless of the type of endpoint hardware, VMware has helped even the most complex organizations transition smoothly and securely to a virtualized desktop environment that was best for their users.

Customer References

Links to customer success stories referenced in this document:

- Ontario-Montclair School District
<http://www.vmware.com/a/customers/customer/769/Ontario+Montclair+School+District>
- Stefanini TechTeam
<http://www.vmware.com/a/customers/customer/794/TechTeam+Global>
- AGAR Supply
<http://www.vmware.com/a/customers/customer/567/AGAR+Supply>
- Aledo Independent School District (ISD)
<http://www.vmware.com/a/customers/customer/768/Aledo+Independent+School+District%20%28ISD%29>
- Columbia Memorial Hospital
<http://www.vmware.com/a/customers/customer/686/Columbia+Memorial+Hospital>
- Centaur Fund Services
<http://www.vmware.com/a/customers/customer/658/Centaur+Fund+Services>

