

PC Blade Virtualization Solutions VMware Server

Virtualization technology is changing today's IT industry by enabling more effective use of existing computing assets. While server virtualization has seen widespread adoption over the last several years, desktop PC virtualization is a relatively new development with great promise to enable higher asset utilization and better PC management, without compromising the experience of the end user.

ClearCube Technology is at the forefront of centralized client computing and desktop PC virtualization. Leveraging its long-term experience and leadership in centralized client computing, the combination of ClearCube PC Blades and management software with industry-standard virtualization technology gives IT managers a new way to more efficiently use their computing assets.

Today's PCs are Fast yet Underutilized

In most desktop PC deployments, the actual average utilization of the PC's processor and other resources is very low – often less than 5%. PCs sit idle while users are in meetings, traveling, or performing duties away from their PC.

However, most major analysts and users agree that when a user does need their PC, it should exhibit the high-performance and responsiveness associated with today's typical desktop standards. This unrelenting need for performance drives the need for faster, more powerful processors.

One option to improve overall utilization has been to simply extend the life of older, slower PCs. However, this results in significant sacrifices in the user experience which reduces user productivity.

What is Virtualization?

Virtualization is the division of a single physical computing resource into discrete segments which essentially behave like multiple physical devices. These devices are known as "virtual machines" or "VMs" and can emulate various types of hardware depending on the virtualization technology used. Administrators often use server virtualization to allow them to replace multiple physical machines with fewer servers getting better utilization. PC virtualization extends this concept to desktop applications where resources are significantly underutilized today.

Real Demand: High Power for Short Periods

The highly responsive performance that a user experiences with today's PCs is more a result of short bursts of intense processing than it is of sustained periods of high processor utilization. Typically, the full processing capability goes unused for relatively long periods of time.

For example, when using a word processing application, the processor may peak to 100% when the application is loaded – fully utilizing the power of an advanced Intel Pentium 4 class processor to give the user a quick response. Slower processors will take longer to load the application and thus will give the user a perceptibly sluggish response. However, once the application is loaded and the user is typing in text, the actual processor utilization is very low

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(often less than 2%). These bursts of processing pose a dilemma for IT managers: Their users demand the very latest in processing power, but on average most of this power goes unused.

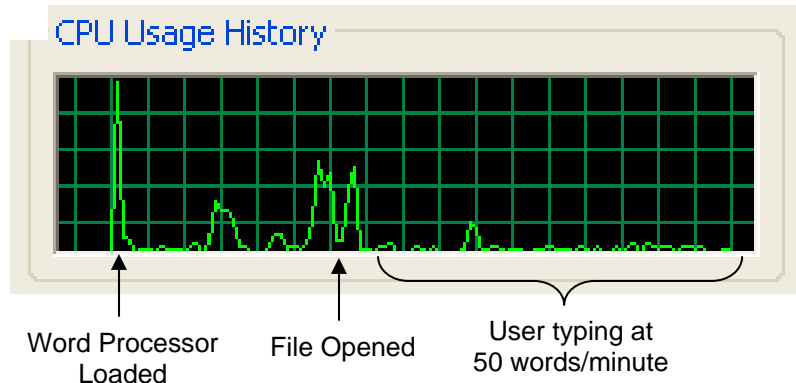


Figure 1. Typical PC processor usage – short, high peaks with extended inactivity

PC Virtualization Addresses Underutilization

Virtualization technology can address PC underutilization by enabling multiple users to share the hardware of a single PC. Since typical peak usage patterns are erratic, the actual overlap of multiple peak demands on the processor and other resources is very rare. Depending on the application and deployment environment, a larger or smaller number of users can be configured to share a single PC resource with little to no noticeable performance impact. This principal is similar to networking, where a large number of users share a finite amount of available bandwidth. Note that the peak capability of the processor remains a very important parameter – as this is what governs the responsiveness that each user experiences when they require peak power. Therefore, the alternative of putting each user on their own dedicated but low-power PC, results in unacceptable, sluggish performance.

Terminal Services versus Virtualization

Terminal services technology is an alternative approach to virtualization, but with significant limitations. With terminal services, multiple users share a single piece of hardware running a single operating system hosting multiple sessions. This approach works well when a small number of applications are shared among users. However, when users require a larger number of varied applications, as is typical in desktop PC environments, this model quickly becomes difficult to manage and support. Furthermore, many applications were not designed to be shared, making it impossible to use them with a terminal services infrastructure.

Virtualization involves hosting multiple instances of separate operating systems on a single piece of hardware. This approach enables each user's applications to run on a "private" operating system which appears to the application software as an independent PC. Each software application is installed independently on each VM so users have their own private instance. This eliminates the software incompatibility problems typically associated with terminal services and significantly simplifies the design and implementation of the required infrastructure. Furthermore,

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the licensing of application software is much more straightforward in a virtualized environment since it maps directly to a traditional box PC approach.

PC Blades: The Ideal Approach for PC Virtualization

For practical reasons, multiple users cannot effectively connect to and share a single box PC. Even if multiple sets of monitors and keyboards could be connected, the cabling limitations would require all users to sit within a few feet of the PC. PC virtualization can only be realized effectively using a centralized computing architecture such as PC Blades. In this model, end users can be located any distance from the computing resource and multiple user connections can access a single resource via Ethernet. The ClearCube PC Blade solution is therefore an ideal platform for virtualization. This combination delivers the following key benefits:

- **High User Performance** – shared users still get the responsiveness of their own full Intel Pentium 4 computer. IT managers leverage the latest in PC performance in a blade format.
- **Full Application Compatibility** – application software runs on virtualized OSES as if it were running on its own independent PC with all its own resources (i.e. IP address, hard drive, etc.) – this eliminates compatibility problems associated with traditional terminal services approaches.
- **Option for Dedicated PC Blades** – One of the key differentiators for PC blades vs. server blades is the option of running an individual user on a dedicated PC blade. For users that have high sustained demand or require a dedicated resource for other purposes, administrators can assign a dedicated PC. Due to the flexibility of this architecture, a dedicated blade can always be switched to a virtualized mode if needed.
- **Security and Manageability** – the centralized nature of the PC Blade platform makes it easy to secure and manage in a controlled environment away from end users.
- **Cost Savings** – by sharing the hardware amongst multiple users, IT managers can save on acquisition costs. In addition, the centralized environment is much easier to manage resulting in support cost savings.
- **High Uptime** – ClearCube PC Blades and management software make it easy to switch and dynamically allocate users in the event of failures or simply to properly balance user loads. With this flexibility, equipment downtime is separated from user downtime.
- **Ability to Scale Down** – Virtualization of desktops on top of blade PCs is ideal to allow for varied needs of end users because it is more cost effective to scale the solution down to the needs of individual users or groups of users than that of a server offering.

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PC Blade Virtualization through VMware Server

Typical virtualization requires a host operating system on the PC blade, virtualization software, and individual desktop OS instances installed on each virtual machine. VMware Server follows this model by using Windows 2003 Server as the host operating system. The virtualization software abstracts the underlying physical hardware and virtualizes it for the eventual guest OS while utilizing underlying the host OS to provide basic support functions to interact with the physical world. This approach also involves individual desktop OS instances installed on each virtual machine. Each user connects to their own independent Microsoft Windows XP Professional desktop OS instance over Ethernet via the RDP protocol from their I/Port device. The I/Port device resides at the user's desktop and connects to standard peripherals such as the monitor, keyboard, mouse, and USB peripherals. The I/Port itself runs an embedded operating system that can be either Windows XP Embedded or Linux. Figure 2. shows how four users would connect to a single PC Blade.

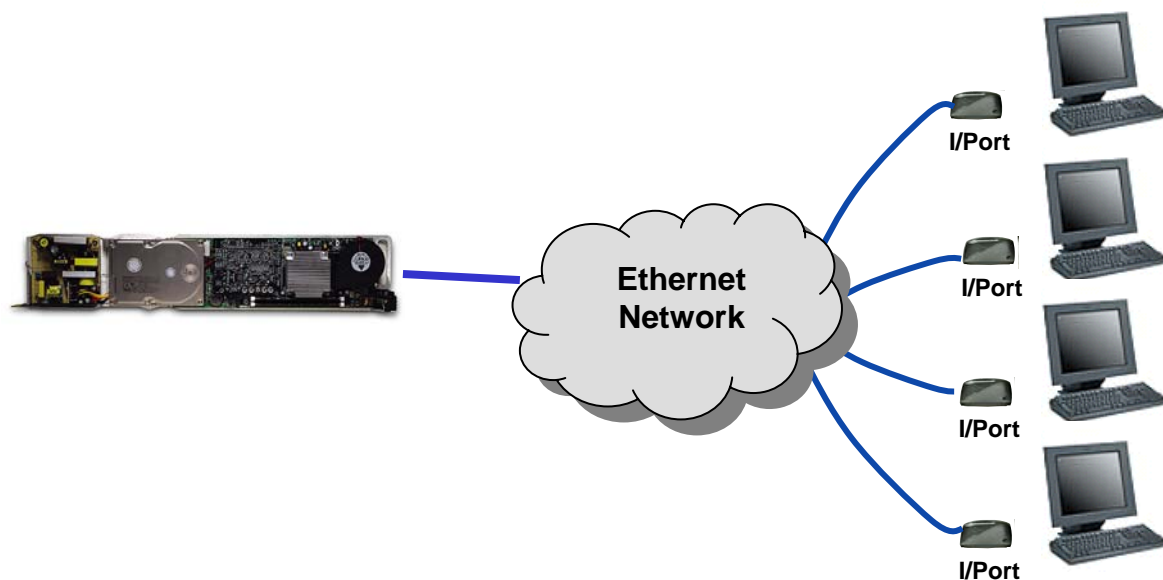


Figure 2. Multiple users connect to a single PC Blade via Ethernet

The core operating system and virtualization software stack required for the configuration shown above is depicted below in Figures 3 & 4 (ClearCube supports two approaches: VMware ESX and VMware Server running on Windows Server 2003). Each virtual machine runs a full instance of Microsoft Windows XP Professional that connects over the network to an individual user connected to an I/Port.

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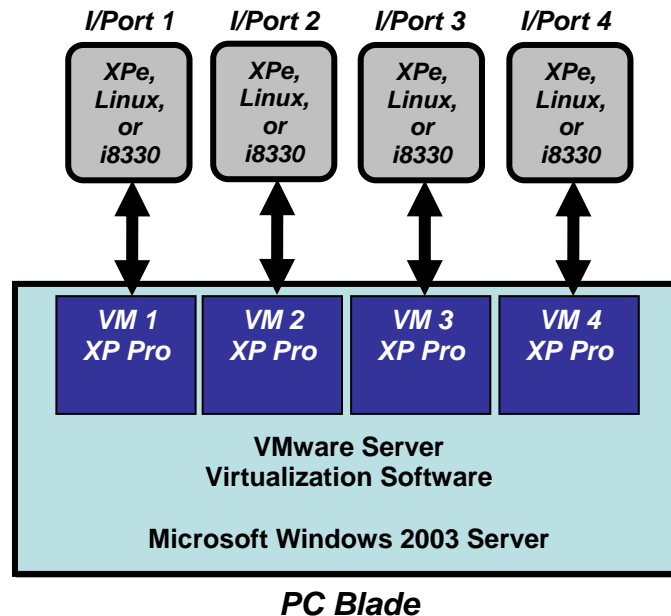


Figure 3. Core operating system and virtualization software stack

Management Software is Critical for PC Virtualization

A key enabling component for the management of the virtual machines created in a PC virtualization environment is the ClearCube Sentral™ management software. Sentral includes the following components that are shown as part of the overall solution in Figure 4:

- **ClearCube Sentral Console** is a centralized software dashboard that works in conjunction with Sentral client instances that are installed on the VMs. Sentral manages Blade/VM assets by indicating health status and enabling configured alerts. Alerts are constructed and configured using an easy to use interface for monitoring such parameters as available hard disk space, installed applications, and memory.
- **ClearCube Sentral Dynamic Allocation module** provides IT administrators with a comprehensive set of features for managing their I/Port environments. Sentral can be used to setup static or dynamic connections between I/Ports, users, and Virtual Machines. Administrators can also switch an I/Port user to a spare VM should they experience a problem. The Sentral I/Port agent presents the end-user with a login screen that automatically populates the target VM information configured in the Sentral management console. Auto discovery of I/Ports and VMs makes it easy to inventory and manage assets. In addition, an update feature deploys driver updates and new applications to I/Port groups.
- **ClearCube Sentral Switching module** is used to manage the main PC blade chassis and host blade hardware. Health of critical hardware components such as Blade and Chassis fans and power supplies as well as internal temperatures can be monitored to ensure uninterrupted operation of the whole system. Sentral's powerful hardware remote control feature gives an administrator the capability to connect directly to any host Blade using ClearCube's unique C/Port technology.

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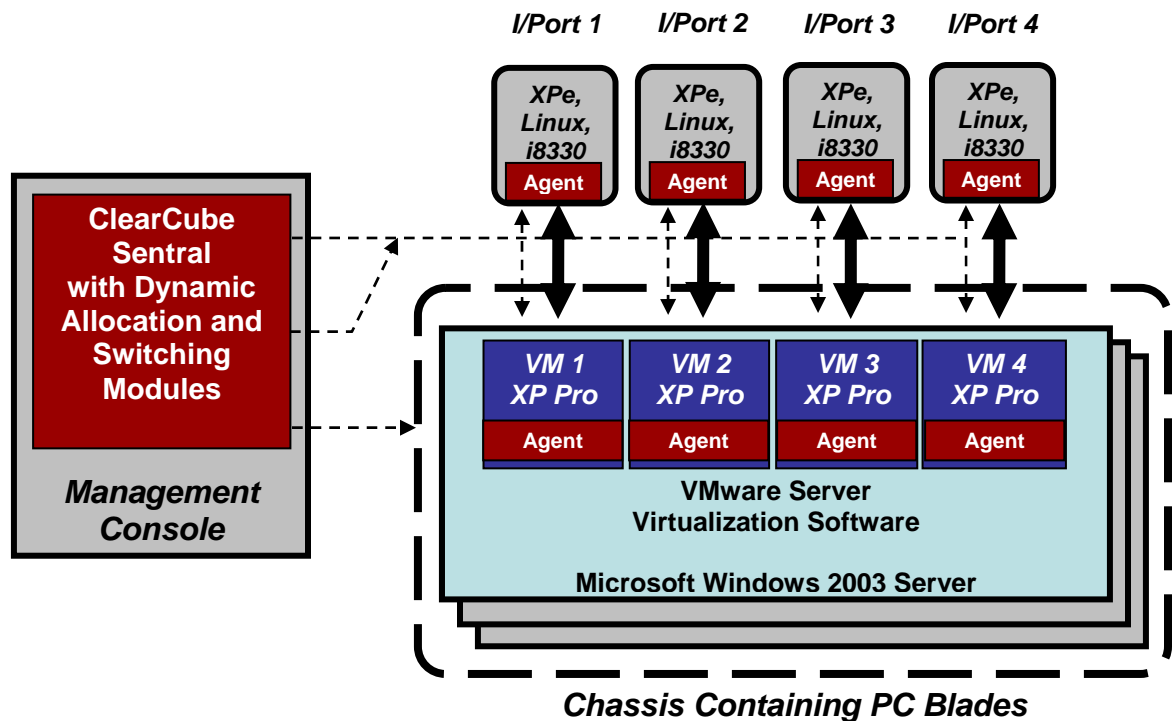


Figure 4. Management Software Components for PC Blade Virtualization

Sources for Solution Components

Customers or resellers can build the solution described above by acquiring the VMware Server virtualization software for free by registering and downloading from VMware (www.vmware.com). The management software, I/Ports, Blades, Chassis, and Windows XP Professional operating systems can be purchased directly from an authorized ClearCube Partner.

Example Deployment Applications

While PC virtualization is not the ideal fit for all desktop deployments, there are many areas where the technology makes sense.

- Task workers, such as help desk and call center professionals that operate in the same low-power applications, including data entry and spreadsheet applications.
- Knowledge workers, such as medical professionals, that require quick bursts of powerful computing resources to conduct their jobs. Applications such as word processing, presentation drafting and standard Internet browsing are ideal for knowledge workers.
- Power users, such as traders in the financial services industry and select government organizations, need full-time access to high-availability and high-power computing resources. These users are often better suited to traditional one-to-one dedicated ClearCube PC blade solutions, as opposed to virtual desktop deployments.

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Task and knowledge workers such as administrative users, data entry users, remote users and any users who intermittently need access to a computer are good candidates for virtualization. Industries well suited to these types of scenarios include manufacturing, healthcare, banking, warehousing, and others. Applications demanding intensive graphics capabilities, multiple screens, and/or generating continuous high CPU loads are still best served by dedicated 1:1 Blades connected with C/Ports or I/Ports. However, as virtualization technology continues to improve, more higher-end applications will be able to reap the efficiencies delivered by virtualization.

For more information on how virtualization technology can be used in your environment, contact ClearCube at 1-800-652-3500.