



Creating a Dynamic Virtual Client Infrastructure with Intel® vPro™ Technology and Microsoft Virtualization Technologies

Today's IT organizations face growing pressures to control costs and manage increasing demands for computing services and service levels. One way to meet these demands is to optimize desktop value by taking advantage of hardware innovations and new software technologies, such as desktop virtualization, to provide advanced levels of desktop performance and efficiency. Such optimization offers immediate and significant cost, efficiency, and productivity benefits. These realities are motivating IT administrators to consider alternative models for deploying and managing client computers and applications.

Intel® vPro™ technology and Microsoft* virtualization technologies together power a cost-effective alternative desktop computing model with Dynamic Virtual Client (DVC) computing. The Intel vision of DVC computing combines centralized application and operating system delivery with execution on local client hardware. Microsoft virtualization technologies enable centralized management of operating system and application images, while Intel vPro technology delivers the processing power users demand and the security and manageability IT organizations require. This best-of-both-worlds approach to desktop computing promotes better desktop performance, improved security, and more efficient energy use. It also gives end users the power and mobility they value, while ensuring that IT retains the security and control of centralized management.



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Do More with Less

In today's ever-changing computing environment, IT managers are often expected to do more with less while maintaining, or even improving, the level of performance and flexibility their companies need to remain agile and competitive.

The increasing challenges IT organizations face include the following:

- Costs and reduced business efficiency associated with IT desk-side repair visits and maintenance calls, especially for large organizations
- A growing number of mobile users who expect immediate and reliable offsite access to services and applications
- Rising energy costs and pressure to consolidate servers to compensate
- An increasing number of applications that demand greater processing power
- Computer security threats that can affect computer performance and the security of confidential data
- Regulatory compliance requirements, such as the demand to protect personally identifiable information

To meet these challenges, IT organizations must assess and develop new and better computing strategies that focus on the varying needs of their companies' business segments. This assessment must recognize that the hardware and software investment decisions made today play a direct role in a company's efficiency, profitability, and survival in the future. By thoroughly assessing their strategies and investment plans, IT organizations can pinpoint inefficiencies in IT management and security as well as limitations in client hardware, application accessibility, and user flexibility.

To proactively resolve these issues, IT organizations can invest in PCs equipped with advanced hardware and empower these computers by using the latest software options. For example, by combining virtualization technologies and advanced hardware capabilities, IT organizations can mitigate many of the problems that traditional client-side models often entail, including IT inefficiency, application compatibility problems, and security threats. Laptop and desktop PCs equipped with Intel vPro technology bring increased performance for multitasking and computing-intensive applications. PCs powered by Intel® Core™ i5 and Core i7 vPro processors also feature Intel® Virtualization Technology (VT), which enhances the Windows XP* Mode experience. Windows XP Mode is a simple yet powerful

productivity tool that enables Windows 7 users to use legacy Windows XP applications. Windows XP Mode transparently brings the benefits of virtualization to end user desktops. Indeed, the wide range of today's virtualization technologies offer IT managers more freedom than ever to select specific features that best serve their company's business objectives and the varied computing needs of end users.

The Dynamic Virtual Client Vision

IT organizations can realize substantial gains in efficiency and end user satisfaction by incorporating comprehensive desktop optimization through advanced hardware and software technologies. The advanced chip-based hardware solutions provided by Intel vPro technology, combined with desktop virtualization technologies, equip IT organizations with the tools they need to move their infrastructures toward optimized desktop computing.

This powerful combination of sophisticated client hardware, manageability, security, and centralized software delivery represents the Intel vision of DVC computing. A DVC infrastructure uses the robust hardware capabilities of Intel vPro technology and Microsoft virtualization and management technologies to enable a combined solution that centralizes management and security while ensuring the performance and mobility advantages inherent in client-side execution. The DVC model thus offers IT organizations a solid way to maximize their desktop infrastructures and connect users with their computing environments. (See Figure 1).

DVC models support desktop optimization by fulfilling IT requirements, business requirements, and end user expectations. They also promote consolidated IT management, enhanced security, and improved end user mobility, responsiveness, and experience.

Organizations that refresh their PC hardware in preparation for a DVC infrastructure can enjoy many benefits. For example, PCs powered by the all new 2010 Intel® Core™ vPro™ processor family can take advantage of intelligent performance and unique hardware-assisted security and manageability features to give you a more optimized desktop environment while providing greater IT control and cost savings. IT organizations that take advantage of the power management and solid computing performance of Intel vPro technology can improve return on investment (ROI) while reducing environmental impact and total cost of ownership (TCO).



Figure 1. Dynamic Virtual Client computing addresses the needs of IT organizations and end users by connecting users with their computing environments.

Planning the Dynamic Virtual Client Infrastructure

When planning and developing a DVC solution, IT managers must consider various organizational components to ensure that the new infrastructure will best serve their business needs. For example, they must fully understand application workload, available computing resources, demand fluctuation, IT responsibilities, and end user behavior if they are to tailor a DVC infrastructure that effectively meets the company's needs.

To ensure this understanding, IT managers must consider a number of business factors. These factors include a company's goals for the new infrastructure and whether the current infrastructure requires extensive investment to meet the computing requirements of a virtualization deployment. Managers must also consider whether the company's applications are suitable for virtualization, and whether end users require specific virtualization features.

When planning a DVC solution, IT managers might consider the following questions:

Regarding IT Responsibilities

- What benefits do we hope to achieve through our virtualization deployment?
- What type of infrastructure does IT staff currently support?
- What security issues do we face (for example, segmented high-security groups or support for mobile users)?
- What are user mobility needs?
- What are our scalability needs?
- What is our plan for remote support and troubleshooting?
- Does the company have mobile users that require alternative asset or access management methods?
- Will a software vendor support an application if it is virtualized?

Regarding Available Infrastructure

- Can physical servers be repurposed as virtualization hosts during the conversion to a virtualized environment?
- What investment in new hardware is required for our data center to support a virtualization infrastructure?
- What network infrastructure investments are required to support the bandwidth demands for application and operating system delivery?

Regarding Application Usage and Workload

- Can an application run well in a virtualized environment?
- Is the application graphics- or video-intensive, which would require additional computing power and bandwidth?
- Are there licensing restrictions against virtualizing the application?
- Does virtualizing the application affect our support agreements with the vendor?

Regarding User Behavior

- Will a virtualized application deliver the native performance and high availability the user expects?
- How do the users work? For example, do users spend the majority of their working hours on a PC, or are PCs used less frequently or infrequently as backup support for other work?

- How do users' computers access the network and the resources they need to do their jobs (for example, via Ethernet, WAN, wireless, or via the Internet)?
- What service level agreements (SLAs) need to be maintained for mobile users?

By carefully considering these and other business questions during the planning stage, IT managers can avoid a costly investment in an inefficient technology, or the development of a solution that fails to adequately support business goals or end user needs.

Intel® vPro™ Technology: the Ideal Platform for a DVC Infrastructure

The enhanced performance, manageability, and security offered by Intel vPro technology make it a key component of an ideal DVC computing platform. By deploying laptop and desktop PCs equipped with the latest Intel Core i5 and Core i7 vPro processors, IT organizations can significantly improve the reach and functionality of the management console and provide advanced support for Microsoft client virtualization options and the DVC infrastructure. In addition, IT organizations that make an up-front investment in Intel vPro technology can ensure a DVC infrastructure that is prepared for a centrally managed, virtualization-ready, and secure operating system rollout when they are ready to migrate to Windows 7.

Intelligent Performance

The all new 2010 Intel Core vPro processor family provides a foundation of solid performance for a DVC infrastructure. Enhancements in Intel Core i5 and Core i7 vPro processors ensure stellar performance for both physical and virtual desktops. Performance-enhancing innovations include the following:

- Intel® Turbo Boost Technology maximizes speed for demanding applications, dynamically accelerating performance to match your workload—more performance when you need it the most and energy savings when you do not.
- Intel® Hyper-Threading Technology enables highly threaded applications to get more work done in parallel. With eight threads available to the operating system, users can run multiple demanding applications more efficiently, improving productivity.
- Intel® HD Graphics provides superb visual performance for sharper images and richer color.

In addition, Microsoft and Intel collaborated during the development of Windows 7* to help optimize Windows 7 performance on Intel processors. If your future desktop infrastructure plans include Windows 7 and virtualization, PCs equipped with Intel Core vPro processors are the best choice.

Enhanced Manageability

IT organizations that invest in hardware equipped with Intel vPro technology can reduce infrastructure complexity and TCO through streamlined management and remote PC support. Microsoft System Center Configuration Manager 2007* delivers native support for Intel vPro technology, including tools to improve system configuration management, software distribution and updates, asset inventory, remote power management, and remote troubleshooting and control.

The remote access and power management capabilities enabled by Intel vPro technology and accessed by System Center Configuration Manager 2007 improve IT response time and cost efficiency while reducing user downtime. In the past, IT organizations spent substantial time and resources managing, updating, and repairing PCs. Now, using System Center Configuration Manager 2007, IT managers can centrally manage Intel vPro technology capabilities across the enterprise—even on out-of-band devices—and can remotely power off devices that are not in use to reduce energy costs.

The use of Intel vPro technology with System Center Configuration Manger 2007 also enables more accurate inventory by gathering information from PCs that are connected to the network through a physical or wireless connection, even when the PCs are powered off. Intel vPro technology allows IT organizations to securely and remotely power up or power down a PC using the integrated out-of-band management console. And now, with hardware-based keyboard, video, and mouse (KVM) control, the latest Intel Core i5 and Core i7 processors enable remote IT technicians to see what their users see through all states (such as operating system blue screen), even beyond the firewall.¹

Hardware equipped with the latest Intel® vPro™ technology allows improved management capabilities, including the following:

- **Enhanced PC repair capabilities through remote, in-band, out-of-band, and secure management options:** Intel vPro technology supercharges out-of-band management with full keyboard, video, and mouse (KVM) control.[‡] Remote IT staff can see what their users see through all states (such as operating system blue screen), even outside the firewall. IT staff can remotely boot the PC to a clean state or view the remote PC's screen, reducing user downtime and costly desk-side visits for most Operating System, boot, and software problems.
- **Improved configuration capabilities that maintain consistent system and product performance**
IT technicians can remotely reset the power and access critical memory and BIOS settings.
- **Persistent event logs that store event information on dedicated memory, not the hard drive**
IT managers can access and review legacy event data for hardware or software problems or repair, even if the hard drive is unavailable.
- **Better monitoring of computer asset inventory**
Asset information is recorded in dedicated memory, allowing IT staff to access a computer at any time to verify software and hardware information and address missing or problem components.

[‡]KVM requires Intel AMT 6.0 and a processor with Intel integrated graphics. Not available on all Intel Core vPro processors.

IT staff can access PCs whether or not a user is available and can securely and remotely manage PCs regardless of location or power state. These centralized management features enable more accurate hardware and software inventories and faster resolution of software and operating system problems. They also allow efficient diagnosis of hardware problems from the System Center Configuration Manager 2007 console (see Figure 2).

Using a secure channel for communication, Intel vPro technology also provides access through standard communication through the operating system or below the operating system through the TCP/IP layer, thus ensuring that an IT organization maintains communication with the PC, even in the event of an operating system or hard drive failure. Additionally, Intel vPro technology works both inside and outside the corporate network. (See Figure 3.)

These communication and power-management features of Intel vPro technology enhance an organization's ability to access and manage PCs from the data center—a key IT requirement as the number of remote clients continues to increase. Because Intel vPro technology allows IT managers to maintain PCs in any location, day or night, and to troubleshoot, update, and repair laptop and desktop computers remotely, the technology enhances IT and end user efficiency and increases cost savings. As a result, resources that were formerly expended on costly desk-side visits can be redirected to business development tasks that add value.

In addition, Intel vPro technology enables faster and easier migration to Windows 7. IT staff can use the asset assessment and power-on/power-off capabilities of Intel vPro technology to determine which machines are candidates for migration. IT can then migrate these machines to the new operating system, regardless of a PC's power state, thereby assuring broader migration for targeted users connected to the network, including the migration of users who work remotely. The improved efficiency of these capabilities delivers significant cost savings and reduced user downtime during the Windows 7 migration process.

Hardened Security

With the abundance of threats today's companies confront, unequivocal IT security is critical. Using System Center Configuration Manager 2007 with integrated Intel vPro technology support, IT managers can reduce threats and improve business continuity and security compliance using remote security capabilities such as Intel® Anti-Theft Technology. These capabilities strengthen encryption and reduce a company's risk of loss due to data theft, even when laptops are lost or stolen.

Remote management and security capabilities available via remote communications channel

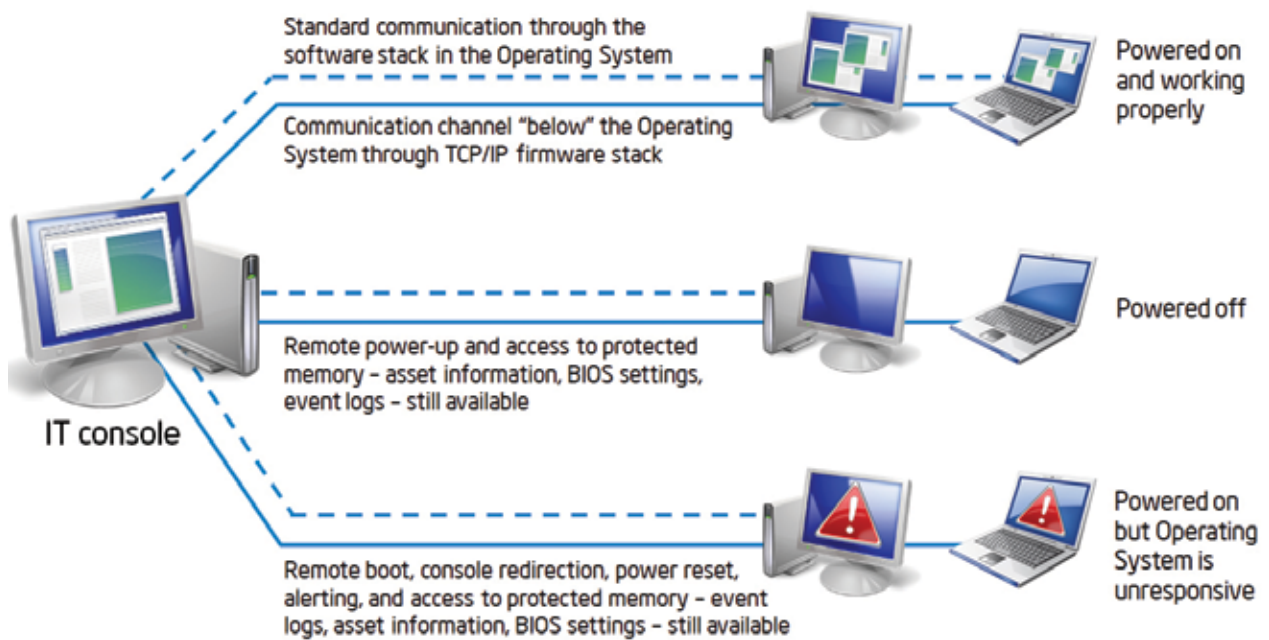


Figure 2. The remote management capabilities of Intel vPro technology improve cost efficiency, IT response time, and inventory management.

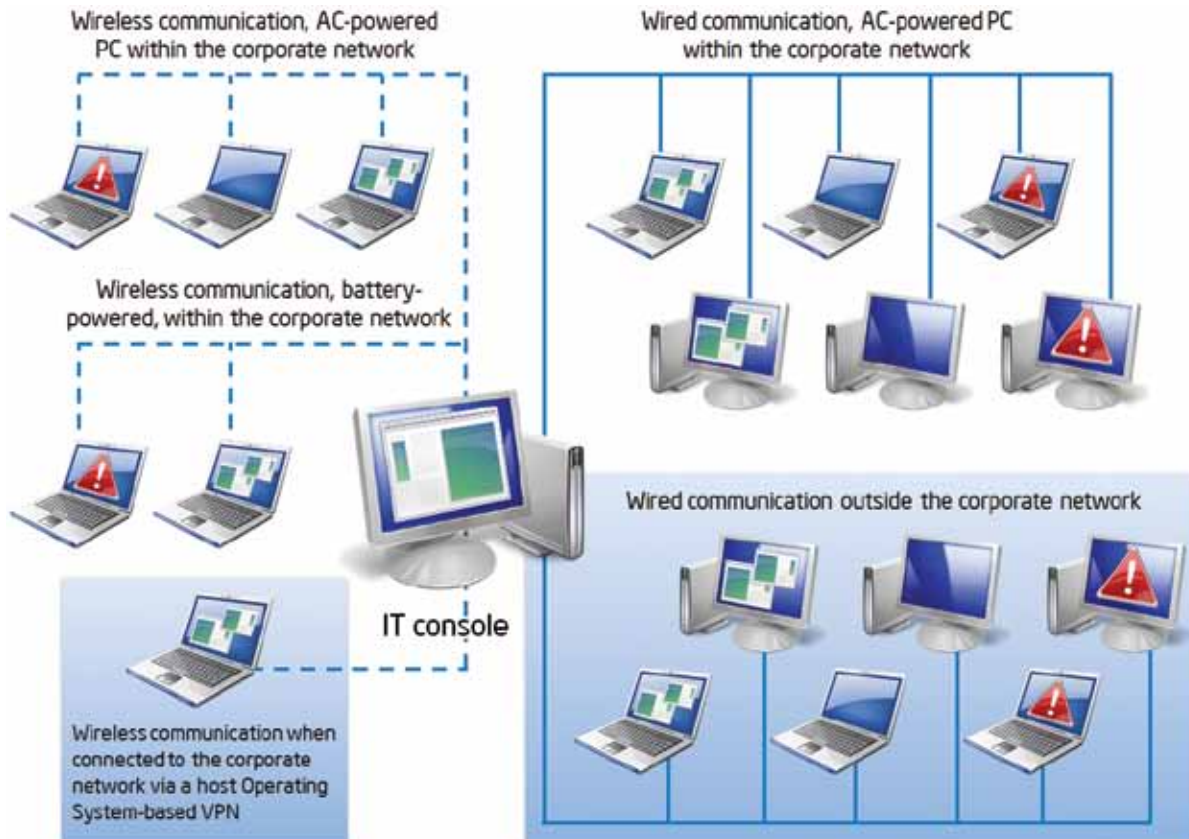


Figure 3. Intel vPro technology works inside and outside the corporate network.

Intel Anti-Theft Technology

With increasing numbers of mobile users outside the secure walls of the workplace, laptop loss and theft will continue to create serious security problems for organizations. Approximately 2 million laptops² are lost or stolen every year, with each loss costing as much as \$49,246 when data breach, lost intellectual property, and other factors are considered.³

Intel Anti-Theft (AT) Technology helps organizations combat the costly risk of sensitive data being compromised. Enabled by Intel vPro technology found in laptops powered by Intel Core i5 and Core i7 processors, Intel AT Technology allows laptops to be disabled if they are lost or stolen so that sensitive data is protected. A local or remote poison pill can delete or block access to software-based encryption keys (or other cryptographic material), thereby disabling access to encrypted data stored on the hard drive. Because the technology is built into the PC hardware, it provides local, tamper-resistant defense that works even if the operating system is re-imaged, a new hard drive is installed, or the laptop is disconnected from the network. Intel AT Technology is effective with or without a connection to the Internet or the corporate network and can detect suspicious behavior or receive a remote theft alert in response to programmable triggers.

Intel vPro technology further enhances security by increasing the speed and penetration of security patching, which enables more protection while reducing user downtime. In a recent study, an organization using Intel vPro technology to remotely power on computers achieved 98 percent patch saturation in four hours versus an average saturation period of five days for PCs that were not equipped with Intel vPro technology.⁴

Administrators can be certain that remote power-on operations are secure. PCs equipped with an Intel Core i5 vPro or Intel Core i7 vPro processor create a secure out-of-band communication tunnel to the IT management console using TLS with 128-bit AES encryption and RSA keys with modulus lengths of 2,048 bits. Because the encrypted communication is out-of-band, the PC's hardware and firmware receive magic packets before network traffic reaches the software stack for the operating system. Because the encrypted communication occurs "below" the operating system level, it is less vulnerable to attacks by viruses, worms, and other threats that typically target the operating system level.

Increased Security with Windows 7

In addition to the hardened security discussed above, the complementary security technologies in Windows* 7 Enterprise and the all new 2010 Intel Core vPro processor family help enhance data protection and compliance, building your foundation for an optimized desktop environment.

Furthermore, Windows* 7 Enterprise Crypto APIs take full advantage of the six new instruction sets in the 2010 Intel Core i5 vPro processor that encrypts sensitive data up to 3.5 times faster.^{5,6}

These hardware-assisted security and management capabilities of Intel vPro technology enhance an IT organization's ability to maintain and protect business PCs. Combined with the virtualization features of DVC computing, these capabilities give managers the centralized control they need for optimized desktop computing.

Energy and Cost Savings

Companies investing in PCs that use Intel vPro technology can significantly lower power consumption now and into the future. Using Microsoft System Center Configuration Manager 2007 to support the Intel vPro technology remote power-management options, IT managers can power down PCs when the PCs are not in use (such as overnight), which has been shown to reduce a company's energy costs by up to 50 percent.⁷

Computacenter is one company that is capitalizing on these energy savings. Computacenter chose to deploy PCs equipped with Intel vPro technology as part of its transition to Windows 7. New opportunities to reduce power consumption were a large part of its motivation. With the combination of the intelligent power-saving features of Intel vPro technology, Intel processors, and Windows 7, Computacenter's mobile workforce is able to conserve power and battery life, remain at work longer, and achieve more results.⁸

Selecting Microsoft Client Virtualization Technologies

Microsoft virtualization technologies offer organizations more choices than ever for developing a DVC infrastructure that delivers the advantages of an alternative computing model. A DVC infrastructure that combines Intel vPro technology with the accessibility and management features of Microsoft virtualization technologies enables optimized desktop computing that

Microsoft Client Virtualization Technologies

- **Microsoft Enterprise Desktop Virtualization (MED-V)*** works with Microsoft Virtual PC* to enable deployment and management of virtual Windows* desktops in enterprise scenarios.
- **Microsoft Application Virtualization (App-V)*** virtualizes applications for delivery to the end user client in a sandboxed environment so that native applications or even other virtual applications are isolated from one another.

improves IT efficiency, enhances user mobility and productivity, consolidates data center infrastructure, and reduces costs. In addition, through DVC computing, IT organizations can develop a mixed-model strategy that delivers focused, comprehensive solutions to address a complete set of IT and user requirements.

A DVC model might incorporate only one virtualization technology—an appropriate strategy when security, management, and workload requirements are unlikely to change over time. Or it might involve a mix of virtualization technologies to ensure flexibility for users whose needs are dependent on their current environment, workload, or location. For example, IT organizations whose end users require flexibility and mobility can develop solutions that incorporate a managed, client-side virtualization technology, which provides local execution power for graphics- or computing-intensive applications. In contrast, server-side execution provides limited graphics support, and computing-intensive applications are restricted by the number of virtualized clients on the hosting server.

An optimized DVC infrastructure can effectively serve an IT organization's unique and varied business needs by incorporating the Microsoft Enterprise Desktop Virtualization (MED-V) or Microsoft Application Virtualization (App-V)—two of the six virtualization technologies provided by the Microsoft Desktop Optimization Pack (MDOP)*. Both MED-V and App-V provide server-based deployment with client-side execution and local data storage.

MED-V delivers the benefits of a centrally managed dynamic virtual enterprise, which include improved IT efficiency, better security and maintenance, and increased user accessibility and scalability. IT organizations can use MED-V to increase business flexibility when migrating corporate users to a new version of Windows. Because these solutions run older productivity applications inside a Windows XP virtual machine, IT organizations enjoy the benefits of the stable operating system while supporting legacy applications. In addition, this virtualization technology is client-hosted and does not require the server resources or constant connectivity that server-based approaches, such as VMware VDI*, require.

App-V provides the advantages of real-time, on-demand delivery of rich applications to multiple user locations and PCs; improved and faster recovery of applications in the case of desktop failure; and enhanced tracking of application usage to better manage license compliance. Some of the key benefits derived from App-V include the following:

- **Immediate cost savings** by reducing the need for app-to-app compatibility testing
- **Dramatically increased business agility** due to the ability to deploy full applications and updates with no application installations or user interruptions
- **Improved business continuity** that enables quick recovery of PCs. With App-V, applications are available on the new PC, with no need for re-installation
- **Anywhere access to applications** on any authorized PC, online or offline, without application installations

When coupled with the remote access and power management features of Intel vPro technology, App-V and MED-V incorporate “best of both worlds” results to broaden an IT organization's capabilities and service. By combining hardware equipped with Intel vPro technology with one or both of these Microsoft technologies, IT managers can develop a DVC infrastructure with the proven advantages of local performance, security, and mobility while maintaining centralized management and control of users' PCs.

Microsoft Enterprise Desktop Virtualization

IT organizations updating their client operating systems frequently face migration challenges and delays due to incompatible applications. These compatibility hurdles can extend the migration process, sometimes by weeks, reducing IT efficiency and increasing user downtime.

MED-V is a virtualization technology that can solve this problem. MED-V works with Microsoft Virtual PC, a hypervisor that runs on Windows operating systems, to enable deployment and centralized management of Windows virtual machines on client computers in enterprise scenarios. Virtual PC uses the processing power of the local computer, and is further enhanced by Intel® Virtualization Technology (Intel® VT), which offloads overhead from Virtual PC to the processor, providing near-native performance of the virtual machines. This pairing of central creation and management of virtual machines with local execution allows enterprises to run legacy applications on a new operating system.

Available as part of the MDOP suite of technologies, MED-V establishes an IT-configured and customized virtual machine and adjusts the settings of Virtual PC to the specific parameters of the virtual machine (for example, the amount of memory available and network settings). Finally, MED-V allows IT organizations to centrally monitor and troubleshoot the virtual machines deployed in the environment.

The latest version of MED-V, MED-V 2.0, also supports deployment of virtual machines onto Virtual PC 2007, the latest version of Virtual PC included with the Windows 7 operating system. Virtual PC 2007 is enhanced by hardware-assisted virtualization, such as Intel VT. MED-V 2.0 also supports deployment of virtual machines running Windows 7. Working with Virtual PC 2007, MED-V 2.0 allows IT to distribute legacy applications to client computers running Windows 7, via a virtual machine, and expose those legacy applications to the Windows 7 start menu for seamless operation by the end user. This latest version of MED-V will help to improve migration efficiency for IT organizations as the transition to Windows 7 increases.

How It Works

MED-V allows enterprises to centrally prepare and manage virtual machines for execution on client computers. These virtual machines contain an operating system, applications, and associated support tools. Legacy applications inside the

virtual machines can be exposed to the Windows 7 Start menu; however, they run inside the virtual machine, avoiding conflict with the host operating system and applications running on the host.

Using the virtual management and control features of MED-V in a DVC infrastructure ensures that IT organizations can avoid the delays commonly caused by application compatibility problems and can deploy a new operating system faster and more easily than would be possible through traditional methods.

IT managers can create and test a virtual machine using the MED-V management console. The console allows IT managers to define a MED-V workspace, which associates the virtual machine with specific end users, IT-directed usage policies, and data-transfer permissions.

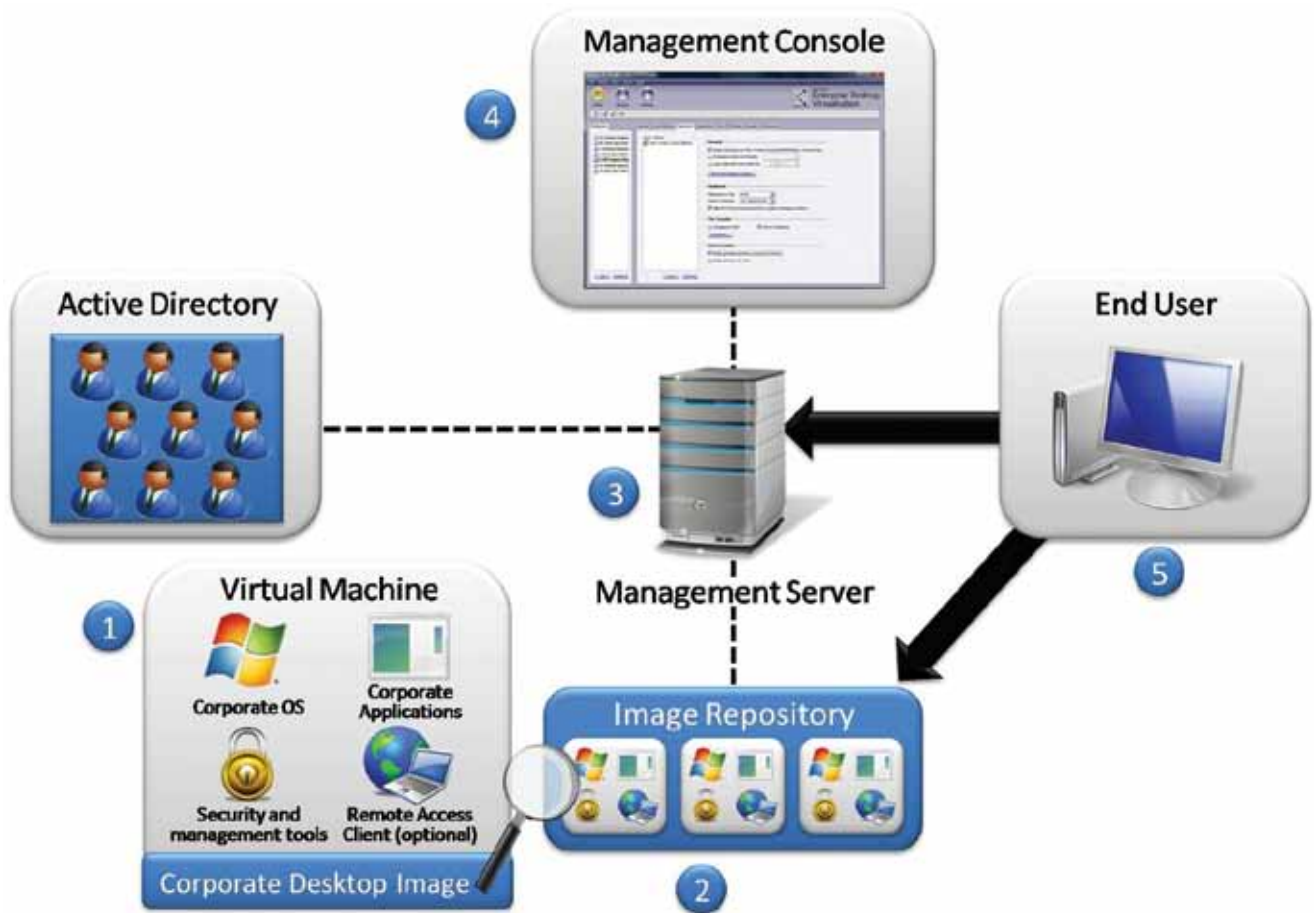
Once testing within the management console is completed, IT managers load the virtual machine into the MED-V image repository, which houses all the virtual machine images created with MED-V. Client PCs can then receive the virtual machine from MED-V in one of two ways:

1. The clients can be updated with the MED-V client software, authenticated against the MED-V management server, and provided access to the image repository, where they can download the virtual machine to the client PC.
2. IT can deploy the image to the host machine through Microsoft System Center Configuration Manager 2007*.

After the virtual machine is downloaded to the PC, the user can use Virtual PC to launch the virtual machine and its virtualized operating system and applications, with all computing occurring locally on the client PC. The virtualized computing experience is transparent to the user because applications virtualized with MED-V appear on the host system's Start menu. When combined with Intel VT, the performance of the virtual machine and the applications running in it are enhanced, providing end users with an optimized experience.

IT Features

MED-V addresses many of the IT challenges associated with deploying new operating systems and managing applications and brings extensive centralized management benefits. These benefits include enhanced deployment and provisioning options for virtualized applications across the enterprise and improved management and monitoring features for deployed virtual machines.



Microsoft MED-V Architecture

The high-level architecture of MED-V is a virtual machine containing a full desktop environment, including an operating system, applications, and management and security tools; a management console; an image repository that stores and provides access to the virtual images; a management server; and the end user client computer.

Using the centralized management features of the MED-V management console, IT organizations can direct and update usage policies, data control permissions, and Web redirection settings. These centralized controls prevent unauthorized execution of virtual machine images and ensure that virtualized applications and operating systems are updated with current security patches and are compliant with applicable regulations.

IT managers can also use MED-V to adjust virtual machine memory allocation based on a client's available RAM (so that an application does not monopolize PC resources), to update

applications on a virtual machine, and to deploy updated applications to the enterprise clients. These centralized management capabilities reduce interruptions to the end user, improve business continuity and employee productivity, and ensure greater security and patch saturation.

In addition, the MED-V management console features diagnostic tools that record detailed information on all client events and virtual machines, allowing IT departments to assess, respond to, and repair problems with the virtual machines from the centralized location.

MED-V requires Virtual PC to run the virtual machines on the client computer. The latest version of Virtual PC, Virtual PC 2007, in turn requires hardware-assisted virtualization, such as Intel VT.

End User Features

By integrating the virtual machine onto the native desktop, MED-V improves the end user experience by providing a seamless transition to virtualization technology. The applications running in the virtual machines are listed alongside native desktop applications on the client Start menu. This familiar user interface promotes user adoption, increases the usability of the new technology, and lets users transparently maneuver between native and virtualized programs.

By simplifying the user experience, this single desktop format can increase user productivity and reduce the need for extensive training or changes to the user's normal work habits. MED-V also enhances user scalability and mobility by allowing users access to virtual images from multiple user locations and PCs via Microsoft Remote Desktop Protocol*.

Microsoft Application Virtualization

The ever-growing number of applications and the increased diversity of use cases complicate the management of software. Because traditional computing models require that an application be run on a compatible operating system hosted on an individual client, IT organizations face an array of compatibility challenges. Complex implementation and maintenance of applications on individual clients drain IT resources because of the lengthy testing processes required to confirm application compatibility.

Microsoft offers IT organizations an option for avoiding application incompatibility problems. Available as part of the MDOP suite of technologies or as a stand-alone application, App-V virtualizes applications for delivery to the end user client in a sandboxed environment so that native applications or even other virtual applications are isolated from one another.

How It Works

IT managers can sequence normal applications into virtualized applications, which are delivered through the App-V Sequencer* as .msi files to host PCs. The applications can be delivered on removable media such as USB, CD, or DVD devices, or through the Microsoft System Center Application Virtualization Streaming Server* (using Real-Time Streaming Protocol), which streams virtualized applications in real time to the end user's PC.

To optimize desktop computing and deliver the benefits of a centralized management solution in a DVC infrastructure, IT organizations should use the dynamic streaming format of the App-V Streaming Server. Using this distribution model, IT managers can load and store applications in virtual capsules on the centralized streaming server and stream the capsules to the client on demand.

Virtualized applications are cached on the end user's PC, providing the user with a rich and robust experience even when offline. Application compatibility issues are resolved because App-V isolates the virtualized application from other applications installed on the native desktop.

Operational Features

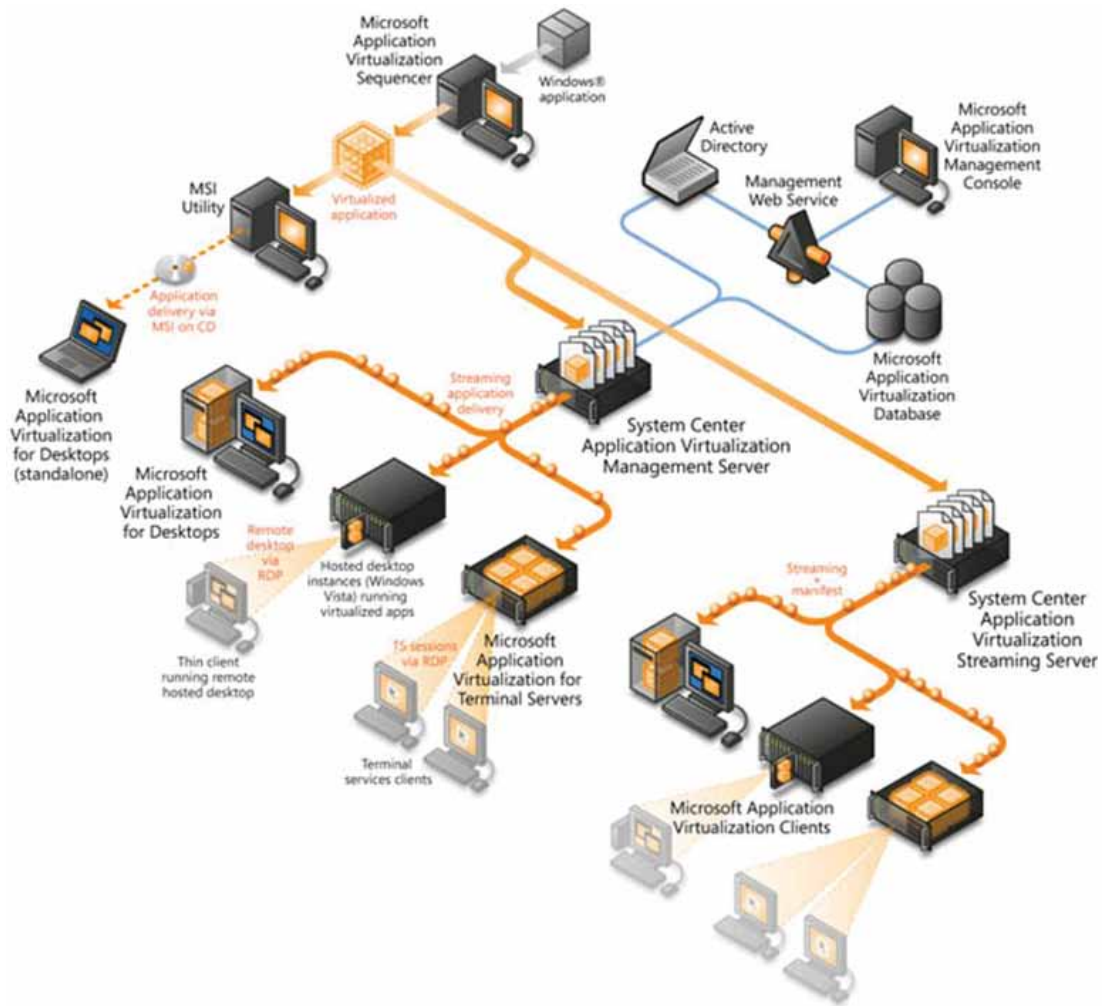
App-V offers IT organizations key features that benefit their business and end users. Using App-V, organizations can run multiple applications on a PC without the typical compatibility conflicts frequently encountered with traditional computing models.

Because App-V virtualizes applications so that they run separately from the native desktop, native applications, and other virtualized applications, App-V can eliminate application-to-application incompatibility. As a result, IT departments can conduct fewer test cycles and accelerate application deployments.

IT Features

The centralized management features of App-V enhance an IT department's ability to configure, manage, and update virtualized applications from one location. IT managers perform maintenance, security, and configuration tasks from the App-V centralized server. This ability to manage applications and conduct central-server updates ensures that streamed applications contain the latest features and security patches.

Quite simply, App-V allows IT departments to complete security refreshes and operating system and application migrations in a more automated and less time-consuming fashion. Moreover, because App-V caches the virtualized application on the client PC, IT departments can perform maintenance, updates, and repair tasks without interrupting the end user. The enhanced manageability of virtualized applications in App-V ensures increased IT efficiency, improved cost control, and business continuity.



Microsoft App-V Architecture

The Microsoft App-V architecture consists of the App-V Sequencer*, used by IT managers to virtualize desktop applications; the Microsoft System Center Application Virtualization Streaming Server*, a centralized server that stores the virtualized applications and streams them to the end users' PCs; and the end-user's client PC, which receives and runs the streamed applications and caches them for local use.

Another benefit of App-V is improved disaster recovery. Because App-V stores applications on the centralized server, IT organizations can quickly restore applications after a disaster. Instead of spending time reloading applications to individual PCs in the event of a failure, loss, or theft of a computer, IT departments can use App-V to simply redeploy the applications to another computer without needing to dispatch a technician.

End User Features

Companies that incorporate App-V into their DVC infrastructures give users easy access to their applications without the risk of application incompatibilities. In addition, the streaming capability of App-V ensures that users receive fast, on-demand access to applications while also enjoying the benefits of application cache—key productivity applications are available whether users are online or offline.

The streaming delivery options of App-V also give users improved access to applications from various computers and locations, providing the increased mobility, scalability, and flexibility users need to stay productive. App-V also integrates virtualized applications on the client desktop, which provides users with a familiar PC interface and a better end user experience.

Business Scenarios

The following sections illustrate various DVC computing models to assist decision makers when selecting the combination of virtualization technologies that best suits their IT organization's needs.

Business Scenario 1: Marketing Agency

A mid-sized marketing agency has more than 400 employees, including account managers, graphic designers, video editors, media buyers, and administrative and accounting staff. Most employees work daily at the main business location; however, the account managers travel often to meet with clients. The agency's heavy workload and tight deadlines require that staff put in frequent overtime, which most employees handle after hours from their homes. (See Figure 4.)

Profile: Marketing agency with 400+ employees

Requirements:

- Rich applications
- Multiple versions of applications
- Remote access for users

Solution:

- Intel® vPro™ technology
- Microsoft App-V
- Configuration Manager 2007

Business and User Requirements

The marketing agency's business requirements for DVC infrastructure include rich applications, multiple versions of applications, and remote access for users. The graphics and editing departments use applications that are computing intensive, graphics heavy, and involve a high processing load.

These departments also use a number of different applications to complete their projects and require immediate access and ease of use to ensure that they meet their deadlines.

In contrast to the graphics and editing employees, the media buyers, account managers, and administrative and accounting staff use standard business applications. Recently, the IT administrator upgraded the agency's media buying group to a new version of its primary software. Although this upgrade has improved the media department's efficiency when estimating ad space costs for clients, many of the clients still prefer the previous version of the presentation software and save the presentation files in the older format. Therefore, the agency buyers must be able to run the previous version of the software on their desktops to serve their clients effectively. From a hardware perspective, most of the agency's employees work on desktop PCs and maintain similar systems in their homes; however, the agency's account managers work on laptops and access the network remotely when traveling.

Supporting Technology—Microsoft App-V

The remote management capabilities of Intel vPro technology and the streaming capabilities of App-V provide ideal options to meet the marketing agency's computing needs. Using System Center Configuration Manager 2007 with Intel vPro technology-enabled hardware, the IT staff can ensure that the account managers' laptops are updated with the current security patches and can service issues remotely, thereby improving user productivity and reducing downtime. Moreover, laptops equipped with Intel vPro technology feature advanced security options and extended battery life, which benefits the marketing agency's mobile users.

Intel vPro technology's remote management features also reduce downtime and increase IT efficiency for onsite workers because the power-up/power-down options of Intel vPro technology allow IT technicians to complete critical tasks outside a user's normal business hours.

Finally, by converting applications into virtual services that can be run on demand by the agency's graphics and editing departments, the IT staff can manage and host these applications centrally, improving employee access and productivity and reducing complexity in deployment, management, and updates. The marketing agency's IT staff can also use App-V to stream the legacy versions of estimating software for use by the agency's media department.

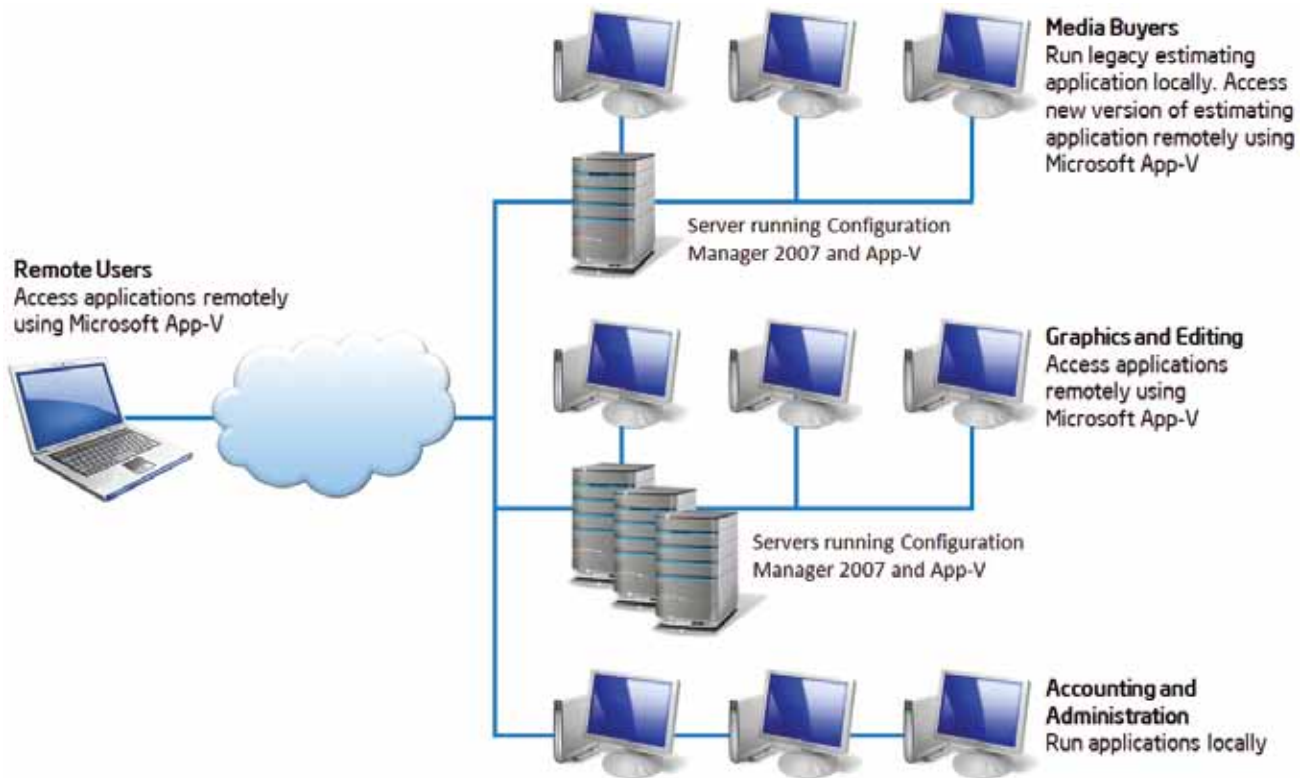


Figure 4. Business Scenario 1: Marketing Agency

Because App-V allows the virtualized applications to run in their own environment on the end user client PC, the technology reduces the application footprint on the operating system, thus eliminating application conflicts between software versions. This elimination of application conflicts is instrumental in reducing IT operating expenses, and there is no need for migration or testing of the applications prior to upgrade.

In addition, App-V protects business continuity by giving employees access to the virtualized applications from their home computers. Instead of remaining in the office to complete overtime work, employees with desktop computers in the office can access the streamed applications from a desktop computer environment in their homes. Employees with laptop computers can take advantage of the cache capabilities of App-V and continue work that they began in the office from an offsite location.

Overall, a combined-technology solution of App-V and Intel vPro technology would provide an optimized DVC infrastructure that supports all of the marketing agency's end users. Beyond the application streaming benefits outlined above, an investment in hardware with Intel vPro technology would provide employees

with PCs that have improved performance for computing-intensive programs, a requirement for applications that have a high graphics load.

Business Scenario 2: Nationwide Accounting Firm

A nationwide accounting firm employs more than 600 professionals in 28 locations and serves approximately 200,000 business and individual clients per year. The accountants work on desktop PCs using a variety of accounting applications and handle clients' proprietary business information (PBI) and personally identifiable information (PII) on a daily basis. This work is conducted mainly onsite in office locations (See Figure 5, next page). The firm is supported by seven regional IT organizations, with employees that spend a great deal of time traveling and servicing individual office and desktop environments.

Business and User Requirements

The primary challenge for the accounting firm is IT support of the desktops at individual locations, which is very costly due to travel for IT technicians. In addition, IT managers have limited control of individual desktops, and maintaining security and asset inventory is difficult.

Profile: Accounting firm with 600+ employees

Requirements:

- Remote access
- Security
- Asset inventory
- Application compatibility

Solution:

- Intel® vPro™ technology
- Microsoft MED-V

The firm also recently upgraded to the Windows 7 operating system, which is creating application conflicts for some of the legacy applications the accountants use on a daily basis. The accountants need the applications to work as expected so they can provide efficient services to clients, and the applications must have updated security to protect PBI and PII. Most of the employees work onsite, so mobility is not a concern.

Supporting Technology—Microsoft MED-V

A DVC solution incorporating MED-V would enable the IT staff to deploy virtualized enterprise desktops for access by the accounting staff. This scenario would improve the user experience, significantly reduce the need for desk-side visits for updates and repair, and provide the IT staff with better control

and management of the desktop environment. In addition, because IT administrators can manage the content, access, and security of the virtual machines through the MED-V management console, users would have access to updated applications and operating systems each time they use the virtual machine.

Because MED-V can encapsulate the operating system and applications in the virtual machines, the accountants will be able to run virtualized systems on their desktop computers alongside native applications. This capability reduces the application conflicts currently experienced when the accounting professionals run legacy applications that are incompatible with the new Windows 7 operating system. MED-V also integrates the virtualized machine’s applications onto the user desktop so that applications running on the virtual machines appear the same as those running on the host computer, thus alleviating the need for additional training on the new technology for the accounting firm staff.

Incorporating Intel vPro technology into a DVC infrastructure that uses MED-V can bring additional security and manageability to the accounting firm’s IT staff. With the firm’s IT assets spread throughout its many locations, the remote manageability of Intel vPro technology could enable improved IT service and maintenance and better asset management. More importantly, the firm can protect its business data and its customers’ personal information with hardware-based security that can render data inaccessible in case of loss or theft.

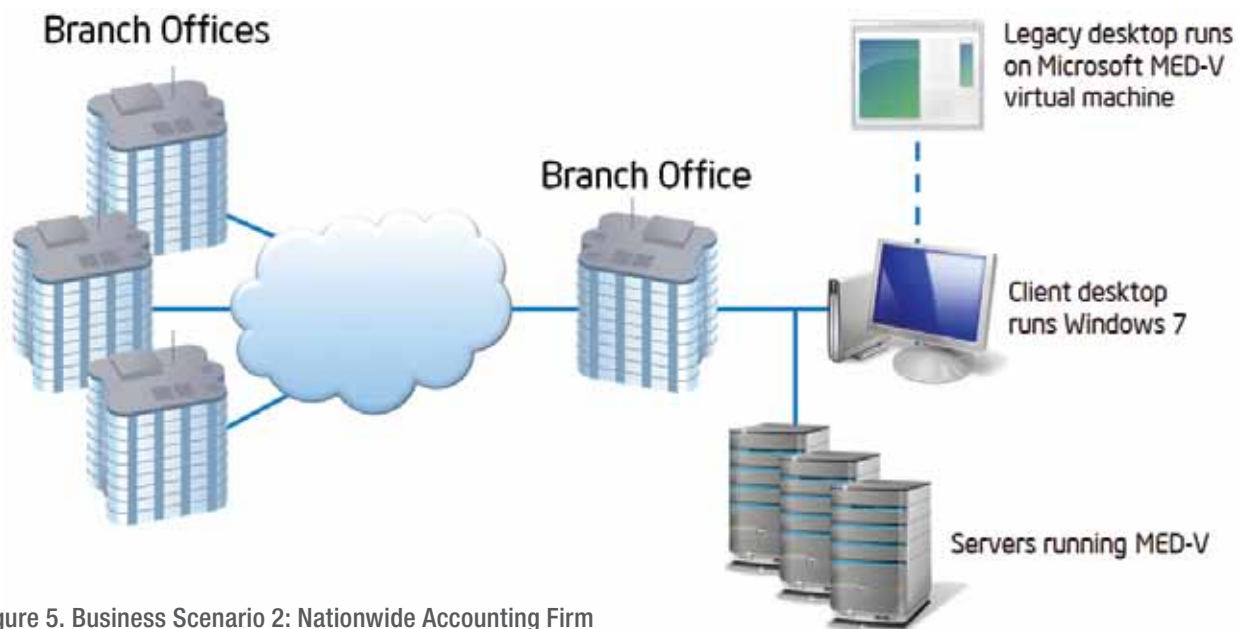


Figure 5. Business Scenario 2: Nationwide Accounting Firm

Summary

Today's IT organizations can take advantage of alternative computing solutions that address many of the challenges created by traditional computing infrastructures, including:

- Excessive IT costs and reduced business efficiency
- Growing numbers of mobile users
- Advanced security threats
- Risks due to data loss
- Increasing compliance requirements

The Intel vision of DVC computing mitigates these challenges by combining centralized application and operating system delivery with client hardware execution to enable improved and more efficient IT management and to extend the power and flexibility of client-side execution.

DVC computing uses the advanced hardware capabilities of Intel vPro technology in concert with Microsoft virtualization technologies such as App-V and MED-V to enable a “best-of-both-worlds” approach to software and hardware management. This approach enhances desktop performance, reduces costs, and allows broader policy-based control for IT organizations. By deploying laptop and desktop PCs equipped with the latest Intel Core i5 and Core i7 vPro processors, IT organizations can improve the reach and functionality of the management console and ensure advanced support for Microsoft client virtualization options and the DVC infrastructure. Hardware equipped with the latest Intel vPro technology offers:

- Enhanced PC repair capabilities through remote, in-band, out-of-band, and secure management options—including KVM
- Configuration capabilities that maintain consistent system and product performance in physical and virtual environments
- Monitoring of computer inventory
- Hardened security options
- Energy savings

The Microsoft virtualization technology MED-V works with Microsoft Virtual PC to enable deployment and management capability of virtual Windows desktops in enterprise scenarios. Microsoft App-V virtualizes applications for delivery to the end user client, isolating native applications or virtual applications from one another to reduce compatibility conflicts.

IT organizations that invest now in a DVC infrastructure will be prepared for a centrally managed, virtualization-ready, and secure operating system rollout to Windows 7. IT organizations can use the asset assessment and power-on/power-off capabilities of Intel vPro technology to determine which machines are candidates for migration, and can then migrate these machines to the new operating system regardless of a PC's power state. This capability assures a broader migration across the enterprise for both local and remote users. In addition, Intel VT, a component of Intel vPro technology, increases business flexibility when migrating corporate users to Windows 7. It enhances end user experience when running older productivity applications inside a Windows XP virtual machine on their Windows 7 desktops, allowing users to enjoy the benefits of Windows 7 while supporting legacy applications.

By deploying one or both Microsoft virtualization technologies and coupling them with the advanced hardware capabilities of Intel vPro technology, IT organizations can develop a DVC architecture that meets the dynamic computing needs of the business now and into the future.

Related Links

<http://communities.intel.com/docs/DOC-1494.pdf>

Footnotes

1. KVM requires Intel AMT 6.0 and a processor with Intel integrated graphics. Not available on all Intel Core vPro processors.
2. Processor, May 19, 2006
3. Ponemon Institute, April 2009
4. Calgary Health Region ROI Case Study available at <http://communities.intel.com/servlet/JiveServlet/downloadBody/1755-102-1-2207/320198-001US.pdf>
5. Advanced Encryption Standard New Instructions (AES-NI) is a set of instructions that consolidates mathematical operations used in the Advanced Encryption Standard (AES) algorithm. Enabling AES-NI requires a computer system with an AES-NI-enabled processor as well as non-Intel software to execute the instructions in the correct sequence. AES-NI is available on Intel® Core™ i5-600 Desktop Processor Series, Intel® Core™ i7-600 Mobile Processor Series, and Intel® Core™ i5-500 Mobile Processor Series. For further availability of AES-NI enabled processors or systems, check with your reseller or system manufacturer. For more information, see http://softwarecommunity.intel.com/isn/downloads/intelavx/AES-Instructions-Set_WP.pdf
6. (Cross Client) Cross client claim based on lowest performance data number when comparing desktop and mobile benchmarks. Configurations and performance test as follows:

(Mobile) Comparing pre-production Intel® Core™ i5-520M processor-based laptops to theoretical installed base of Intel® Core™ 2 Duo processor T5500. Laptop system configurations: Intel® Core™ i5-520M (3MB Cache, 2.4 GHz), with Intel® Turbo Boost Technology and Intel® Hyper-Threading Technology on pre-production Intel® Ibox Peak HM55, Dual-channel Micron* 4GB (2x2GB) DDR3-1066 7-7-7-20 with Intel® Graphics Media Accelerator HD graphics, Hitachi* 320GB HDD, Intel® Matrix Storage Manager 8.9.0.1023 (BIOS, Intel® INF and Graphics: pre-production, Imon compliant with VRD 11.1 requirements), Microsoft* Windows* 7 Ultimate 64-bit RTM. Intel® Core™ 2 Duo processor T5500 (2MB Cache, 1.66 GHz, 667 MHz FSB) in Lenovo* Thinkpad* T60 laptop, Mobile Intel® 945GM Express Chipset, Micron* PC5300 DDR2 667 2x1GB 5-5-5-15 memory, Intel® GMA 950 graphics 224MB Dynamic video memory technology, Hitachi* Travelstar* HTS721010G9SA00 SATA 100GB 7200RPM HDD, BIOS Lenovo* 79ETD7WW 2.17 with default settings, Microsoft* Windows* Vista Ultimate. Business productivity claims based on SYSmark* 2007 preview is BAPCo's latest version of the mainstream office productivity and Internet content creation benchmark tool used to characterize the performance of the business client. SYSmark 2007 preview features user-driven workloads and usage models developed by application experts. Multitasking claims based on financial calculations workload consisting of advanced spreadsheet calculation measured using Microsoft* Excel* Monte Carlo Simulation plus Virus Scan. Security workload consists of Winzip*12 decompressing an encrypted archive containing 200 photos, 125 of which are 10MP photos and 75 which are 6MP photos. The photos are in jpeg format. The total size of all the photos is about 830MB.

(Desktop) Comparing pre-production Intel® Core™ i5-650 processor based desktops to theoretical installed base of Intel® Core™2 Duo Processor E6400 with comparable frequency. Desktop configurations: pre-production Intel® Core™ i5-650 processor (4MB Cache, 3.20 GHz) on pre-production Intel® Ibox Peak P55, Dual-channel DS Micron* 4GB (2x2GB) DDR3-1333 9-9-9-24 with Intel® Graphics Media Accelerator HD graphics @ 900 MHz, Seagate* 1TB HDD, Intel® Matrix Storage Manager 8.9.1023 (BIOS, Intel® INF and Graphics: pre-production, Imon compliant with VRD 11.1 requirements), Microsoft* Windows* 7 Ultimate 64-bit RTM Intel® Core™2 Duo Processor E6400 (2M Cache, 2.13 GHz, 1066 MHz FSB) on Intel® DQ45CB, Dual channel DS Micron* 2GB (2x1GB) DDR2-800 5-5-5-18 with Integrated Intel® GMA 3000 onboard graphics subsystem, Seagate* 320GB HDD, (BIOS:0059, Intel® Chipset INF: 8.4.0.1016, Graphics: 7.14.10.1329), Microsoft* Windows* 7 Ultimate 64-bit RTM, Microsoft* Windows* Vista Ultimate 32-bit. Business productivity and energy claims based on SYSmark* 2007 preview is BAPCo's latest version of the mainstream office productivity and Internet content creation benchmark tool used to characterize the performance of the business client. SYSmark 2007 preview features user-driven workloads and usage models developed by application experts. Multitasking claims based on financial calculations workload consists of advanced spreadsheet calculation measured using Microsoft* Excel* Monte Carlo Simulation plus Virus Scan. Security workload consists of Winzip*14 decompressing an encrypted archive containing 200 photos, 125 of which are 10MP photos and 75 which are 6MP photos. The photos are in jpeg format. The total size of all the photos is about 830MB.
7. University of Plymouth ROI case study <http://communities.intel.com/openport/docs/DOC-1494>
8. Computacenter participates in Windows® 7 First Wave Program – final rollout will be based on Intel® vPro™ technology Case Study.

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