

# The All New 2010 Intel® Core™ vPro™ Processor Family and Windows® 7: Your Best Choice for Business PCs

**Increasing Performance, Security, and Manageability on Desktops and Laptops with the all new 2010 Intel® Core™ vPro™ Family and Windows® 7**

## **Abstract**

Technical decision makers are faced with many challenges in today's economy: help users get more work done faster and with fewer difficulties, protect the network and individual systems from attacks or malicious code, and reduce administrative overhead and the associated costs. The underlying hardware platform can provide a foundation for making the best use of new software capabilities. The all new Intel® Core™ vPro™ processor family complements the new Windows® 7 operating system by building effective trusted computing and management mechanisms into the hardware.



**Microsoft®**

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## Abstract continued

The release of Windows 7 Professional and Windows 7 Enterprise provides the ideal opportunity to realize the benefits of a PC refresh. By refreshing the PC fleet to new desktops and notebooks with all new 2010 Intel Core vPro processors, IT organizations can benefit from up to a 50 percent reduction in operational costs, do more with up to 2x faster multi-tasking performance than previous generations of processors,<sup>1</sup> and be more secure by avoiding the 53 percent increase in security incidents seen in four-year-old PCs.<sup>2</sup> Intel vPro technology eases management of PCs. PCs with activated Intel vPro technology can save 40 minutes or more of end user productivity during an operating system upgrade.<sup>3</sup> In addition, new PCs can do even more with shorter boot times and new productivity tools.

Intel vPro technology support built into Microsoft® System Center Configuration Manager 2007 SP2 enables remote power on, remote inventory of PCs regardless of the power state, out-of-band configuration, and improved management tools. These features make it possible to carry out company-wide Windows 7 migrations from the service center with minimal impact on user productivity.

Windows 7 enables you to run many legacy applications seamlessly with Windows Virtual PC and Microsoft Enterprise Desktop Virtualization (MED-V), taking advantage of the hardware virtualization

assistance provided by Intel® Virtualization Technology (Intel® VT).<sup>4</sup> Windows 7 running on PCs with Intel vPro technology offers a great combination of manageability and virtualization performance and flexibility.

Energy-efficient technologies built into Intel Core vPro processors and the power management features of Windows 7 work together to help reduce your energy costs. The combination of Intel vPro technology and Windows 7 helps reduce total cost of ownership and increase return on investment.

## Desktop and Notebook PCs Built with the All New Intel® Core™ vPro™ Processor Family and Windows® 7: Your Best Choice for Business PCs

Windows 7 is Microsoft's latest PC operating system for desktop and notebook computers. Windows 7 lets users get more work done, from more places, using more types of computing devices than previous Microsoft desktop operating systems. The tight integration of ease of use, enhanced security, and improved manageability makes it possible for users – from information workers to corporate IT managers – to get the most out of their computing experiences.

The all new 2010 Intel Core vPro processor family has intelligent technology that adapts to the needs of your business with smart security, cost-saving manageability, and intelligent performance. PCs built with Intel Core vPro processors let users run more software applications faster and more reliably with industry-leading processor and memory technologies, such as Intel® Dynamic Execution, Intel® Intelligent Power Capability, Intel® Advanced Smart Cache, Intel® Smart Memory Access, and Intel® Advanced Digital Media Boost. Intel® HD Graphics provide superb visual performance for sharper images and richer color, all in an energy-efficient package, and powerful remote management and control capabilities are enabled by Intel® vPro™ technology.

The combination of Intel vPro technology, Windows 7, Windows Server® 2008 R2, and Microsoft System Center Configuration Manager provides an array of Microsoft software tools and Intel hardware-based technologies that IT can use to streamline the deployment of operating system images and to significantly reduce the overhead involved with company-wide operating system migrations.

### **Save Money by Refreshing Now with PCs Based on Intel® Core™ vPro™ Processors**

Intel Core vPro processors adapt to the needs of your business with smart security, cost-saving manageability, and intelligent performance while keeping downtime to a minimum in your Windows 7 environment.

Organizations can see up to a 50 percent reduction of costs to maintain PCs when they refresh to PCs built with Intel Core vPro processors. Cost reductions are seen in a number of areas: operating system migrations, application deployment, patch deployment, manual hardware malfunction resolution, manual software malfunction resolution, audit and inventory failure resolution and security failure resolution.<sup>5</sup> Intel vPro technology reduces the costs of managing the deployed PC fleet by reducing the number of costly desk-side visits by up to 56 percent.<sup>6</sup> Industry studies indicate that desk-side visits can cost up to seven times more than remote problem resolution.<sup>7</sup>

The all new 2010 Intel® Core™ vPro™ processor family and Windows® 7 Professional or Windows® 7 Enterprise deliver the best foundation for an optimized desktop environment

- Intel vPro technology eases management of PCs and, when activated, can save 40+ minutes of end-user productivity during the Windows 7 upgrade<sup>3</sup>
- Run legacy applications seamlessly with Intel Virtualization Technology and Microsoft Virtual PC

### **Get More Done Securely**

PCs powered by new 2010 Intel® Core™ i5 vPro™ processors deliver up to 2x faster multitasking performance than a three-year-old PC! Faster multitasking performance enables employees to get work done faster so that they can complete projects in less time and become more productive.

Another reason to refresh is to reduce the costs related to security incidents. A four-year-old PC can have up to 53 percent more security incidents compared to a PC in its first year.<sup>5</sup> More security incidents can increase risks to your business and reduce overall user productivity.

Intel Core vPro processors are built with Intel Core microarchitecture on a revolutionary 32-nm die process that benefits from the atomic and electrical advantages of hafnium-based high-k metal gates. Intel Core microarchitecture speeds computing by using a number of advanced technologies, including Intel Dynamic Execution, Intel Advanced Smart Cache, Intel Smart Memory Access, and Intel Advanced Digital Media Boost.

Planning a migration to Windows® 7 is the perfect time to invest in Intel® Core™ vPro™ processors:

- Save money by reducing help desk costs and reducing power consumption
- Secure your environment and help ensure compliance
- Ease your Windows 7 deployment

Intel® Core™ Microarchitecture Technology	Description
Intel® Wide Dynamic Execution	Intel Dynamic Execution delivers more instructions per clock cycle. Fewer clock cycles means that less power is required to complete a task, reducing execution times and increasing energy efficiency.
Intel® Advanced Smart Cache	Intel Advanced Smart Cache increases the probability that each execution core can access data from the faster, more efficient processor cache subsystem. This enables each core to dynamically use up to 100 percent of L2 cache, while obtaining data from the cache at higher throughput rates when compared to Intel's previous-generation Smart Cache.
Intel® Smart Memory Access	Intel Smart Memory Access hides memory latency, which optimizes data bandwidth to the memory subsystem and improves system performance. Memory disambiguation increases the efficiency of out-of-order processing by providing the execution cores with the built-in intelligence to speculatively load data for instructions that are about to execute before all previously stored instructions are executed, thereby improving performance across a wide range of applications.
Intel® Advanced Digital Media Boost	Intel Advanced Digital Media Boost improves performance when Streaming SIMD Extension (SSE, SSE2, and SSE3) instructions are executed. These instructions enable Intel® Core™ vPro processors to deliver superior performance and energy efficiency to a broad range of 32-bit and 64-bit applications, including graphics, video encoding, 3-D imaging, and high-performance line-of-business applications.

### Work More Securely from Anywhere with Intel vPro Technology and Windows 7

Viruses, worms, Trojans, drive-by malware, and social engineering exploits threaten the integrity of the services and data that help drive business success. Attacks can come from removable devices, network connections, e-mail, Web sites, and numerous internal and external sources.

Intel Core vPro processors can help secure Windows 7-based PCs and your business by:

- Pushing updates down the wire – regardless of the PC's power state
- Programmable defense filters to protect against viruses and isolating PCs based on IT policy
- Sending alerts even if a system is off the corporate network
- Performing continuous automatic checks that critical agents are running
- Enabling out-of-band management on Microsoft Network Access Protection (NAP)-protected networks
- Blocking buffer overflows with Intel® Execute Disable Bit
- Authenticating network traffic
- Encrypting data up to 3.5x faster<sup>8</sup>

### Push Updates over the Wire Regardless of the PC Power State

Several methods are available to wake a PC to push out updates, but those methods are not secure or they work only when the operating system is running. In contrast, Intel vPro technology includes a more secure, encrypted power-on capability that helps IT prepare systems for updates. With Intel vPro technology, IT can remotely power on notebook and desktop PCs from the IT console so that updates can be pushed to PCs that were powered off at the start of the maintenance cycle and deploy more updates and critical patches during off hours or when it won't interrupt users. Intel vPro technology can also help lower power consumption for businesses by powering off PCs when they are not in use and remotely and securely powering on PCs only during off hours for updates, patches, or other services.

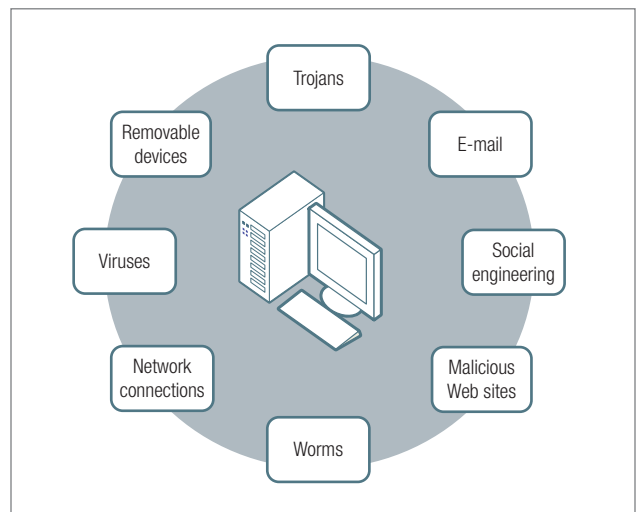


Figure 1. Your business faces a growing variety of security threats.

### **Filter Threats and Isolate PCs Based on IT Policy**

Notebook and desktop PCs with Intel vPro technology include programmable filters that monitor inbound and outbound network traffic for threats. With Intel vPro technology, IT can use third-party software to define policies that will trigger hardware-based network isolation of a PC. Both notebook and desktop PCs with Intel vPro technology use hardware-based filters for examining packet headers for suspicious behavior. Desktop PCs with Intel vPro technology also include additional hardware-based filters that monitor the rate of outbound traffic to help identify suspicious behavior, including both fast-moving and slow-moving worms.

### **Send Alerts Even If a System Is Off the Corporate Network**

Notebook and desktop PCs with Intel vPro technology have policy-based alerting built into the system. IT can define the types of alerts they want to receive. Although all alerts are logged in the persistent event log, IT can receive only the alerts they want. Since alerting uses the out-of-band communication channel, IT can receive critical notifications from PCs within the corporate network out-of-band, even if the operating system is inoperable, hardware has failed, or management agents are missing. And because PCs with Intel vPro technology can initiate a secure communications tunnel to the IT console, these PCs can send these alerts from outside the corporate firewall.

### **Perform Continuous Automatic Checking for Agents**

Traditionally, IT organizations have used serial polling to verify the presence of security agents. Because this method can saturate the network with healthy heartbeats, IT organizations often poll for compliance only once or twice a day or less often. In contrast, notebook and desktop PCs with Intel vPro technology use a regular, programmable “heartbeat” presence check, which is built into the Intel® Management Engine. If an agent hasn’t checked in before a heartbeat timer goes off, the agent is presumed removed, tampered with, or disabled.

### **Enable Out-of-Band Management on Microsoft NAP-Protected Networks**

In the past, IT often felt they had to choose between using out-of-band management and maintaining full network security with 802.1x, Cisco SDN\*, or Microsoft Network Access Protection (NAP).<sup>9</sup> With Intel vPro technology, network security credentials can be embedded in the hardware. This includes an Intel® Active Management Technology<sup>10</sup> (Intel® AMT) posture plug-in,

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which collects security posture information (such as firmware configuration and security parameters), and the Intel AMT Embedded Trust Agent.<sup>10</sup> This capability enables the network to authenticate a PC before the operating system and applications load and before the PC is allowed to access the network. The result is better security for PCs regardless of the PC operating system state, the application state, or the presence of management agents.

### **Block Buffer Overflows with Intel Execute Disable Bit**

The Intel Execute Disable Bit functionality can help prevent certain classes of malicious buffer overflow attacks when Intel Execute Disable Bit is combined with a supporting operating system, such as Windows 7. Intel Execute Disable Bit allows the processor to classify areas in memory where application code can execute and where it cannot. When a malicious worm attempts to insert code in the buffer, the processor disables code execution, preventing damage and worm propagation.

### **Windows 7 Security Enhancements**

In addition to the security that is enabled by Intel Core vPro processors, Windows 7 offers complementary technologies that help secure the PC fleet by introducing new operating system platform security features such as AppLocker™,<sup>11</sup> BitLocker™,<sup>12</sup> and the Windows Biometric Service.<sup>13</sup> Windows 7 Crypto APIs take full advantage of the new instruction sets in the Intel Core i5 vPro processor to encrypt sensitive data up to 3.5 times faster.<sup>14,15</sup> System Center Configuration Manager SP2 enables network traffic on new Intel Core vPro processors-based PCs to authenticate itself, whether the enterprise is using 802.1x or Microsoft NAP to secure end point access to these networks.

## Decrease TCO and Increase ROI with Intel vPro Technology

Administrative overhead is a significant part of the total cost of ownership (TCO) for IT assets. PCs using Intel Core vPro processors and running Windows 7 Professional or Windows 7 Enterprise introduce a number of manageability improvements that reduce TCO by helping to increase automation, improve productivity, and provide flexible administrative control to meet compliance requirements. At the same time, these manageability improvements can increase the company's ROI.

Many case studies have shown how Intel vPro technology can help substantially reduce IT service costs for problem resolution and software updates, including patching. For example, the Indiana Office of Technology recently reported that using Intel vPro technology to improve remote management has reduced desk-side visits by 80 percent, and achieved a positive ROI of 502 percent across 4 years by deploying PCs with Intel vPro technology with break-even point achieved in 21 months.<sup>16</sup>

### Manage PCs Regardless of the Power State

PCs with Intel vPro technology are designed to give IT greater remote visibility in wired and wireless environments. With the ability to remotely wake, power on, maintain, and manage a PC anytime, IT can make sure that key tasks are performed when needed and at times that don't affect user productivity.

### Push Updates Down the Wire Regardless of the Power State

One of IT's major challenges includes managing and updating powered-off PCs. Application and operating system updates are often performed at night and during the weekends to reduce the affect on user productivity. With Intel vPro technology, users can still power off their PCs before leaving for the night or for the weekend, and IT can remotely power on these PCs from the service center to install critical application and operating system updates. This saves energy costs during non-work hours, when PCs are waiting for updates.

### Receive Alerts Even If the System Is Disabled

Intel vPro technology enables out-of-band alerts so that IT can be notified rapidly and automatically when a system falls out of compliance, when hardware is about to fail, or when applications hang – sometimes even before users know they have a problem. With out-of-band alerts, IT can shift more work from a costly reactive stance to a more cost-effective proactive service.

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### Resolve More Problems Remotely

Intel vPro technology delivers powerful tools, such as remote/redirected startup, console redirection, persistent event logs, and access to pre-boot BIOS, that let IT staff more accurately diagnose hardware and software problems from the service center. This leads to fewer expensive desk-side visits, faster average time to repair, and less user downtime.

### Improve Remote Inventory for Wired and Wireless Systems

One of the main challenges in managing PCs is acquiring information that is typically lost or unavailable when a system is powered down, reconfigured, rebuilt, or inoperative. Notebook and desktop PCs with Intel vPro technology give technicians access to asset information from virtually anywhere. This information is stored in protected, persistent memory that is contained on a chip, and improves discovery and inventory completeness and accuracy.

### Windows 7 Management and Troubleshooting Improvements

Windows 7 introduces its own new and powerful tools that complement Intel platform technologies and improve managing and troubleshooting the entire Windows 7-based PC fleet. Examples of these tools are Windows PowerShell™ 2.0,<sup>17</sup> Windows Troubleshooting Platform,<sup>18</sup> and Problem Steps Recorder.<sup>19</sup>

## Intel® Solid-State Drives (SSDs) Improve Performance, Reduce the Total Cost of Ownership and Improve Battery Life

Drawing on decades of memory engineering experience and now on new, industry-leading compute-quality 34-nm NAND flash memory manufacturing processes, Intel® Mainstream SATA Solid-State Drives are designed to deliver outstanding performance. Intel Mainstream SATA SSDs feature the latest-generation native SATA interface with an advanced architecture that employs ten parallel NAND flash channels that are equipped with multi-level cell NAND flash memory.

With powerful Native Command Queuing to enable up to 32 concurrent operations, Intel Mainstream SATA SSDs deliver higher input/output per second and throughput performance than other SSDs on the market today and drastically outperform traditional hard-disk drives (HDDs). The Intel drives also feature low write amplification and a unique wear-leveling design for higher reliability, meaning that they not only perform better, they also last longer.

SSDs offer significant benefits for both users and IT. User benefits include:

- An 18 percent to 33 percent overall system performance improvement over HDDs with industry-standard workloads and benchmarks
- A 41 percent performance improvement on average with Intel IT-developed workloads
- About 59-70 minutes longer battery life compared with an HDD, providing extended mobile use and reducing recharge cycles and battery replacements
- An estimated 90 percent lower failure rate than HDDs over a three-year refresh period<sup>20</sup>
- The ability to move more quickly between locations due to faster start up, standby, and resume, and the ability to safely transport a notebook while it is on<sup>21</sup>
- An estimated 27 hours annual productivity gain per user due to better responsiveness<sup>21</sup>

Based on Intel IT and industry data, SSDs are expected to have a 90 percent lower failure rate than HDDs over a three-year refresh period. As a result, we estimate a 90 percent reduction in employee time lost due to drive failures and a 96 percent reduction in IT support time for PC rebuilds. SSDs also provide much faster data access, resulting in user productivity improvements; we estimate an average 44 percent time savings for common tasks such as reboots and loading software. Other benefits include a lower thermal footprint; our tests showed that notebooks with SSDs ran about 12 degrees cooler.<sup>20</sup>

Windows 7 works with Intel® SSDs. Windows 7 will disable disk defragmentation on SSD system drives. In addition, by default, Windows 7 will disable Superfetch and ReadyBoost, as well as boot and application launch prefetching on SSDs that record pre-defined random read, random write, and flush performance values.

Intel SSDs also support the Windows 7 Trim feature which will allow users to refresh their Intel SSDs and maintain peak performance with SSD use over time. In addition, SSDs perform at their best when the operating system's partitions are created with the SSD's alignment needs in mind. All of the partition-creating tools in Windows 7 place newly created partitions with the appropriate alignment.<sup>22</sup>

**Intel® High-Performance SATA Solid-State Drives perform nine times better than traditional hard drives on PCMark Vantage\* HDD test suite.<sup>23</sup>**

## Improve Mobility and Manageability with Intel vPro Technology and DirectAccess

### Enable Mobile Workers' Anytime, Anywhere Access to Information

An ever-increasing number of workers are working outside of the main office. Many of them are located at branch offices. Mobile workers need to access information hosted on the corporate LAN. Traditional remote access solutions included network-level VPNs and remote access gateways. Although these solutions let motivated users connect to the resources they need, they often require users to carry out additional steps to connect to the network.

Windows 7 Professional or Windows 7 Enterprise and Windows Server 2008 R2 introduce a new remote access solution that is completely transparent to users. Named DirectAccess,<sup>24</sup> this technology allows secure connectivity to the corporate LAN without requiring the end user to log on and initiate the connection.

### Secure Remote Access for Mobile Workers

DirectAccess connection privacy is enabled by industry-standard Internet Protocol Security<sup>25</sup> (IPsec). DirectAccess uses IPsec to enable a secure, private tunnel between the PC and the DirectAccess server. However, IPsec is a highly processor-intensive encryption technology. Encryption and decryption of IP packets in real time can test the limits of the server processor.

Intel® PRO Server LAN adapters<sup>26</sup> can solve the server IPsec processing problem by offloading the computationally expensive encryption engine (AES-128) onto an Intel LAN controller. Intel offers dual-port 1 and 10 gigabit LAN adapters that not only support solid performance on standard networking workloads and advanced virtualization features, but the LAN adapters also have the ability to offload IPsec in hardware to improve system performance under large IPsec input/output (I/O) workloads. On the PC side, Intel Core vPro processors provide the raw compute power that is required to carry out the processor-intensive encryption that is required for the IPsec communication.

### Extend IT's Reach to Mobile Managed Assets

Businesses often provide workers with corporate notebooks to help improve productivity when workers are outside the office. IT deploys a secure, locked-down master image to these notebooks to reduce the risk of a security incident. The problem IT faces with managed mobile computers is that they tend to quickly fall out of compliance because they receive software updates and Group Policy security configuration only when they are connected to the LAN. Sometimes workers never connect to the corporate LAN at all, leading to spiraling entropy in the mobile PC fleet's security and compliance configuration. DirectAccess helps solve this problem by allowing management console access to DirectAccess PCs. In addition, DirectAccess connected PCs are able to receive Group Policy and other configuration settings that LAN connected hosts are able to access.<sup>27,28</sup>

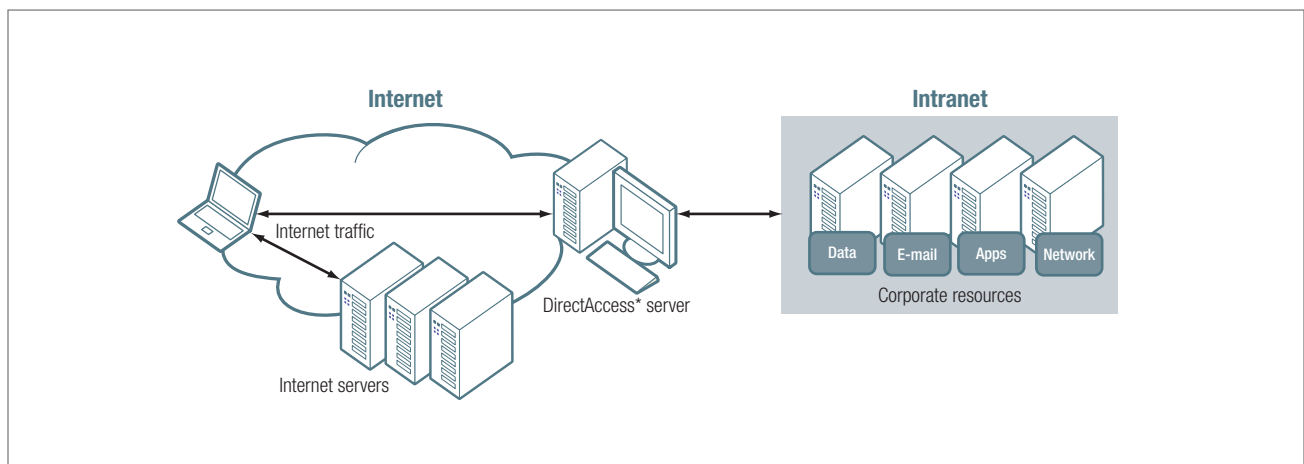


Figure 2. Direct access gives users transparent secure connectivity to resources on the corporate LAN.

## Ensure Application Compatibility with Intel® Virtualization Technology and Windows Virtual PC

### Enable PC Virtualization with Intel Virtualization Technology

Hardware-assisted Intel Virtualization Technology (Intel VT) provides greater flexibility and maximum system utilization by consolidating multiple environments into a single PC. Intel VT delivers:

- Reduced overhead for virtualization software
- More efficient virtual environments
- Improved virtual machine performance to near native levels or better<sup>29</sup>

With support from the processor, chipset, BIOS, and enabling software, Intel VT improves traditional software-based virtualization. These integrated features take advantage of offloading instructions to system hardware and enable virtualization software to provide more streamlined software stacks and enhanced virtual machine performance.

### Deploy Virtualization with Windows Virtual PC

Windows Virtual PC<sup>30</sup> is Microsoft's virtualization technology designed for Windows 7. Windows Virtual PC is integrated with the Windows 7 shell so that applications that run on the guest operating system (the operating system running as a virtual machine) appear in the Start menu on the host PC's desktop, and when the applications are run, appear as windows on the host system's desktop.

Windows Virtual PC provides support for many USB devices and lets users run applications installed on the virtual machine directly from the host Windows 7 desktop with a single click. Windows Virtual PC is designed to work on all editions of Windows 7 and supports 32-bit versions of Windows XP, Windows Vista®, and Windows 7 as guest operating systems.

Windows Virtual PC takes advantage of the hardware virtualization assistance provided by Intel VT, to optimize virtualization performance.<sup>4</sup> Organizations that want the best of both management and virtualization worlds will standardize on PCs built with Intel Core vPro processors.

### Solve Application Compatibility Issues with Windows XP Mode

Windows XP Mode<sup>31</sup> is a new benefit of Windows 7 and provides application compatibility. It lets you install and run many of your productivity applications for Windows XP directly from a PC running Windows 7. Windows XP Mode utilizes Windows Virtual PC to provide a virtual Windows XP environment. Both the Windows Virtual PC virtualization software and a Windows XP virtual disk file can be downloaded from the Microsoft Web site to enable Windows XP Mode. The Windows XP Mode virtual disk file includes a full Windows XP license.

Designed as an unmanaged solution for small and mid-sized businesses, you can use Windows XP Mode to run Windows XP applications seamlessly in Windows 7 when the applications are installed in a virtual guest instance of Windows XP. Windows XP Mode is available for the 32-bit and 64-bit editions of Windows 7 Professional, Windows 7 Enterprise, and Windows 7 Ultimate.

### Convert Windows Virtual PC into an Enterprise Managed Solution with Microsoft Enterprise Desktop Virtualization (MED-V)

Windows Virtual PC provides the runtime virtualization engine for Microsoft Enterprise Desktop Virtualization (MED-V).<sup>32</sup> MED-V turns the unmanaged Windows XP Mode into an enterprise-ready client-side virtualization solution. MED-V is one of six components that are included in the Microsoft Desktop Optimization Pack (MDOP).<sup>33</sup> MED-V adds virtual image delivery, policy-based provisioning, and centralized management to Windows Virtual PC hosted client-side virtual machines.

With MED-V and Windows Virtual PC, enterprise IT can:

- Create, deploy, and update Windows Virtual PC images throughout the enterprise with zero-touch management
- Create virtual machine images based on business affiliation and group requirements and enforce custom policies on those deployments
- Speed Windows 7 adoption by enabling legacy line-of-business applications to run in virtual Windows XP instances

PCs with Intel vPro technology help ensure a reliable MED-V enabled client-side virtualization infrastructure by allowing enterprise IT to:

- Remotely manage PCs that host managed virtual machines to make sure that configuration settings and management agents meet performance, reliability, and security requirements
- Collect PC fleet hardware asset information to assess which PCs are provisioned to support processor, memory, and disk requirements for client-side virtualization, even if the PCs are powered off, have a disabled operating system, or have a failed hard disk
- Remotely troubleshoot and service host PCs with advanced out-of-band management technologies, such as the IDE-Redirect (IDE-R) and Serial Over LAN features of Intel vPro technology

## Reduce Costs and Stay Productive Longer with Intel Power Management and Windows 7

As environmental issues take a front seat and cost saving continues to be a top priority, one of IT's missions is to keep users productive and keep power consumption down.

Microsoft and Intel have collaborated on investigating power usage in PCs. This resulted in modifications to Intel products and changes in Windows 7 that enable PC OEMs to build more power-efficient PCs.

### Lower Overall Power Consumption with Intel Core vPro Processors

Intel Core vPro processors with Intel Core Microarchitecture include a number of power-saving technologies that reduce overall power consumption for desktops and notebooks. Using materials such as hafnium-based circuitry and Intel® 32-nm high-k metal gate silicon technology helps to dramatically increase processor energy efficiency and provides more powerful computing experiences and greater flexibility of design.<sup>34</sup>

Building on a common technology foundation, notebook and desktop PCs with Intel vPro technology enable IT to manage and help protect more PCs with fewer resources. With the latest IT management consoles, such as Microsoft System Center Configuration Manager 2007 Service Pack 2,<sup>35</sup> you can monitor and maintain desktops and mobile notebooks over a more secure wired or wireless link.

### Key power-saving features of Intel Core vPro processors include:

- **Intel Advanced Smart Cache.** Intel Advanced Smart Cache is a shared L2 cache that allows both cores full access to the entire L2 memory area. Intel Advanced Smart Cache enables better performance, responsiveness, and power savings.
- **Intel Front Side Bus Frequency Switching.** Intel Front Side Bus Frequency Switching enhances Intel SpeedStep® technology by reducing CPU frequency and allowing a lower operating voltage to be used in minimal workloads. This leads to lower power consumption.
- **Intel Intelligent Power Capability.** Ultra fine-grained control over the CPU's logic circuitry enables the processor to turn on only the parts that are needed.
- **Intel Dynamic Power Coordination.** Intel Dynamic Power Coordination helps manage voltage and power consumption to allow one core to demand high performance while the other core can transition to a lower power state.
- **Energy-efficient DDR3 memory.** The chipset technology in Intel Core vPro processor-based notebooks and desktops supports energy-efficient, high-performance DDR3 memory.

### Make Computing Even More Energy Efficient with Windows 7

Windows 7 introduces operating system design changes that integrate with and amplify the power savings enabled by the hardware-based power management and energy conservation technologies of Intel Core vPro processors. Microsoft and Intel jointly analyzed the startup, shutdown, sleep, and resume times on Intel platforms during the development of Windows 7 to identify opportunities for optimizing the Intel BIOS and Windows 7.

For example, in previous versions of Windows, users missed out on the energy saving and battery-life enhancing benefits of sleep because of the way that the operating system assessed processor activity before it put the computer to sleep. Often, the computer was not put to sleep. Windows 7 no longer reviews the processor activity before it puts the computer to sleep, which makes sleep available in more scenarios.<sup>36</sup>

## Stay Productive Longer with Battery-Life Improvements

Mobile workers need to get as much time as possible out of a single battery charge. To meet this requirement, Microsoft introduced a number of Windows 7 power management features that work together to help optimize battery life for mobile workers. Some of these improvements include Adaptive Display Brightness<sup>37</sup> and optimizations in key multimedia scenarios and intuitive power notifications.

### Advances in Processor Power Management

Windows 7 supports the power management technologies of the latest Intel Core vPro processors, such as Intel Intelligent Power Capability. Intel Core vPro processors can enter different performance states, and the operating system platform can choose the power state depending on the application load. This allows the PC to adjust processor power use on a dynamic basis. Windows 7 introduces new methods for assessing which processor state is the most efficient given current software demands. By making more accurate assessments, the operating system can decrease overall processor power use while maintaining application performance.

### Optimizations for Key Business Multimedia Scenarios

Businesses are increasingly using multimedia applications to enable greater productivity. Video based training, online audio and video collaboration and multimedia presentations are critical business enablers. Windows 7 includes advances in processor power management and architectural changes that improve the Desktop Window Manager (DWM) and graphics processing unit (GPU) utilization, playback pipeline scaling, audio stack and timer resolution optimizations, and smart data caching that allows aggressive optical drive spin down.

In addition, the continuation of a long Intel and Microsoft collaboration has enabled a rich multimedia experience on Intel platforms. Intel has made the most of the latest processor architectures (both instruction set and threading/cores) in multimedia processing, such as codecs. The nature of these processes is such that they can gain performance improvements from Intel's multi-core architectures and SSE instruction sets. Windows 7

### Other areas in which Windows 7 helps reduce overall power consumption include:

- Optimization of background activity and idle states
- On-demand startup of background services
- Power-management-aware device drivers

makes the most of the processor optimizations and hardware acceleration for H.264, VC-1, and MPEG-2 video that are provided by Intel through the DirectX® Video Acceleration architecture.

With Intel's development and standardization of power-saving audio hardware specifications, Windows 7 can take advantage of these new features to reduce the overall power consumption when the computer is playing audio. With the development of a new hardware standard for High-Definition Multimedia Interface (HDMI) audio, Windows 7 and Intel platforms provide consumers with support for high-definition, multi-channel audio over HDMI.

### Increase IT Control of Power Management with Intel vPro Technology and Windows 7

IT administrators need to control power consumption not only in the data center, but also throughout the PC fleet. This can be difficult because IT often needs all computers in the organization to be turned on prior to company-wide updates or operating system migrations. This can lead to thousands of computers being powered on and doing nothing other than waiting for updates or if not powered on, fail to receive the updates at all.

IT can avoid extra power consumption by taking advantage of Intel vPro technology remote power control capabilities. Intel vPro technology-enabled and activated Windows 7 PCs can be remotely powered on by using out-of-band remote power-on, so that the PC fleet can be powered off until it is time to distribute updates and patches or to start a migration. Windows 7 PCs are then powered down remotely, which helps ensure that power is on only when needed.

## Simplify Migration with New and Improved Windows 7 Deployment Tools

Upgrading and migrating to a new operating system can be complex. There are a number of challenges and costs. You need to survey the current hardware environment and the currently deployed software and then determine where incompatibilities might exist. After you identify software issues and refresh your hardware, you can design a smooth migration path.

Windows 7 and Windows Server 2008 R2 include a number of new and improved tools that reduce the costs and administrative overhead inherent in any wide-scale migration plan. Some of these tools are included in the Windows Automated Installation Kit for Windows 7, including the Windows User State Migration Tool (USMT), ImageX, and Deployment Image Servicing and Management (DISM) and the Windows Preinstallation Environment (Windows PE).<sup>38</sup>

## Speed Windows 7 Deployment and Increase Image Saturation with Intel vPro Technology and System Center Configuration Manager 2007 SP2

Although the improved Windows 7 and Windows Server 2008 R2 tools help ease some of the common difficulties in operating system migration, you can take additional steps to speed Windows 7 migration and increase operating system saturation by combining the power and flexibility of Intel vPro technology and System Center Configuration Manager 2007 SP2.

IT personnel often face the following issues when they work on an operating system migration project:

- To reduce the negative effect on user productivity, PC agents are run when users are not at their desks. The problem is that many users power off their PCs when they leave, and these PCs may be missed during the deployment cycle.
- Often, desk-side visits or trips to the service center are required to deploy an operating system. This helps IT get closer to 100 percent operating system migration saturation, but it affects user productivity and increases administrative overhead.
- IT personnel need to visit PCs when the current operating systems are nonfunctional or when operating system deployment fails.

### When an IT department integrates Intel vPro technology into a Windows 7 deployment plan, IT staff can:

- Increase user productivity by reducing user downtime
- Perform remote operating system deployments on bare metal hardware
- Perform remote operating system deployments on PCs when the operating system or client-side agents are not responsive
- Inventory the PC fleet to determine which PCs meet hardware requirements for Windows 7, even if the PCs are turned off, have disabled operating system or client agents, or suffer from failed hard disks
- Meet defined or mandated operating system deployment timelines regardless of the PCs' power state or connectivity; PCs can be remotely managed and migrated over wired or wireless connections

Intel vPro technology together with System Center Configuration Manager 2007 can help solve these problems by letting IT migrate PCs to a new operating system regardless of the PCs' current power states. With integrated support for Intel vPro technology, System Center Configuration Manager 2007 SP2 allows you a low touch method of efficiently deploying Windows 7 to your PC fleet over wired or wireless networks.

### Deploy Windows 7 with Intel vPro Technology In-Band and Out-of-Band Management Capabilities

Intel vPro technology helps you deploy Windows 7 by taking advantage of its ability to use in-band and out-of-band connections to PCs. Intel vPro technology works together with key deployment tools and technologies such as Microsoft System Center Configuration Manager Service Pack 2, Windows USMT 4.0, Pre-Boot Execution Environment (PXE)-enabled network infrastructure, and Windows Preinstallation Environment (Windows PE) to give IT managers the control and visibility to reduce end-user interruptions and IT overhead and to make deployment as fast, smooth, effective, and efficient as possible.<sup>39</sup>

**“I have never experienced an operating system changeover happen so smoothly as with Intel vPro.”<sup>40</sup>**

Jens Gastrop, Head of IT Operations  
from the Union Investment Group

System Center Configuration Manager 2007 SP2 with integrated support for Intel vPro technology enables several Windows 7 deployment scenarios, including:

- In-band deployment with Intel vPro technology remote power-on
- Out-of-band deployment with Intel vPro technology-initiated PXE startup
- Out-of-band deployment with Intel vPro technology-initiated IDE-R startup

Each of these deployment scenarios leads to reduced energy costs and reduced user downtime.

### **In-Band Deployment with Intel vPro Technology Remote Power-On**

In this scenario, IT uses Microsoft System Center Configuration Manager 2007 SP2 to deploy Windows 7. The operating system deployment task sequence contains both the user state migration and the Windows 7 operating system deployment. User State Migration and operating system deployment are advertised as a single task sequence. An advertisement is made for the operating system deployment task sequence and the advertisement performs an AMT power on. The User State Migration Tool runs and then the Windows 7 deployment begins. When the Windows 7 deployment is finished, the PC reports the results of the migration to the management console. IT then uses the Intel vPro technology out-of-band management console to troubleshoot and remediate any PCs on which the migration failed. Finally, the PC can be remotely turned off to conserve energy and save costs.

### **Out-of-Band Deployment with Intel vPro Technology-Initiated PXE Startup**

In this scenario, IT defines a PXE-enabled advertisement to initiate the Windows 7 deployment. IT uses the Intel vPro technology out of band management console in Microsoft System Center Configuration Manager to initiate a PXE redirection to begin the PXE startup. The Intel vPro technology-enabled PC is network started with a Windows 7 deployment Windows PE image. Windows 7 deployment and the migration of the user state are initiated. When the Windows 7 deployment is finished, the PC reports the results of the migration to the management console. IT then uses the Intel vPro technology out-of-band management console to troubleshoot and remediate any PCs on which the migration failed. Finally, the PC can be remotely turned off to conserve energy and save costs.

### **Out-of-Band Deployment with Intel vPro Technology-Initiated IDE-R Startup**

This scenario is enabled by the Intel vPro technology IDE redirection capabilities. With IDE-R, IT administrators can configure the PCs to start from a network location that hosts remote media. Next, IT defines an advertisement to initiate the Windows 7 deployment. IT uses the Intel vPro technology out of band management console in Microsoft System Center Configuration Manager to initiate an IDE redirection to begin a remote media startup. The Intel vPro technology-enabled PCs start off of the remote media with the Windows 7 deployment Windows PE image, which begins the Windows 7 deployment and the user state migration. After the operating system deployment and the user state migration are finished, the results are reported to the management console. IT then uses the Intel vPro technology out-of-band management console to troubleshoot and remediate any PCs on which the migration failed. Finally, the PC can be remotely turned off to conserve energy and save costs.

## Summary

Windows 7 Professional and Windows 7 Enterprise introduce significant advancements in security, mobility, and manageability. Microsoft has made key investments to make sure that users can be productive anytime anywhere and those users have a satisfying computing experience. In addition, Microsoft has made major advancements in simplifying deployment of the Windows 7 operating system with new and enhanced deployment tools as improved features included in System Center Configuration Manager 2007 SP2.

However, to get the most from the Windows 7 operating system architecture and to smooth the path to deployment, the operating system needs to be installed on the right hardware platform. Intel worked together with Microsoft during the development of Windows 7. As a result, organizations deploying the new operating system on PCs with Intel Core vPro processors benefit from significantly higher levels of performance, security, mobility, manageability, reliability, availability, and serviceability.

Windows 7 users will benefit from the Intel platform improvements that are made possible with Intel Core microarchitecture-infused processor improvements. Hafnium circuitry with high-k metal gates increase capacitance and reduce electron leakage to increase

battery life. Intel Core vPro processors provide the power to run the most demanding line-of-business applications. At the same time, Intel Core vPro processors reduce the overall power consumption even in the most demanding 64-bit multitasking scenarios.

Intel Core vPro processors work in tandem with Windows 7 to boost multi-tasking performance up to 2x,<sup>1</sup> reduce power use, increase security, simplify deployment, and make PCs more manageable. Intel vPro technology enables PCs to be more manageable and more secure, even if the wired or wireless computer is powered off, has a disabled operating system, or suffers from a failed hard disk.

The combination of the operating system platform improvements that are included with Windows 7 and performance, security, and manageability enabled by the all new 2010 Intel Core vPro processor family helps users do more from any place at anytime and helps users work easier and faster. Windows 7 makes new things possible and allows users to work the way they want to work. Intel Core vPro processors help optimize the computing experience, reduce the total cost of ownership, and increase the return on both hardware and operating system investments.

<sup>1</sup> 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, Noncompliant 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® 79E1D7WW 2.17 with default settings, Microsoft® Windows® Vista Ultimate. Multitasking claims based on financial calculations workload consisting of advanced spreadsheet calculation measured using Microsoft® Excel® Monte Carlo Simulation plus Virus Scan.

(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, Imcom 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. Multitasking claims based on financial calculations workload consisting of advanced spreadsheet calculation measured using Microsoft® Excel® Monte Carlo Simulation plus Virus Scan. For more information go to <http://www.intel.com/performance>.

<sup>2</sup> "Using Total Cost of Ownership to Determine Optimal PC Refresh Lifecycles", Wipro Technologies, March 2009 ([www.wipro.com/industryresearch](http://www.wipro.com/industryresearch)). Based on a survey of 106 firms in North America and Europe representing 15 different industries and projections based on a Model Company developed by Wipro Technologies. Actual results may vary based on the number of use-cases implemented and may not be representative of results that individual businesses may realize. For additional implementation examples refer to Intel Case Studies available at <http://communities.intel.com/openport/docs/DOC-1494>.

<sup>3</sup> MMS demo showing remote, wireless Windows 7 upgrade on Win XP laptops: <http://www.vimeo.com/4430604>. Time to upgrade a PC with a HDD on a standard enterprise network is approximately 40 minutes. This time can vary depending on network conditions and HDD/PC performance. Time to upgrade could be considerably longer if a depot visit is required.

<sup>4</sup> Intel® Virtualization Technology (Intel® VT), Intel® Trusted Execution Technology (Intel® TXT), and Intel® 64 architecture require a computer system with a processor, chipset, BIOS, enabling software and/or operating system, device drivers and applications designed for these features. Performance will vary depending on your configuration. Contact your vendor for more information.

<sup>5</sup> [http://www.wipro.com/resource-center/wipro-council-for-industry-research/pdf/using\\_total\\_cost\\_of\\_ownership\\_to\\_determine\\_optimal\\_pc%20refresh\\_lifecycles.pdf](http://www.wipro.com/resource-center/wipro-council-for-industry-research/pdf/using_total_cost_of_ownership_to_determine_optimal_pc%20refresh_lifecycles.pdf)

<sup>6</sup> Results shown are from the 2007 EDS case studies with Intel® Centrino® Pro and the 2007 EDS case studies with Intel vPro processor technology by LeGrand and Salamack; a third-party audit commissioned by Intel of various enterprise IT environments and the 2007 benefits of Intel Centrino Pro processor technology in the enterprise; and a Wipro Technologies study commissioned by Intel. The results shown may not be representative of the results that can be expected for smaller businesses. The EDS studies compare test environments of Intel Centrino Pro and Intel vPro processor technology equipped PCs versus non-Intel vPro processor technology environments. The Wipro study models the projected ROI of deploying Intel Centrino Pro processor technology. Actual results may vary. The studies are available at [www.intel.com/vpro](http://www.intel.com/vpro), [www.wipro.com](http://www.wipro.com), and [www.eds.com](http://www.eds.com).

<sup>7</sup> <http://download.intel.com/products/vpro/whitepaper/crossclient.pdf>

<sup>8</sup> Cross-client claim based on lowest performance data number when comparing desktop and mobile benchmarks. Configurations and performance test as follows:

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(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, Imcom 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.

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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.

<sup>9</sup> <http://software.intel.com/en-us/articles/intel-vpro-technology-faq/>

<sup>10</sup> Intel® Active Management Technology requires the computer system to have an Intel® AMT-enabled chipset, network hardware and software, as well as connection with a power source and a corporate network connection. Setup requires configuration by the purchaser and may require scripting with the management console or further integration into existing security frameworks to enable certain functionality. It may also require modifications of implementation of new business processes. With regard to laptops, Intel AMT may not be available or certain capabilities may be limited over a host OS-based VPN or when connecting wirelessly, on battery power, sleeping, hibernating or powered off. For more information, see <http://www.intel.com/technology/platform-technology/intel-amt/>.

<sup>11</sup> [http://technet.microsoft.com/en-us/library/dd378941\(ws.10\).aspx](http://technet.microsoft.com/en-us/library/dd378941(ws.10).aspx)

<sup>12</sup> <http://www.microsoft.com/downloads/details.aspx?familyid=6E419E75-BBEC-44BF-BF94-48EC4E1265AC&displaylang=en>

<sup>13</sup> <http://download.microsoft.com/download/9/c/5/9c5b2167-8017-4bae-9fde-d599bc8184a/WBFINtr.docx>

<sup>14</sup> Based on lowest performance data number when comparing desktop and mobile benchmarks. Configurations and performance test as follows: ) 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, Imcom 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. 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. For more information go to <http://www.intel.com/performance>.

<sup>15</sup> 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/intelxv/AES-Instructions-Set\\_WP.pdf](http://softwarecommunity.intel.com/isn/downloads/intelxv/AES-Instructions-Set_WP.pdf).

<sup>16</sup> <http://communities.intel.com/servlet/JiveServlet/previewBody/1703-102-2-2745/320101-002US.PDF>

<sup>17</sup> [http://technet.microsoft.com/en-us/library/dd367858\(ws.10\).aspx](http://technet.microsoft.com/en-us/library/dd367858(ws.10).aspx)

<sup>18</sup> <http://technet.microsoft.com/en-us/windows/dd572173.aspx>

<sup>19</sup> <http://www.microsoft.com/downloads/details.aspx?familyid=B72D3AC2-4352-4184-9992-E122DBB80883&displaylang=en>

<sup>20</sup> [http://download.intel.com/it/pdf/Enterprise-wide\\_Deployment\\_of\\_Notebook\\_PC\\_s\\_with\\_Solid-State\\_Drives.pdf](http://download.intel.com/it/pdf/Enterprise-wide_Deployment_of_Notebook_PC_s_with_Solid-State_Drives.pdf)

<sup>21</sup> [http://download.intel.com/it/pdf/Improving\\_the\\_Mobile\\_Experience\\_with\\_Solid\\_State\\_Drives\\_2009.pdf](http://download.intel.com/it/pdf/Improving_the_Mobile_Experience_with_Solid_State_Drives_2009.pdf)

<sup>22</sup> <http://blogs.msdn.com/e7/archive/2009/05/05/support-and-q-a-for-solid-state-drives-and.aspx>

<sup>23</sup> <http://www.intel.com/performance/mobile/sata/sata.htm>

<sup>24</sup> <http://technet.microsoft.com/en-us/network/dd420463.aspx>

<sup>25</sup> <http://www.iئت.org/rfc/2401.txt>

<sup>26</sup> [http://www.intel.com/Assets/PDF/prodbrief/server\\_adapters.pdf](http://www.intel.com/Assets/PDF/prodbrief/server_adapters.pdf)

<sup>27</sup> [http://technet.microsoft.com/en-us/library/dd637825\(ws.10\).aspx](http://technet.microsoft.com/en-us/library/dd637825(ws.10).aspx)

<sup>28</sup> <http://technet.microsoft.com/en-us/magazine/2009.05.cableguy.aspx>

<sup>29</sup> <http://download.intel.com/products/vpro/whitepaper/crossclient.pdf>

<sup>30</sup> <http://www.microsoft.com/windows/virtual-pc/>

<sup>31</sup> <http://www.microsoft.com/windows/virtual-pc/download.aspx>

<sup>32</sup> <http://www.microsoft.com/windows/enterprise/products/mdop/med-v.aspx>

<sup>33</sup> <http://www.microsoft.com/windows/enterprise/products/mdop/default.aspx>

<sup>34</sup> [http://www.intel.com/technology/silicon/high-k.htm?id=tech\\_arch\\_45nm+body\\_hik](http://www.intel.com/technology/silicon/high-k.htm?id=tech_arch_45nm+body_hik)

<sup>35</sup> <http://www.microsoft.com/systemcenter/configurationmanager/en/us/default.aspx>

<sup>36</sup> [http://download.microsoft.com/download/8/5/4/854F66B6-8C09-4F8A-986E-38E9EAC1677/Windows7\\_Power\\_Management\\_Whitepaper.pdf](http://download.microsoft.com/download/8/5/4/854F66B6-8C09-4F8A-986E-38E9EAC1677/Windows7_Power_Management_Whitepaper.pdf)

<sup>37</sup> <http://www.microsoft.com/whdc/system/ppnpwr/powergmt/BrightnessCtrl.msp>

<sup>38</sup> [http://technet.microsoft.com/en-us/library/dd349343\(ws.10\).aspx](http://technet.microsoft.com/en-us/library/dd349343(ws.10).aspx)

<sup>39</sup> <http://communities.intel.com/servlet/JiveServlet/download/3232-5-2246/Microsoft%20System%20Center%20Configuration%20Management%20-%20-%20OS%20Deployment%20Whitepaper%20-%20Version%20%204.pdf>

<sup>40</sup> [http://www.intel.com/references/pdfs/Union\\_Investment.pdf](http://www.intel.com/references/pdfs/Union_Investment.pdf)