



**lenovo**

# THE INNOVATIVE LENOVO® THINKCENTRE M92P TINY

Tiny is the new BIG: Why go "thin" when you can go Tiny

## Introduction

The Lenovo ThinkCentre M92p Tiny is an innovative new desktop PC. It is based on the 3rd Generation Intel® Core™ vPro™ processor<sup>1</sup> with the latest and most comprehensive hardware-based management and security capabilities. Because the M92p Tiny also includes all Intel® Virtualization Technologies<sup>2</sup>, it's able to support desktop virtualization or to function as a traditional desktop. As a virtualized desktop, it is flexible enough thrive with client or server-based virtualization with either a Type 1 or Type 2 hypervisor. But the M92p Tiny is innovative in other ways. It shares the characteristics traditionally associated with a thin client, such as small size, low power consumption, and availability with or without a hard drive.

With its unique design, the M92p Tiny represents a new option for customers considering desktop virtualization or virtual desktop infrastructure (VDI). This paper will focus on how and why organizations considering desktop virtualization can benefit by choosing the M92p Tiny. It does so by comparing the M92p Tiny to three thin clients and a zero client across multiple categories.

## Lenovo® ThinkCentre M92p Tiny Overview

The latest addition to Lenovo's line of desktop PCs and based on the 3rd Generation Intel Core vPro processors, the M92p Tiny is Lenovo's smallest ThinkCentre desktop ever. Its one-liter, ultra-compact footprint, highly energy-efficient design, and nearly silent operation make it ideal for office or professional environments where space, acoustics, or heat are an important consideration. Table 1 includes a brief description of the desktop devices included in this analysis, comparing the size of each device. The M92p Tiny is just barely larger than the zero client. And amazingly, the thin clients included in this analysis are between two to three times larger than the M92p Tiny.

**ThinkCentre®**



While it's small and nearly silent, when it comes to performance, the M92p Tiny is indeed BIG! Equipped with a 3rd Generation Intel Core vPro processor, the M92p Tiny delivers outstanding performance for even the most demanding tasks. And with Intel® Processor Graphics, the M92p Tiny is ideal for environments requiring support for multiple monitors such as financial services and healthcare. The M92p can support up to three independent displays or up to four monitors when used in conjunction with the available Mosaic\* Quad Display\* capability. Mosaic Quad Display allows four displays to function as one, enabling four times the viewing space without the need for a discrete graphics card. Finally, because it's available with 3rd generation Intel Core vPro Processors, it comes with the latest security, manageability, and client-based virtualization capabilities built right into the hardware.

## Lenovo® ThinkCentre M92p Tiny Advantages or Features

### Amazing Performance

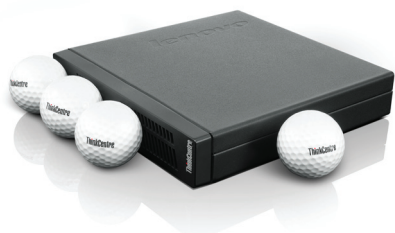
As the pace of business accelerates, today's IT environments and the enterprises they support are changing more rapidly than ever before. This change impacts everything, from the work we do, to the content we view, to how we communicate and collaborate. The content that workers access is increasingly dominated by pictures, video, and audio. And for those deploying web-based services, Adobe Flash\* has emerged as

a key technology for delivering media content. Unfortunately, the performance of server-hosted VDI desktops for use cases that require multimedia performance can be inconsistent or nonfunctional.

Desktop virtualization technologies such as multimedia redirect (MMR) enable desktop virtualization without compromising performance. MMR enables Flash and video files to be streamed directly to the client device for local decode and rendering. Major desktop virtualization providers support this technique for compatible client devices, which currently include endpoint clients based on the MPEG media format for the Windows\* operating system.

The extent to which an organization can take advantage of MMR can depend on the performance of the desktop device. We used PassMark\*<sup>3</sup>, a Windows benchmarking tool, to test the local performance of the devices included in this paper. Desktop devices with a higher PassMark\* score are considered to be faster and better performing overall.

Figure 1 compares the PassMark\* rating across four categories, plus an overall score for each device tested. Because both thin client #3 and the zero client are based on the Linux\* operating system, we were not able to measure



M92P TINY



M92P TINY MOSAIC QUAD DISPLAY MODE

TABLE 1. DESCRIPTION AND DIMENSIONS OF DEVICES INCLUDED IN THIS EVALUATION (DIMENSIONS IN MILLIMETERS)

	ZERO CLIENT	LENOVO® THINKCENTRE M92P TINY	THIN CLIENT #1	THIN CLIENT #2	THIN CLIENT #3
Processor	None	3 <sup>rd</sup> Generation Intel® Core™ vPro™ processor i5-3470T - 2.9 GHz	Intel® Atom™ Processor n270 - 1.6 GHz	Via C7 TC 1000 1 GHz	Via C7 1.6 GHz
Graphics	Integrated	Intel® Processor Graphics	Integrated	Integrated	Integrated
Height	128	182	268	229	229
Depth	114	179	250	226	226
Width	65	34.5	50	50	50
Total Volume (000)	949	<b>1123</b>	3350	2588	2588

SMALLEST



LARGEST

performance with PassMark. The results clearly demonstrate the superior performance advantage of the M92p Tiny. Organizations using graphically rich multimedia can improve application performance by offloading rich media processing to the M92p Tiny.

### Optimized Infrastructure Investments

When considering desktop virtualization, the “thinner” the desktop device, the greater the corresponding processing load and investment will typically be required in data center infrastructure. As workflows become increasingly media and collaboration-rich, thin and zero clients can place a heavy burden on IT infrastructure, overloading the network and servers in already density-constrained data centers.

As mentioned earlier, some applications are less well suited to a server-based VDI model. Collaboration-based applications, as an example can be both delay-sensitive and compute-intensive. Reverse seamless is a redirection technology that can be used to address this challenge. Similar to MMR, reverse seamless shifts workloads from the data center to the client. This has two benefits: first, running collaboration applications locally can improve the user experience by reducing the impact of network delay and latency. Second, local execution enables a more efficient balanced compute model, reducing the demand on, or the need to grow, data center infrastructure.

Organizations deploying the M92p Tiny can take advantage of offload technologies such as MMR and reverse seamless to improve the efficiency of their compute resources. This can also help reduce investment in servers, storage, and networking as well as incremental data center infrastructure, such as cooling, power distribution, and redundant power, both in primary and backup data centers.

Figure 2 illustrates the server utilization of a production server with and without reverse seamless technology. Without reverse seamless, server CPU utilization increases as additional user virtual machines (VMs) with media are added. A VM is an instance of a self-contained or virtual operating environment running on the server. In this example, the sixth incremental media-based VM session added drives server utilization above 70 percent, the point at which user experience begins to degrade significantly. With reverse seamless enabled, ten additional multimedia VM sessions can be added with less than a 5 percent increase in server utilization.

Organizations that are capital-constrained or constrained in terms of data center infrastructure can alleviate these challenges by offloading compute functions to client devices. By taking advantage of offload technologies such as MMR and reverse seamless, in conjunction with the M92p Tiny, organizations can better control their investment in servers, storage, networking, and data center infrastructure.

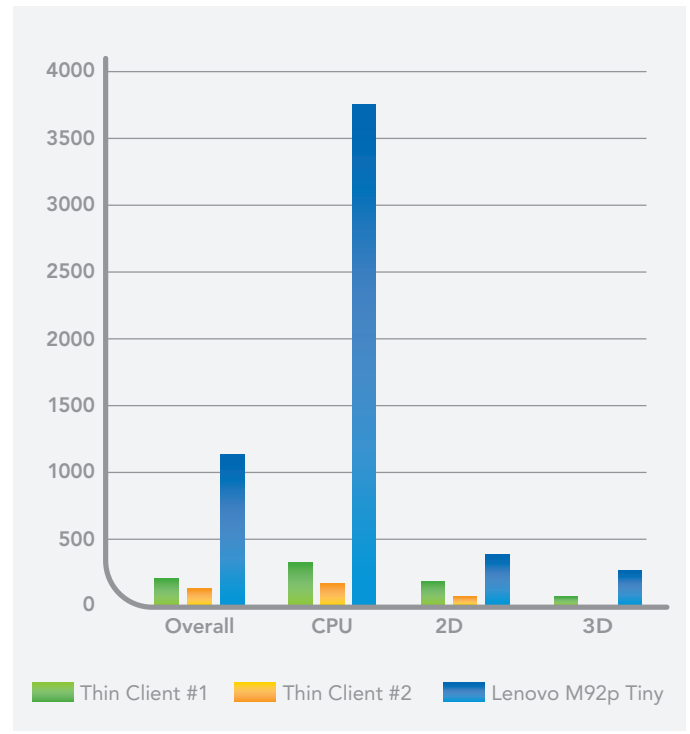


FIGURE 1. PASSMARK PERFORMANCE COMPARISON

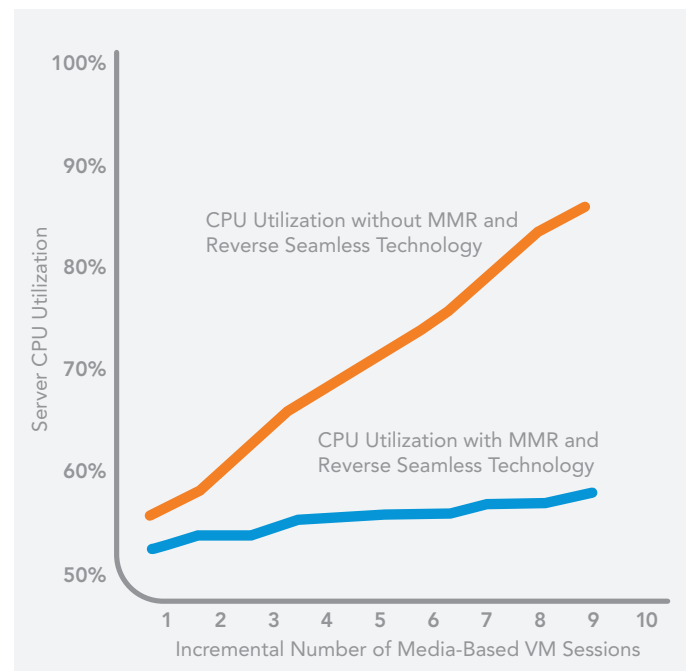


FIGURE 2. SERVER UTILIZATION OF VDI BEFORE AND AFTER REVERSE SEAMLESS - ENHANCED REDIRECTION TECHNIQUE<sup>4</sup>





















## Exceptional User Experience

The user experience of server-hosted VDI, for use cases that require multimedia performance or real-time collaboration tools, can be inconsistent or nonfunctional. While video and Flash-based applications may be able to take advantage of desktop performance, devices with lower performing CPUs can be limited in their ability to support more compute or graphically-intensive workloads. Scenarios like this can leave little or no headroom to accommodate additional tasks, impacting user experience and productivity. As an example, if a user is taking part in a video conference or watching a training video, and simultaneously working in Microsoft

Powerpoint,\* performance can suffer. Server-based virtualization, combined with lower performing desktop devices, can leave less margin for error.

Because the M92p Tiny is based on 3rd Generation Intel Core vPro Processor, it has ample performance to support video, Flash, and collaboration-based applications while ensuring that user experience and productivity are not jeopardized. Companies currently using or planning to deploy compute, collaboration, or multimedia-intensive applications can take advantage of the M92p Tiny to maximize end user based experience and productivity.

TABLE 2. USER EXPERIENCE

	LENOVO® THINKCENTRE M92P TINY	THIN CLIENT #1	THIN CLIENT #2	THIN CLIENT #3	ZERO CLIENT
<b>Local App Capable:</b>	Yes	Yes	Yes - No local processing	No	No
– VoIP					
– Collaboration					
<b>MMR Capable:</b>	Yes	Yes	Yes - No local processing	No	No
– Video (720p)					
– Flash*					









	BEST	GOOD	ADEQUATE	POOR
Audio				
Video				

Table 2 summarizes the results of our user experience testing. All testing was conducted using Citrix® XenDesktop with Citrix® Receiver loaded on each device. VoIP and collaboration testing was performed using Microsoft Lync® with collaboration including both voice and video. The M92p Tiny performed best for both VoIP and collaboration testing. There were two primary reasons for this. First, the M92p Tiny is local application capable and second, performance of the 3rd Generation Intel Core vPro Processor easily supported both applications. Thin Clients 1 and 2, both of which are local application capable, provided good quality support for VoIP, with Thin Client 1 providing slightly better user experience for collaboration due to better overall local performance. Both the Zero Client and Thin Client 3, which are not local application capable, provided adequate support for VoIP but an overall poor collaboration experience. Note that testing did not introduce delay or latency into either scenario. Given that both voice and video traffic are delay sensitive, this would most likely impact performance for devices without local execution.

Regarding video and Flash,\* the M92p Tiny as well as Thin Clients 1 and 2 are MMR capable, allowing video delivery to be offloaded to the local desktop. Consistent with performance results from Pass-Mark testing, the M92p Tiny provided the best overall user experience for both video and Flash. While Thin Client 1 and Thin Client 2 are MMR capable, their relatively lower local performance noticeably impacted playback quality. Both Thin Client 3 and the Zero Client are Linux\*-based and thus are not MMR capable. Flash and video playback on these devices was lower quality, which included instances of video freezing during playback. As with VoIP and collaboration, this testing did not factor in the impact of network delay or latency, which would most likely further impact performance of Thin Client 3 and the Zero Client.

## Ultra Energy Efficiency

For some organizations, the desire to reduce energy consumption or carbon emissions can be a factor in considering a thin or zero client device. Thin and zero clients have been viewed as being more energy efficient than traditional desktop PCs. However, this view is often based only on power consumption of the desktop device.

From purely a desktop perspective, the M92p Tiny is the most energy-efficient ThinkCentre PC ever built. With the energy-efficient performance of the 3rd Generation Intel Core vPro Processor, the M92p Tiny is up to 40 percent more energy efficient than the prior-generation platform.

Figure 3 includes the results from testing each of the devices across five different scenarios. The M92p Tiny compared very favorably, consuming less energy than two of the three thin clients in four out of five scenarios. For the 720p video test, the zero client and thin clients two and three each saw a limited increase in the rate of power consumption. This is due to the fact that each of these devices were already operating at or near their maximum performance level. As a result, the incremental compute resources required to support the 720p video were provided by the data center. Power consumption for the M92p is particularly impressive when one factors in its superior performance. Device-level power consumption for the M92p also compared favorably to the zero client, again considering that the zero client is totally dependent on the data center for processing capacity.

“The overall cost of a rich-client solution is less expensive than a thin-client solution due to the increased processing in the backend/server-side associated with thin-client deployments.”

– Dr. Peter Krcho, Head of the Neonatal Clinic, Perinatal Center, Neonatal Clinic LF UPJS and DFN Kosice Slovakia

When considering energy efficiency, it's also important to evaluate end-to-end comparison of power consumption, spanning both the desktop and the data center. Data center power consumption includes servers, storage, and networking, plus an additional element known as PUE (Power Usage Effectiveness). PUE is a measure of the energy efficiency of the data center itself and is a significant factor in overall power consumption. PUE includes power consumed for data center cooling, power distribution, battery backup, and other loads. A study of 121 data centers by the U.S. Environmental Protection Agency<sup>5</sup> (EPA) found the average PUE to be 1.91. This means that for every kWh of power consumed by servers, storage, and networking, an additional 1.91 kWh of power was consumed by data center infrastructure.

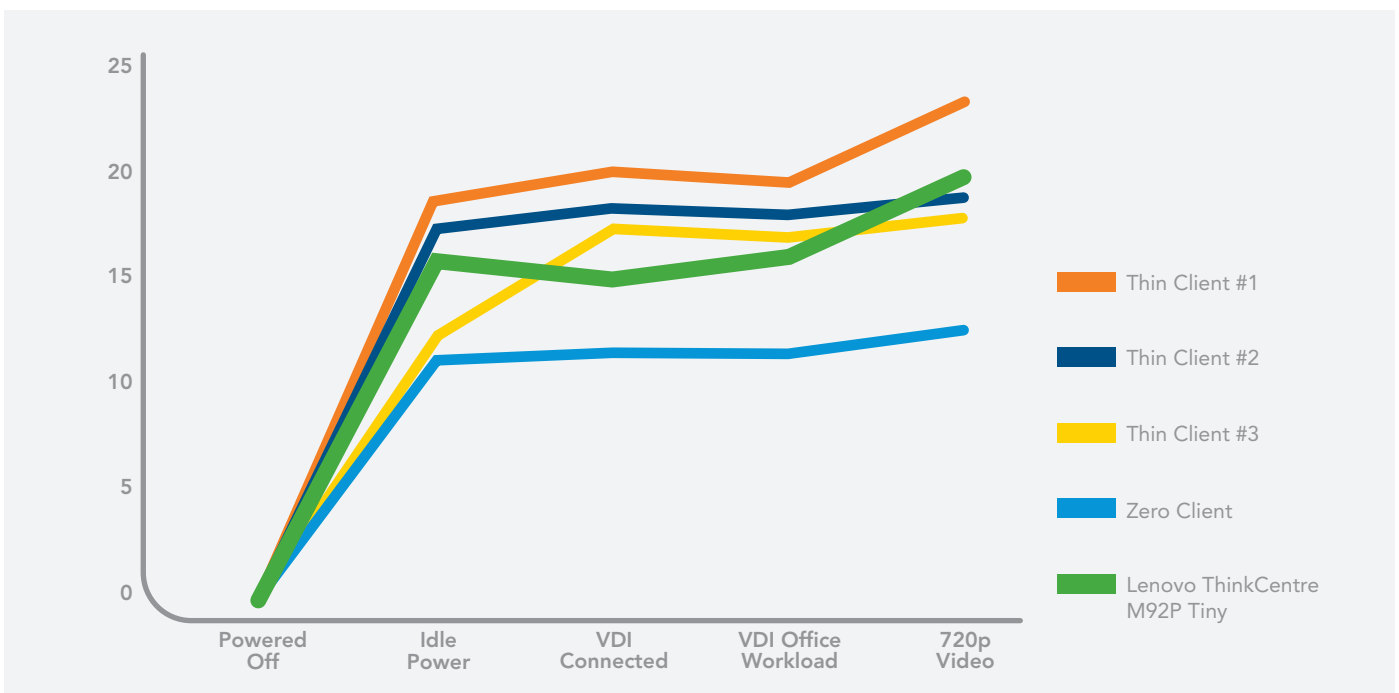


FIGURE 3. DESKTOP DEVICE POWER CONSUMPTION (IN WATTS)

Given the multiplier effect of PUE, it's important to remember that the M92p Tiny, when deployed in conjunction with technologies such as MMR, can help reduce data center infrastructure and power consumption. By helping to increase the number of VMs simultaneously operating on a given server, MMR can help reduce data center infrastructure. The ability to increase the number of VMs simultaneously operating on a server without substantially increasing server workloads can help reduce data center power consumption. The multiplier effect of PUE makes the already energy-efficient M92p Tiny even more valuable.

### Stronger Security

Organizations considering desktop virtualization are often motivated by security. The ability to centralize data in the data center is achievable with many different desktop devices, including the M92p Tiny. And because the M92p Tiny is available with or without a hard drive, organizations can take advantage of local performance while still centralizing data in the data center.

Additionally, because the M92p Tiny is based on 3rd generation Intel Core vPro Processors, it includes specific capabilities that can enhance and strengthen enterprise security. 3rd generation Intel Core vPro processors include innovative hardware-enhanced capabilities to improved protections against malware; enhance identity protection and authentication, secure media and data; and enhance patching and recovery. And because these capabilities are hardware-based they can enable more robust security than can software alone.

For solutions that distribute VMs to client devices, such as virtual containers, data can be encrypted for protection. Intel® Advanced Encryption Standard-New Instructions (Intel® AES-NI)<sup>6</sup> can help accelerate encryption performance by 3x to 10x over a software-only implementation. Intel® Identity Protection Technology (Intel® IPT)<sup>7</sup> provides one of the strongest techniques for avoiding the possibility of

"Today's advances in virtualization and solutions such as Intel vPro technology look to provide for us the best of both worlds; the power of the traditional PC coupled with the ease of management and heightened security of thin client infrastructures."

– Defense Intelligence Agency Implementing New Hardware Based Information Security Capabilities.  
[www.intel.com/content/dam/doc/white-paper/enterprise-security-vpro-dia-paper.pdf](http://www.intel.com/content/dam/doc/white-paper/enterprise-security-vpro-dia-paper.pdf)

sensitive data ending up on an unauthorized client. Industries such as financial services, healthcare, or government, with a higher need for security, can take advantage of Intel® Trusted Execution Technology<sup>8</sup> to further strengthen security. As an example, the United States Defense Intelligence Agency has chosen to take advantage of the hardware-enhanced security available with Intel Core vPro processors.

### Enhanced Management

A primary goal of desktop virtualization is to reduce complexity and cost. Yet, depending on the endpoint device, IT organizations may need to deploy custom management tools and/or applications for ongoing management of thin or zero client devices. Because these tools and processes are often different from existing PC tools, organizations may also need to train helpdesk and other IT personnel on new processes for troubleshooting, maintenance, and management. Plus, because thin clients are often appropriate for only a subgroup of users, IT organizations typically have to maintain two management systems and troubleshooting processes. All this can actually lead to increased complexity.

A primary benefit of the M92p Tiny is flexibility: organizations can deploy desktop virtualization where and when it makes sense while using existing mature PC management tools and processes. But because the M92p Tiny is based on the 3rd Generation Intel Core vPro processor, it can help improve the ability to manage and control remote systems. It includes



The 3rd Generation Intel Core vPro processor includes the latest client-based virtualization capabilities built right into the hardware. Client-based virtualization makes it possible to use the same techniques employed in server-hosted VDI while running the desktop locally on a client-based hypervisor. Client-based virtualization combines centralized management with local execution. Running applications locally on the desktop can improve the user experience without changing the way employees work and without the need to modify applications.

For more information please visit

[www.intel.com/content/www/us/en/virtualization/improve-laptop-and-desktop-virtualization.html](http://www.intel.com/content/www/us/en/virtualization/improve-laptop-and-desktop-virtualization.html)

support for advanced hardware-based management capabilities such as the ability to remotely access and manage a PC regardless of power or system state, even if deployed beyond the corporate firewall. The M92p Tiny is the ideal solution for a broad range of deployments, including remote locations or branch offices, where maintenance and management are doubly important.

## Conclusion

The Lenovo Think Centre M92p Tiny is an innovative new desktop PC that combines the benefits of a thin state client device with the local performance to optimize the delivery of compute and graphically-intensive applications. Based on the 3rd Generation Intel Core vPro Processor, it includes support for the latest and most comprehensive hardware-based manageability, security, and desktop virtualization capabilities. The M92p is a flexible and adaptable platform that offers organizations a number of benefits, including:

- **Compact Design:** Ideal for environments where heat and space are key considerations.
- **Triple and Quad Display:** Intel Processor Graphics support three independent monitors or Quad Mosaic mode.
- **Amazing Performance:** For collaboration, graphically-rich multimedia, or compute intensive applications.
- **Optimized Infrastructure:** Optimize data center resources by offloading compute-intensive applications.
- **Exceptional User Experience:** To ensure user experience and productivity are not jeopardized.
- **Ultra Energy Efficient:** Reduce energy consumption both at the desktop and in the data center.
- **Stronger Security:** 3rd Generation Intel Core vPro processors provide hardware-enhanced security for better protection.
- **Enhanced Management:** 3rd Generation Intel Core vPro processors enable the M92p Tiny to be more manageable for better control.

In addition to the M92p Tiny, Lenovo also offers the M72e Tiny, without the hardware enhanced Management and security capabilities available with 3rd Generation Intel Core vPro Processor family.

2012

EVOLUTION OF THE COMMERCIAL DESKTOP

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### M92 TINY

- Up to 3rd gen Intel® Core™ i5
- Two SoDimm/Up to 6 GB/1600 MHz
- HDD (320/500/750 GB)  
SSD (128 GB)  
Opal (250 GB)



### M57 ECO USFF

- Up to Intel® Core™ 2 Quad
- Two 200-pin SoDIMM/Up to 8 GB/800 MHz
- HDD 80/160/320/500 GB



### M55 USFF

- Up to Intel® Core™ 2 Duo
- Two 240-pin DIMM/Up to 4 GB/667 MHz
- HDD 80/160/320/500 GB



### M55 SFF

- Up to Intel Core 2 Duo
- Two 240-pin DIMM/Up to 4 GB/667 MHz
- HDD 80/160/320/500 GB



### M55 MICROTOWER

- Up to Intel Core 2 Duo
- Four 240-pin DIMM/Up to 8 GB/667 MHz
- HDD 80/160/320/500 GB

For more information visit  
[www.lenovo.com/products/us/new-products](http://www.lenovo.com/products/us/new-products)

For More information about 3rd Generation Intel Core vPro Processors Please visit  
[www.intel.com/vPro](http://www.intel.com/vPro)

<sup>1</sup> Intel® vPro™ Technology is sophisticated and requires setup and activation. Availability of features and results will depend upon the setup and configuration of your hardware, software and IT environment. To learn more visit: <http://www.intel.com/technology/vpro>

<sup>2</sup> Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, and virtual machine monitor (VMM). Functionality, performance or other benefits will vary depending on hardware and software configurations. Software applications may not be compatible with all operating systems. Consult your PC manufacturer. For more information, visit <http://www.intel.com/go/virtualization>

<sup>3</sup> Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

<sup>4</sup> Intel internal test: Citrix XenDesktop 5.0<sup>4</sup> on server based on Intel® Xeon® processor 5600 series, 96 GB RAM. Base condition of user VM loading at 50 percent server CPU utilization before and after adding 1 to 10 addition VM sessions with Multimedia Redirection (MMR) and reverse seamless.

<sup>5</sup> US EPA Study of 121 data centers [http://www.energystar.gov/ia/partners/prod\\_development/downloads/ENERGY\\_STAR\\_Data\\_Center\\_Prelim\\_Results\\_92909.pdf](http://www.energystar.gov/ia/partners/prod_development/downloads/ENERGY_STAR_Data_Center_Prelim_Results_92909.pdf)

<sup>6</sup> Intel® 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 select Intel® processors. For availability, consult your reseller or system manufacturer. For more information, see Intel® Advanced Encryption Standard Instructions (AES-NI).

<sup>7</sup> No system can provide absolute security under all conditions. Requires an Intel® Identity Protection Technology-enabled system, including a 2nd gen Intel® Core™ processor enabled chipset, firmware and software, and participating website. Consult your system manufacturer. Intel assumes no liability for lost or stolen data and/or systems or any resulting damages. For more information, visit <http://ipt.intel.com>

<sup>8</sup> No computer system can provide absolute security under all conditions. Intel® Trusted Execution Technology (Intel® TXT) requires a computer with Intel® Virtualization Technology, an Intel TXT-enabled processor, chipset, BIOS, Authenticated Code Modules and an Intel TXT-compatible measured launched environment (MLE). Intel TXT also requires the system to contain a TPM v1.s. For more information, visit <http://www.intel.com/technology/security>

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