



# A Quantum Leap in Business Agility, Data Center Efficiency and IT Value

## Microsoft Windows Server® 2008 and the Intel® Xeon® Processor 5500 Series

### SOLUTION BRIEF

Refresh existing infrastructure and accelerate data center ROI, saving on power and cooling, space, and labor costs

With many data centers now stretched to capacity in terms of power, cooling, and floor space, IT infrastructure is actually limiting IT from investing in innovation. IDC estimates that for every dollar IT spends on hardware to support new users and applications, they spend another 50 cents on power and cooling for existing hardware! The availability of Microsoft Windows Server® 2008, Windows Server® 2008 Hyper-V™, and SQL Server® 2008, together with intelligent server platforms based on the Intel® Xeon® processor 5500 series, offers an antidote to these challenges – an unprecedented opportunity to refresh existing infrastructure and accelerate data center ROI, saving on power and cooling, space, and labor costs, while delivering more computing capacity in the same footprint.

Compared to single-core servers, these new intelligent processors deliver up to 9x higher performance per server, enabling 9:1 server consolidation, up to 90% lower operating costs, and an estimated 8-month return on investment? Windows Server 2008 takes advantage of the new generation of Intel® Microarchitecture, codenamed Nehalem, to adapt processor performance to workload requirements, to deliver the highest system-level performance/watt, and to provide flexible virtualization with outstanding energy efficiency and near-native performance. Because of their exceptional performance and efficiency, an investment in servers based on the Intel Xeon processor 5500 series running Windows Server 2008 will pay for itself with exceptional data center efficiency and business agility.



**Microsoft®**

## Boost Business Agility and Insight with Better Cost/Performance

Together, Windows Server 2008, SQL Server 2008 and the Intel Xeon processor 5500 series deliver up to 2.25x the performance<sup>3</sup> in a similar power envelope,<sup>4</sup> so you can deliver greater business agility and insight in the same data center footprint and at a lower cost. Windows Server 2008 and SQL Server 2008 harness new intelligent performance features of Intel Microarchitecture Nehalem, for greater application responsiveness and throughput.

**Intel® Turbo Boost Technology** delivers performance on demand, letting processors operate above the rated frequency under certain conditions to speed specific workloads. With its seamless integration to Microsoft's operating systems and robust support for underlying Intel Xeon processor-based servers, the Windows Server 2008 Resource Governor enables administrators to set workload priorities to optimize business agility and resource usage.

**Intel® Hyper-Threading Technology**<sup>†</sup> benefits from larger caches and up to 144 GB memory capacity, delivering greater throughput and responsiveness for multi-threaded Windows-based applications.

**Intel® QuickPath Technology** and an integrated memory controller speed traffic between processors and I/O controllers to reduce latency and optimize the use of system bandwidth, delivering better application responsiveness and greater throughput/processor for bandwidth-intensive SQL Server 2008 data warehousing, business intelligence (BI) and other Windows-based applications.

The Intel Xeon processor 5500 series also helps lower power consumption and TCO for demanding applications by optimizing the ratio of throughput to total power consumed. Using 60-watt low-voltage versions, you can build high-density database systems, saving on space,

power and cooling costs. These new platforms continue Intel and Microsoft performance leadership, with higher performance/processor that allows IT to support more applications and users per server, so the business can grow more without outgrowing the data center.

“Our benchmarks show that running our on-line gaming system in a Windows Server 2008 Hyper-V virtualization environment on Intel Xeon 5500-based servers almost doubles performance. With their higher performance, consolidation headroom, and energy efficiency, these new Intel Xeon processors and Windows Server 2008 Hyper-V will help us reduce our carbon footprint, save on power costs, and let us grow our business a lot further with our existing data centers.”

– Chen FeiZhou, Vice President, Kingsoft

## Automated Energy Efficiency for Lower TCO

Energy efficiency is becoming a critical issue in the data center. After decades of IT buildout, server sprawl is escalating system management costs and outstripping available data center space, power and cooling capabilities. In a recent survey, 42 percent of data center owners said they would exceed power capacity within the next 12-24 months, and 39 percent said they would exceed cooling capacity in the same timeframe.<sup>5</sup> Windows Server 2008 running on the Intel Xeon processor 5500 series is the first platform to deliver automated power management that scales energy usage in real time to fit workload performance needs and system and data center power and thermal policies.

Windows Server 2008 uses Intel® Intelligent Power Technology<sup>9</sup> to deliver as much as 2.25x more performance in a similar power envelope<sup>6</sup> and reduce idle power as much as 50 percent versus the previous generation of two-socket servers.<sup>7</sup> Intel Microarchitecture Nehalem delivers a 5x improvement in power management capabilities from the first Intel® quad-core server processors: 5x as many

operating states, a 5x reduction in idle power, and 5x faster transitions to and from low-power states.<sup>9</sup> Automated Low-Power States allow the operating system to automatically put processor and memory into the lowest available power states that will meet the current workload while not impacting performance, and Integrated Power Gates allow individual idling cores to be reduced to near-zero power independent of other operating cores. Windows Server 2008 takes advantage of these advances to improve power efficiency. It automatically and transparently matches processor power to the needs of the workload, putting inactive cores into appropriate low-power states, and scaling the power of active processors to fit workload performance needs.

Deploying Intel Xeon processor 5500 series-based servers in an environment with Microsoft's System Center software will further extend the ability of IT professionals to proactively manage the energy consumption and environmental footprint of their physical and virtual IT environments. With its seamless integration to Microsoft's operating systems and robust support for underlying Intel Xeon processor 5500-based servers, System Center optimizes resources and reduces energy consumption through progressive Group Policy management, integrated management of virtualized and consolidated environments, and centralized reporting and control.

Windows Server 2008 R2, available now in beta, will take advantage of the Intel® Intelligent Power Node Manager, allowing IT managers to set a power budget for a rack, a row of servers, or the entire data center. With IPMI and out-of-band management, any third-party system management console can do power monitoring, metering, and capping. In Windows Server 2008 R2, Microsoft plans to have Server Core Parking, offering the capability to park and sleep cores, helping to reduce power consumption to new levels. With the availability of Windows Server 2008 R2, power consumption and budgeting information will be reported via the Windows Management Interface (WMI), and system managers will be able to configure the system power budget from within Windows.<sup>®</sup>



## Refreshing Value for Your Data Center Needs

Whatever your data center model, platforms based on Windows Server 2008 and Intel Xeon processor 5500 series-based servers offer greater efficiency and fast ROI:

**Small and medium business:** Windows Server 2008 and the new Intel Xeon processor 5500 series are ideal for the small to medium-sized business looking for great performance, low TCO and energy efficiency, and plenty of room to grow and virtualize in the future.

**Enterprise computing:** For standard business computing and enterprise applications, these innovative technologies boost performance, energy efficiency, and virtualization flexibility, making it easier to deliver more business services within existing data center facilities.

**Cloud computing:** Flexibility and performance are paramount in the cloud data center, to maximize agility and uptime. Higher performance and data bandwidth plus advanced power management features and advanced virtualization enhance data center efficiency and help to dramatically reduce operating costs.

## Flexible, Efficient Virtualization to Tame Data Center Sprawl

Virtualization is a critical IT tool for responding to data center challenges: through consolidation that gets more computing done in a smaller space and power footprint, load balancing to increase business agility and utilization of server resources, and workload migration for business continuity. To achieve the highest payoff from these virtualization initiatives, IT needs virtualization platforms that provide optimal performance and headroom, energy efficiency, flexible virtualization and reliability to support a wide variety of virtualization models.

Windows Server 2008 Hyper-V, and the Intel Xeon processor 5500 series deliver exceptional performance, energy efficiency and reliability and flexibility in a virtualized environment.

**Greater consolidation** potential and lower data center costs with up to 1.9x<sup>9</sup> the virtualization performance, leading energy efficiency and an integrated, robust set of tools for managing virtual and physical servers

**Unprecedented flexibility and control** through multi-platform support and live virtual machine migration

**Rock-solid business continuity** through complementary software and hardware capabilities that support high availability, disaster recovery, and on-line maintenance

Customer benchmarks with SaaS applications and leading ERP applications have shown that running Windows Server 2008 Hyper-V and the Intel Xeon processor 5500 series increased performance by as much as 1.9x in a virtualized environment.<sup>9</sup>

Windows Server 2008 Hyper-V with Intel Microarchitecture Nehalem provides the same power management capabilities to virtualized workloads that Windows Server 2008 provides natively. Hyper-V functions as an operating system

role within Windows Server 2008, so it can dynamically manage processor performance and power states based on the virtualized workload performance requirements and processor utilization levels. With Hyper-V as a role, plus flexible licensing policies from Microsoft, it's now easier than ever to take advantage of the cost savings of virtualization through Windows Server 2008. To further extend the value of running Intel Xeon processor 5500 series servers with Hyper-V, policy-based management with Microsoft System Center allows IT to manage both virtual and physical assets from a central location – enabling full realization of end-to-end virtualization. Giving IT the ability to handle enterprise-wide provisioning and change management from a central location vastly reduces the resources and time needed to administer the infrastructure, and enables you to be much more agile and responsive to business needs.

With Windows Server 2008 R2, Microsoft includes support for Intel® Extended Page Tables (EPT), which improves performance and reduce load on the Windows Hypervisor. Windows Server 2008 R2 will also support Live Migration, so you can seamlessly migrate virtual machines from server to server or load balance running Virtual Machines based on policy such as CPU utilization or to optimize power usage. With the combination of enhanced virtualization performance, higher energy efficiency, and the flexibility of live migration, Microsoft and Intel deliver a highly scalable, high availability and low-cost solution for the data center.

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## Always-on Business Advantage

Multi-core platforms from Intel provide the highest levels of uptime in Windows-based server environments, with more unique RAS features than competitive offerings. The Intel Xeon processor 5500 series is backed by the proven track record of the world's most widely deployed servers:

- More than 20 years of server experience
- Nearly 40 million servers deployed worldwide
- Billions of hours of real application runtime

To continue this tradition of outstanding reliability and availability, Intel collaborated closely with Microsoft on the Windows Hardware Error Architecture (WHEA).

In Windows Server 2008, WHEA offers enhanced error diagnostics, fewer hardware errors and faster recovery times when errors do occur, to further improve server availability. The Intel Xeon processor 5500 series also provides proactive data protection and improved security through advanced redundancy and error checking features including enhanced memory ECC, memory mirroring, and available DDR3 DIMM. Hot-pluggable component support and simplified clustering in Windows Server 2008, coupled with the mainframe-class RAS features of the Intel Xeon processor, reduce the cost and complexity of high-availability solutions.

Benefits	Features
	<b>Windows Server® 2008 and Intel® Xeon® Processor 5500 Series</b>
<b>Intelligent Performance for Enterprise Applications</b>	<ul style="list-style-type: none"> <li>• Up to 2.25x the performance of previous-generation processors on industry benchmarks.<sup>6</sup></li> <li>• Windows Server® 2008 takes advantage of Intel® Turbo Boost Technology to dynamically adapt performance to workload needs in real time.</li> <li>• Greater bandwidth from Intel® QuickPath Architecture with new inclusive L3 cache speeds data-intensive applications such as SQL Server®-based data warehousing.</li> <li>• Windows Server 2008 and SQL Server 2008 use Intel® Hyper-Threading Technology, larger caches and up to 144 GB of memory, to delivering greater throughput and responsiveness.</li> </ul>
<b>Lower TCO with Automated Energy Efficiency</b>	<ul style="list-style-type: none"> <li>• Windows Server 2008 and Intel® Intelligent Power Technology deliver as much as 2.25x the performance in a similar power envelope<sup>3</sup> and reduce idle power as much as 50 percent versus the previous generation of two-socket servers.<sup>7</sup></li> <li>• Windows Server 2008 automatically matches processor power to the needs of the workload, putting inactive cores into appropriate low-power states, and scaling the power of active processors to fit workload performance needs.</li> <li>• IT professionals can proactively manage the energy consumption and environmental footprint of their physical and virtual IT environments via Microsoft System Center.</li> </ul>
<b>Enhance Data Center Efficiency with Flexible Virtualization</b>	<ul style="list-style-type: none"> <li>• Greater consolidation potential and lower data center costs with up to 1.9x<sup>9</sup> the virtualization performance.</li> <li>• Customer benchmarks show that running Windows Server 2008 Hyper-V™ with the Intel® Xeon® processor 5500 series nearly doubled performance in a virtualized environment.<sup>9</sup></li> <li>• Windows Server 2008 Hyper-V with Intel® Microarchitecture Nehalem provides the same power management capabilities to virtualized workloads that Windows Server 2008 provides natively.</li> <li>• In Windows Server 2008 R2, support for Intel® Extended Page Tables (EPT) will further improve performance, and Live Migration will enhance the ability to optimize utilization.</li> </ul>
<b>Ensure Availability with Best-in-Class RAS</b>	<ul style="list-style-type: none"> <li>• Multi-core platforms from Intel provide the highest levels of uptime in Windows®-based server environments.<sup>6</sup></li> <li>• Windows Hardware Error Architecture (WHEA) offers enhanced error diagnostics and faster recovery times.</li> <li>• RAS features include enhanced memory ECC, memory mirroring, and available DDR3 DIMM.</li> </ul>

## Transforming the Economics of the Data Center

For over 20 years, Microsoft and Intel have collaborated to provide the best performance and value in enterprise platforms. Now Microsoft Windows Server 2008 and Intel Microarchitecture Nehalem take data center efficiency to a new level, with intelligent performance to deliver more business agility in a smaller footprint, plus automated energy efficiency and flexible virtualization that help you dramatically lower TCO. With these industry-leading technologies, you can refresh your IT infrastructure, achieve rapid ROI, and transform the economics of your data center.

### For More Information

To learn more about the Intel Xeon processor 5500 series, visit [www.intel.com/xeon](http://www.intel.com/xeon).

For more about Windows Server 2008, visit [www.microsoft.com/windowsserver2008](http://www.microsoft.com/windowsserver2008).

To learn more about SQL Server 2008, visit [www.microsoft.com/sqlserver](http://www.microsoft.com/sqlserver).

To find out more about Windows Server 2008 Hyper-V, visit [www.microsoft.com/hyper-v](http://www.microsoft.com/hyper-v).

To find out more about Microsoft virtualization, visit [www.microsoft.com/virtualization](http://www.microsoft.com/virtualization).

To calculate your potential savings from virtualization, visit [www.hyper-green.com](http://www.hyper-green.com).

For more information about Intel Microarchitecture, codenamed Nehalem, visit [www.intel.com/technology/architecture-silicon/next-gen](http://www.intel.com/technology/architecture-silicon/next-gen).

<sup>1</sup> Source: IDC Document: Virtualization and Multicore Innovations Disrupt the Worldwide Server Market. Document number: 206035. Publish date: March 2007.

<sup>2</sup> 8-month ROI claim estimated based on comparison between 2S single-core Intel® Xeon® processor 3.80 with 2M L2 Cache and 2S Intel® Xeon® processor X5570 based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, operating system annual license costs and estimated server costs. This assumes 8kW racks, \$0.10 per kWh, cooling costs are 2x the server power consumption costs, operating system license cost of \$900/year per server, per server cost of \$6900 based on estimated list prices and estimated server utilization rates. All dollar figures are approximate. Performance and power comparisons are based on measured SPECjbb2005\* benchmark results (Intel Corporation Feb 2009). Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 9x while the platform power was 0.8x.

<sup>3</sup> Compared to Intel® Xeon® processor 5400 series. Claim supported by multiple performance results including an OLTP database benchmark. Intel preproduction server platforms with two Quad-Core Intel® Xeon® processor X5460, 3.16 GHz, 2x6MB L2 cache, 1333MHz system bus, 64GB memory (16x4GB FB DDR2-667) vs. Intel preproduction server platform with two Quad-Core Intel® Xeon® processor X5570, 2.93 GHz, 8MB L3 cache, 6.4QPI, 72GB memory (18x4GB DDR3-800), Microsoft Windows Server 2008 Enterprise x64 Edition OS. Performance measured in transactions per second. Intel internal measurement. (Feb 2009).

<sup>4</sup> Compared to Intel® Xeon® processor 5400 series. Claim supported by multiple performance results including an OLTP database benchmark. Intel internal measurement. (Feb 2009).

<sup>5</sup> Source: Infoworld, March 26, 2008.

<sup>6</sup> Compared to Intel® Xeon® processor 5400 series. Claim supported by multiple performance results including an OLTP database benchmark on Windows Server 2008. Intel internal measurement (Feb 2009).

<sup>7</sup> Intel internal measurements of 221W at idle with Supermicro 2xE5450 (3.0GHz 80W) processors, 8x2GB 667MHz FBDIMMs, 1x700W PSU, 1x320GB SATA hard drive vs. 111W at idle with Supermicro software development platform with 2xE5540 (2.53GHz Nehalem 80W) processors, 6x2GB DDR3-1066 RDIMMs, 1x800W PSU, 1x150GB 10k SATA hard drive. Both systems were running Windows 2008 with USB suspend select enabled and maximum power savings mode for PCIe link state power management. Measurements as of Feb 2009.

<sup>8</sup> Intel® Xeon® processor 5300 series data based on Intel® Xeon® processor X5365 SKU (B-3 stepping), Xeon® 5400 series based on Xeon® X5470 (E-0 stepping), and Xeon® 5500 based on Xeon® W5580 (D-0 stepping). Number of operating states includes all frequency operating points, including Turbo Boost and base frequency. Idle power based on C6 idle power for Xeon® 5500, and C1E for Intel® Xeon® processor 5300 and 5400 SKUs. C6 also requires OS support and may vary by SKU. Faster transitions based on Package C1E exit transition latency and PLL lock time for p-state transitions.

<sup>9</sup> Sources: Customer measurements (Kingsoft). February 2009. Intel® Xeon® processor X5500 series, 2.8GHz; 12 GB, 6x2GB DDR3-1333 vs. Intel Xeon Processor E5400 series, 2.83GHz; 12GB, 6x2GB DDR2-667 FB. Intel Internal measurements, February 2009 Intel Xeon Processor X5500 series, 2.4GHz; 72GB (18x4GB) DDR3-1066MHz vs. Intel Xeon Processor E5400 series, 2.83GHz; 32GB (8x4GB) DDR2-667MHz.

<sup>10</sup> Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See [www.intel.com/products/processor\\_number](http://www.intel.com/products/processor_number) for details.

<sup>11</sup> Hyper-Threading Technology requires a computer system with a processor supporting Hyper-Threading Technology and an HT Technology enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. See [www.intel.com/info/hyperthreading](http://www.intel.com/info/hyperthreading) for more information including details on which processors support HT Technology.

<sup>12</sup> Intel® Intelligent Power Technology requires a computer system with an enabled Intel® processor, chipset, BIOS and for some features, an operating system enabled for it. Functionality or other benefits may vary depending on hardware implementation and may require a BIOS and/or operating system update. Please check with your system vendor for details.

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