



# HIGH PERFORMANCE COMPUTING (HPC) FOR ORGANIZATIONS OF ALL SIZES

## SOLUTION BRIEF

Utilize cost-effective servers that bring HPC to departments, workgroups, and businesses of all sizes

## WINDOWS\* HPC SERVER 2008 R2 AND INDUSTRY-STANDARD SERVERS BUILD ON INTEL® XEON® PROCESSOR 5600 SERIES

In today's competitive business environment, organizations face increasing pressure to make smarter decisions, fuel product innovation, speed research and development, and accelerate time to market. Intel and Microsoft are focused on empowering a broader group of people in business, academia, and government to solve some of the world's biggest challenges. They deliver the tools to harness computing capacity to make better decisions, fuel product innovation, speed research and development, and accelerate time to market - including decoding genomes, rendering movies, analyzing financial risks, streamlining crash test simulations, modeling global climate solutions and other highly complex problems.

High performance computing (HPC) can solve this challenge but has traditionally been very expensive. High hardware and software costs and the difficulty of managing complex HPC infrastructures have traditionally limited the access of HPC systems. That is, until now.

The latest advances in HPC have made it possible to leverage existing IT skills and create an HPC environment using off-the-shelf hardware. These systems deliver industry-leading computing power with more efficiency and at a lower cost of entry and ownership. Departments, divisions, workgroups, and businesses of all sizes can now access the computation resources for simulation, modeling, image rendering, and complex calculation to solve difficult problems.

## HARNESS THE POWER OF AFFORDABLE HPC

As part of their twenty-year collaboration, Intel and Microsoft have announced a new generation HPC solution that pairs the Intel Xeon® processor 5600 series with Windows HPC Server 2008 R2 to provide the performance and scalability your organization needs at a lower cost. It directly addresses your need to deploy a cost-effective solution that can handle your business-critical applications. The impact of HPC in accelerating science, gaining faster insight, cutting research costs, and driving productivity is significant. For example, film production companies can render animations faster and release movies sooner. Hospitals can speed cancer research by optimizing the pathology review process. And life insurance



companies can accelerate the processing time of financial simulations, providing financial projections in less time.

## Optimize Your Infrastructure

The Intel and Microsoft platform helps you realize many of the benefits of reliability, availability, and serviceability while intelligently adapting system performance and power to match your workload needs. The Intel Xeon processor 5600 series features two sockets, up to 12 cores, and 24 threads, providing the HPC power you require for your most demanding jobs. The Intel hardware delivers up to 40 percent higher performance than its predecessor<sup>1</sup> and more than 20 times the performance of single-core servers.<sup>2</sup> You can harness the power of 256 logical processors per server to handle critical applications and manage data intensive computing requirements. Intel's Turbo Boost Technology allows cores to run faster than base operating frequency to give you extra performance from active cores when and where you need it. Intel's QuickPath Technology maximizes data transfer performance for multi-core or multiprocessor platforms using high speed interconnects.

Even more cost and power can be saved by optimizing the fabric in the HPC cluster. Intel provides solutions in the form of Ethernet. Specifically, 10 Gigabit Ethernet provides an opportunity to be used as both the application performance fabric as well as the cluster management fabric. By reducing from two typical fabrics (InfiniBand and Gigabit Ethernet) down to a single fabric (10 Gigabit Ethernet), power and cost are reduced by eliminating switches, cables, and rack volume. And Intel offers HPC-quality 10 Gigabit Ethernet solutions with iWARP, an RDMA over Ethernet solution enabled for Microsoft MPI applications via the Network Direct interface in Windows HPC Server 2008 R2.

Depending on the application, running your workloads on the Intel and Microsoft platform can decrease capital expenditures by a factor of about five<sup>3</sup> and you also enjoy lower data center energy costs. When the server's full performance is not required, Windows HPC Server can be configured to automatically maximize energy savings by parking idle cores. Organizations can also utilize Windows HPC Server to run HPC jobs on powerful Windows 7 workstations or desktops that are idle for several hours a day, especially at night when their users have gone home.

Windows HPC Server takes full advantage of the specific

hardware characteristics of the Intel Xeon processor 5600 series. For example, the platform includes features such as machine error checking and improved virtualization. The Intel Xeon processor 5600 series comes equipped with next generation Intel Virtualization Technology that enhances virtualization performance by 35 times and reduces round-trip virtualization latency by up to 2 times. Servers of different generations can be combined in the same. And Intel Ethernet solutions support the I/O virtualization accelerations enabled by Hyper-V, thus delivering optimized networking in a virtualized environment.

## Taking Excel\* to New Levels with HPC

Microsoft Excel is being used to handle increasingly complex models and calculations. However the challenge is that some of these complex models can take hours or even days to complete on a single machine.

The solution is to enable execution in a Windows HPC cluster. Windows HPC Server 2008 R2 integrates with Excel 2010 to provide an environment that reduces the calculation time of an Excel workbook by running the workbook across a cluster of servers. Excel calculations are accelerated by one or more orders of magnitude on HPC clusters in a manner transparent to your users.

You have several options for speeding up Excel calculations including: running Excel 2010 workbooks and UDFs in parallel on the computer nodes of a HPC cluster; and running Excel calculations on a HPC cluster using Service Oriented Architecture (SOA) calls.

Whichever route you take, the efficient processing and analysis of large amounts of business data will provide your users with more information in less time, allowing them to conduct more thorough analyses and make better business decisions.

The Windows platform provides an integrated HPC solution including a complete set of runtime and scheduling policies. These policies enable you to run most HPC applications, ranging from MPI-based applications to hundreds of commercial ISV packaged applications and open source code optimized for Windows HPC Server. Also included is a complete set of system administration and management tools, as well as parallel and cluster development tools. And Windows HPC Server delivers on performance, rivaling Linux for real-world applications and providing

significantly lower total cost of ownership (TCO). Plus, you can leverage your existing infrastructure by taking advantage of a dynamic dual-boot solution from Microsoft and its partners that allows you to run Windows HPC Server on your existing Linux clusters.

Another major benefit associated with adopting the Intel and Microsoft platform is that you, your administrators, and your users work with the familiar Windows interface. And with complete, integrated, end-to-end systems management, administrators have everything they need to deploy, provision, monitor, troubleshoot, and manage entire clusters-through the lifetime of the cluster.

### Choosing Deployment Options

With a variety of options, you can configure an HPC solution for your business to fit your budget and meet business needs. For example, HPC can be hosted both on-premises or in the cloud, a cost-effective solution for businesses that don't use HPC every day.

With Windows HPC Server 2008 R2 organizations can leverage Windows Azure to boost on-demand scalability and capacity to further enhance their HPC capabilities. Windows HPC Server 2008 R2 provides the ability to "burst" to Windows Azure from on-premises systems, providing greater capacity when needed.

For organizations looking to fully maximize current investments, Windows HPC Server 2008 R2 also lets you use the idle cycles of your Windows 7 desktops to help process HPC workloads. You increase your capacity without making additional investments.

## SCALE TO MEET YOUR GROWING REQUIREMENTS

What happens when your installation of servers based on the Intel Xeon processor 5600 and Windows HPC Server 2008 R2 has proven so successful that you are bumping up against the HPC system's total capacity? The answer is simple-it's time to move up to the next level of intelligent, expandable platforms: the Intel® Xeon processor 7500 series. You already have Windows HPC Server in place; now by adding the more powerful and scalable Intel Xeon processor, you have the HPC platform needed to handle mission-critical applications and massive data sets.

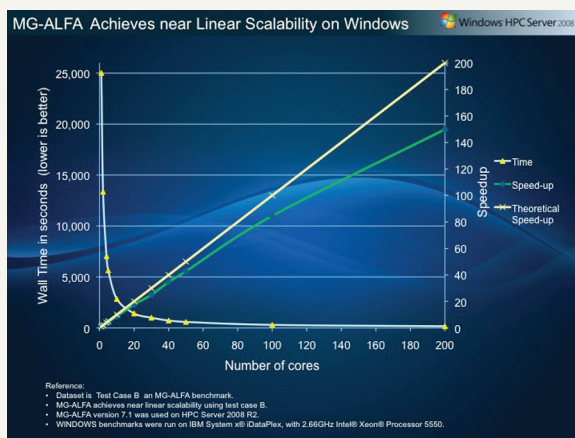
The processor features eight cores and supports 16 threads and 24 MB of cache. Other Intel features maximize the platform's performance and scalability, allowing the new processor series to provide a nine times memory improvement over its predecessor, the Intel Xeon processor 7400, and provide new reliability, availability, and serviceability (RAS) features.

In addition, you can repurpose your existing Intel Xeon processor 5600 series servers in your data center when upgrading your HPC infrastructure to the Intel Xeon processor 7500 series. The Intel Xeon processor 5600 series is a versatile and scalable solution, ideally suited for a wide range of applications.

### Near Linear Scalability with Windows HPC Server

To determine the scalability of Windows HPC Server, IBM, Microsoft and Milliman conducted a joint study running test cases on the Milliman MG-ALFA benchmarks suite. MG-ALFA is a Windows-based actuarial system that generates financial projections to support decision and analysis. The MG-ALFA benchmark suite covers a wide range of problem sizes and real-life scenarios.

The results, shown in the graphics below, demonstrate excellent near-linear scalability of MG-ALFA on an IBM iDataplex cluster running Windows HPC Server 2008 with Intel Xeon processors. Details of the joint study are available in a white paper available at: [http://www-03.ibm.com/systems/resources/systems\\_deepcomputing\\_mg\\_alfa\\_white\\_paper\\_2009\\_final.pdf](http://www-03.ibm.com/systems/resources/systems_deepcomputing_mg_alfa_white_paper_2009_final.pdf)



## BENEFIT FROM A HPC PLATFORM

By deploying servers powered by the Intel Xeon processor 5600 and Windows HPC Server, you can realize the level of performance and scalability your organization needs to handle business-critical applications.

Benefits include:

- **Scalable performance:** with two sockets and up to 12 cores, the Intel Xeon processor 5600 delivers up to 60 percent higher performance than its predecessor and 15 times the performance of single-core servers. And, as your business grows and you need more HPC horsepower for complex computations and modeling, you can upgrade your platform to the Intel Xeon processor 7500.
- **Energy efficiency:** reduces energy costs by automatically controlling power consumption while delivering up to 40 percent higher performance per watt than its predecessor. Lower fabric power by consolidating to a single 10 Gigabit Ethernet fabric.
- **Advanced reliability:** allows you to extend business-critical systems and information to help end-users identify opportunities and gain insights from analyzing data. The Intel Xeon processor 5600 includes a number of features that help ensure hardware reliability.
- **Business agility:** easily deploy new business services and optimize the flexibility of existing applications to more effectively meet changing business requirements.

### Enter the New Era of Cost-Effective, Flexible, Reliable HPC

Industry-standard servers powered by the Intel Xeon processor 7500 and 5600 series and Windows HPC Server give you the computation resources you need to solve difficult problems, while minimizing acquisition costs. Intel

Ethernet provides further opportunities to reduce cost and power. Tight integration of the hardware and software allows you to realize the scalable performance, advanced reliability, and agility you need to run data intensive applications and meet the constantly changing demands of your business. Now high performance computing is more available and affordable than ever before for businesses and organizations of all sizes.

## RESOURCES AND LINKS

- Intel Xeon Processor 5600 Series  
[http://www.intel.com/itcenter/products/xeon/5600/?iid=gg\\_work+home\\_xeon5600](http://www.intel.com/itcenter/products/xeon/5600/?iid=gg_work+home_xeon5600)
- Intel Xeon Processor 7500 Series  
<http://www.intel.com/itcenter/products/xeon/7500/index.htm>
- Windows HPC Server 2008 R2  
<http://www.microsoft.com/hpc/en/us/default.aspx>
- Intel and Microsoft Alliance  
<http://www.intelalliance.com/microsoft/>

### Related Case Studies:

- Beijing Software Testing & QA Center:  
[http://www.microsoft.com/casestudies/Case\\_Study\\_Detail.aspx?CaseStudyID=4000002985](http://www.microsoft.com/casestudies/Case_Study_Detail.aspx?CaseStudyID=4000002985)
- Katholieke Universiteit Leuven:  
[http://www.microsoft.com/casestudies/Case\\_Study\\_Detail.aspx?CaseStudyID=4000002976](http://www.microsoft.com/casestudies/Case_Study_Detail.aspx?CaseStudyID=4000002976)

<sup>1</sup> Up to 40 percent higher performance per watt compared to Intel Xeon processor 5500 series claim supported by performance results on a server side Java benchmark in conjunction with power consumption across a load line. Intel internal measurement as of January 15, 2010. Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information, visit [www.intel.com/performance/server](http://www.intel.com/performance/server).

<sup>2</sup> Intel performance comparison as of February, 2010, using SPE Cjbb2005\* business operations per second between four-year-old single-core Intel Xeon processor 3.8 GHz with 2M cache based servers and one new Intel Xeon processor X5600-based server. Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information, visit [www.intel.com/performance/server](http://www.intel.com/performance/server).

<sup>3</sup> See page 2 of the downloadable document at: <http://search.microsoft.com/results.aspx?form=MSHOME&mkt=en-US&setlang=en-US&q=Nehalem-EX+FAQ>

Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. Go to: <http://www.intel.com/products/processor%5Fnumber/>

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