



Server Virtualization

with Windows Server® 2008 Hyper-V™ on Intel® Xeon® Processor-Based Servers

SOLUTION GUIDE

Discover more ways to win by using Intel Xeon processor-based servers to power Windows Server 2008 for virtualization.

Today's businesses are striving to be more agile. In that quest, virtualization has emerged as a solid architectural foundation upon which to achieve greater efficiency, reliability, and robustness. With its built-in server virtualization technology, Windows Server® 2008 provides this software foundation. However, many businesses are struggling to select the ideal hardware platform to fully capitalize on their selection of Windows Server Hyper-V.™

Intel and Microsoft bring over 20 years of collaboration to bear to meet this challenge. Multi-core Intel® Xeon® processor-based servers featuring Windows Server Hyper-V deliver a fully integrated virtualization solution on the world's most widely deployed hardware and software architecture.



Microsoft®

Intel and Microsoft: Leading Innovation, Lasting Advantage

Leading the fulfillment of Moore's Law, Intel has consistently delivered double the computing power in the same power envelope every 12 to 18 months. These platform improvements provide a foundation for Microsoft to optimize its software IT infrastructure. Intel and Microsoft share a long-time commitment across engineering, sales, and service to bring businesses innovations in hardware and software that make business more powerful, efficient, and flexible.

Intel and Microsoft share a vision with new hardware architectures that are optimized for scalable, multi-core computing, in addition to software that uses these new capabilities. Together, these dual technologies can deliver faster, more flexible performance and capacity where and when they are needed.



Complementary Virtualization Technologies

One facet of the shared Intel and Microsoft vision of faster and more flexible server performance is a joint commitment to delivering complementary virtualization-related technologies to meet the challenges posed by virtualization initiatives, in addition to fully unlocking the business potential of server virtualization.

The virtualization software layer must be a reliable and robust translation engine to faithfully emulate the physical hardware, and it must be scalable and powerful enough to handle demanding virtual machine workloads. In addition, the physical hardware powering the virtualization software and its guest virtual machines must be reliable and powerful. Under all virtualization scenarios, the server is a common point of failure for many workloads, and it must offer rock-solid reliability to meet that challenge.

The pairing of Intel and Microsoft virtualization-related technologies helps realize the benefits of virtualization. For Microsoft, this realization is chiefly represented by Windows Server Hyper-V, the next-generation server virtualization technology offered in Windows Server 2008 Standard, Windows Server 2008 Enterprise, and Windows Server 2008 Datacenter. Coupled with the powerful management features of Windows Server 2008 and the Microsoft® System Center family of management products, this virtualization software platform delivers the performance and manageability demanded by virtualization scenarios.

Fundamentally, virtualized workloads can only be as effective as the processor hosting them is powerful and robust. Intel supplies such a platform for virtualization with its powerful Quad-Core Intel® Xeon® processors extending energy efficiency and multi-core performance. Coupled

with the hardware-assisted virtualization found in Intel® Virtualization Technology¹ (Intel® VT), and outstanding reliability, availability, and serviceability (RAS) features, Intel Xeon processor-based servers embody the Intel leadership in breaking down the barriers to delivering the computing power and reliability needed for all types of virtualization initiatives. The benefits of the next-generation virtualization solution from Microsoft are enhanced and multiplied by Intel Xeon processor-based servers.

Intel Xeon Processor-Based Servers: An Ideal Platform for Virtualization

As virtualization becomes more widely adopted in IT organizations, the performance and reliability of the host computer are increasingly under scrutiny. It is critical for all virtualization usage scenarios that the server provides scalable power to virtual machine workloads that demand increasingly more computing resources. It is also critical for all virtualization usage scenarios that the server is reliable and robust, ensuring the availability of all guest virtual machines. Intel Xeon processor-based servers offer a leading set of features that meets these critical needs.

Intel® Core™ microarchitecture and Quad-Core processors: Intel Core microarchitecture was introduced in 2006 with multi-core processors delivering industry-leading performance and greater energy efficiency. With the latest Intel® 45nm Hi-k metal gate brought the next-generation Intel Core microarchitecture to market.

The evolution of Intel Core microarchitecture with 45nm Hi-k silicon technology, available in Intel Xeon processor 5400^A sequence, includes an extensive array of improvements, including further energy efficiencies, increased transistor density, and improved transistor switching speed. The 45nm Quad-Core Intel Xeon processors

provide up to 12 MB of on-die, L2 cache, a dedicated high front-side bus, and fully buffered DIMM technology to minimize bottlenecks and errors within the memory subsystem. Furthermore, the shared memory bus in these processors has been replaced with a serial point-to-point lane and a dedicated buffer for each memory module, enabling dramatically improved memory efficiency and performance. Quad-Core Intel Xeon processor 5400 sequence-based servers therefore provide leading price/performance per watt, offering an ideal solution for smaller IT virtualization projects typically involving infrastructure consolidation.

The benefits of the next-generation virtualization solution from Microsoft are enhanced and multiplied by Intel Xeon processor-based servers.

The Quad-Core Intel Xeon processor 7300^A sequence, based on Intel Core microarchitecture, offers leading scalable performance and best-in-class virtualization for enterprise-scale server consolidation. On a four-processor platform, with up to 16 threads, 32- and 64-bit processing capabilities, and with up to 8 MB of L2 cache per processor, large-scale consolidation can be a reality, while still providing the peak load responsiveness needed for the unpredictability of virtualized applications. Additionally, the energy efficiency gained from Intel Core microarchitecture helps enable highly dense 80-watt or 50-watt processor-based rack and blade form factors. Quad-Core Intel Xeon processor 7300 sequence-based servers offer an excellent foundation for virtualization projects that require more than 24 GB of memory, intensive input/output (I/O), and high levels of server reliability.

Quad-Core Intel Xeon processors, built using the latest Intel Core microarchitecture, provide an industry-leading platform to deliver the power, reliability, and efficiency needed for any virtualization scenario.

Intel Virtualization Technology (Intel VT): Intel was also the first to introduce hardware-assisted virtualization within the industry-standard space by offering Intel Virtualization Technology. Intel VT reduces the need for compute-intensive software translations between the guest and host operating systems, enabling “near-native” performance for guest virtual machines. Intel Xeon processors based on the new 45nm process provide further virtualization performance improvements by speeding up virtual machine transition (entry/exit) times by an average of 25 to 75%. This is all done through microarchitecture improvements and requires no virtual machine software changes.

Intel® I/O Acceleration Technology (Intel® I/OAT): Intel I/OAT helps a host computer manage the larger volumes of input/output data associated with the operation of many virtual machines on one physical host. Intel I/OAT accelerates TCP/IP processing, delivers data-movement efficiencies across the entire server platform, and minimizes processor overhead, freeing processor resources for more virtual machine multitasking. What is more, Intel and Microsoft

Intel VT reduces the need for compute-intensive software translations between the guest and host operating systems, enabling “near-native” performance for guest virtual machines.

have worked together to ensure that Intel I/OAT is tightly integrated into Windows Server 2008, eliminating the need for third-party hardware and associated support risks. Intel I/OAT is another important tool from Intel that helps deliver leading performance for virtualization.

Leading reliability, availability, and serviceability (RAS) features of Intel Xeon processors: While virtualization offers a wide range of benefits by consolidating many workloads onto a single physical host, it also introduces this single host as a single point of failure for these workloads. Providing a highly reliable and available hardware platform becomes a much greater imperative for businesses seeking to harness the benefits of virtualization.

The industry-leading Intel® RAS features provide this platform by reducing the cost and complexity of high-availability solutions while improving recovery speed and reliability. These features include improved Error Correcting Code (ECC) coverage for system bus and cache, new memory mirroring, fully buffered DIMM technology, and hot-pluggable component support.

Common Scenarios for Using this Combined Platform from Intel and Microsoft

Often a leading use for virtualization technology, testing and development of various IT scenarios benefit from virtualization with safe, controlled environments at lower costs and reduced management overhead. Windows Server Hyper-V and Intel Xeon processor-based servers maximize the utilization of testing hardware by increasing testing speed and reducing testing costs. The benefits of running virtual machines on Intel-based servers extend throughout additional scenarios such as server consolidation, business continuity, and dynamic data center.

Server Consolidation

Server consolidation helps businesses optimize the IT infrastructure, lower total costs of ownership, and improve flexibility. Windows Server Hyper-V, powered by an Intel Xeon processor-based server, helps deliver these time- and cost-saving benefits.

To best optimize the IT infrastructure, businesses need to be able to increase server density (or run as many server workloads – virtual machines – as possible on a single physical server) without sacrificing performance. Windows Server Hyper-V can help realize this goal by supporting a wider range of guest operating systems (Windows®, Linux*, and Xen-enabled Linux) and by supporting both 32-bit and 64-bit guest operating systems. Furthermore, virtual machine performance can be enhanced by using a Server Core installation of Windows Server 2008. Server Core is a minimal installation of the Windows Server 2008 operating system designed to deploy only necessary services, thus enabling higher performance.

These high-density and performance features of Windows Server 2008 are maximized by using Quad-Core Intel Xeon processor-based servers. Intel Xeon processor-based servers help ensure greater performance for all types of workloads. Quad-Core Intel Xeon processor-based servers built on Intel Core microarchitecture offer an optimized server platform for virtualization by providing more instructions per clock cycle and reduced latency to cache. This empowers virtual machines to realize greater performance and multitasking abilities. This architecture delivers native performance leadership and helps realize greater responsiveness for unpredictable virtual machine workloads. When combined with the “near-native” performance benefits of Intel VT and a balanced subsystem, Quad-Core Intel Xeon processor-based servers built on Intel Core microarchitecture deliver the leading platform



for reliably powering server consolidation. Furthermore, the Dedicated High-Speed Interconnects (DHSI) in Quad-Core Intel Xeon processors increase on-chip memory bandwidth by up to two times over previous-generation platforms, leading to more virtual machines per server without sacrificing individual virtual machine performance.

An optimized infrastructure lowers direct costs, such as hardware acquisition costs, by reducing the number of physical servers needed. Server consolidation has the added benefit of reducing indirect costs through reduced power, cooling, and hardware management costs. Using Intel Xeon processor-based servers magnifies these indirect cost savings. For example, Intel and Microsoft have worked together to reduce energy costs with Intel® Demand-Based Switching (DBS). DBS support in Intel Xeon processors

reduces processor power consumption when utilization is low, resulting in better processor power efficiency. In another example, the 45nm Intel Xeon processor 5400 sequence further reduces processor power consumption, enabling Intel Xeon processor-based systems to deliver the leading performance per watt. When this platform is used to power Windows Server 2008 and its advanced power management features, such as processor power management, energy savings can be maximized.

Another example of indirect cost savings is the combination of Intel I/OAT and the unique reliability, availability, and serviceability (RAS) features in Intel Xeon processors.

Consolidating servers with Windows Server 2008 and Intel Xeon processors helps businesses to achieve maximum total cost savings.



These important tools improve virtual machine reliability and portability. If you combine these benefits of Intel Xeon processor-based systems with Windows Server Hyper-V features, such as offline Virtual Hard Disk manipulation, live backup of virtual machines, hot-swap hardware support, virtual machine health monitoring, and Group Policy integration, you can realize dramatic overall savings in management costs.

Finally, Microsoft has introduced a licensing model that offers unique benefits to businesses consolidating using Windows Server Hyper-V. Servers running Windows Server 2008 Enterprise can run up to four virtual instances of Windows Server-based operating systems under the same license, while a server licensed with Windows Server 2008 Datacenter enables you to run an unlimited number of virtual instances of Windows Server 2008. Consolidating servers with Windows Server 2008 and Intel Xeon processors helps businesses to achieve maximum total cost savings.

Business Continuity

Minimizing scheduled and unscheduled downtime and planning for disaster recovery are leading concerns in today's business environment. Virtualization promises to remove traditional barriers to this critical need, such as operating system limitations, hardware costs, bandwidth limitations, and management overhead. Windows Server Hyper-V, powered by Intel Xeon processor-based servers, helps eliminate these barriers.

Windows Server Hyper-V provides several features to update and manage virtual machines without the downtime that a physical machine would normally require. Live backup, for example, uses Volume Shadow Copy Services (VSS) to back up a running virtual machine, including data and system state, without downtime. Virtual Machine Snapshots can also be performed on a running virtual machine. Virtual Machine Snapshots save the state of the virtual machine

so that administrators can reset the virtual machine to a previous “known good” state. All of these features require processing overhead. So when they are coupled with the performance and reliability benefits of Intel Xeon processor-based servers, these features can be applied more quickly and reliably to provide higher levels of availability and reduced management overhead.

Of course, unscheduled downtime is the most costly kind. Windows Server 2008 and Intel Xeon processors have complementary features that help prevent unscheduled downtime. These features include more robust networking features in Windows Server Hyper-V, like support for virtual local area network (VLAN) and Network Address Translation (NAT), and hot-pluggable virtual network interface cards (NICs). Health monitoring and Group Policy integration are other Windows Server Hyper-V features that provide a means for more proactive monitoring of virtual machine patch and upgrade levels. The enhanced RAS features of Intel Xeon processor-based servers further reduce the cost and complexity of high-availability solutions while improving recovery speed and reliability. A key advancement for RAS is the Windows Hardware Error Architecture (WHEA), an effort where Intel has worked closely with Microsoft. WHEA provides a common infrastructure for handling hardware errors, reducing hardware error recovery times through standardized richer error reporting. WHEA also reduces system crashes related to hardware errors by integrating with Windows Server 2008 health monitoring.

Even with the most diligent efforts and the most carefully designed systems, unscheduled downtime may still occur – most likely in the form of a disaster, such as a fire or flood. When it does, you need to be able to recover quickly with minimal data loss. Thanks to the portability of virtual machines, Windows Server Hyper-V and Intel Xeon processor-based servers can form the core of virtualization-



based disaster planning and recovery solutions for industry-leading robustness at an affordable price. Windows Server Hyper-V enables you to rapidly migrate a running virtual machine from one physical host system to another with minimal downtime, taking advantage of familiar high-availability capabilities of Windows Server and System Center management tools. When combined with live backup, this solution helps to ensure minimal downtime.

Dynamic Data Center

Virtualization has quickly become a standard technology in the data center, and management tools have begun to harness its potential as well. Intel Xeon processors also provide the performance and reliability required for powering Windows Server Hyper-V with Microsoft System Center, helping to realize the dynamic data center vision of self-managing systems and operation agility.

Windows Server Hyper-V takes advantage of components of Windows Server 2008, like simplified failover clustering, to provide highly available solutions. When combined with native Windows Server Hyper-V features like Quick Migration, and powered by the computational power of Intel Xeon processor-based servers, Windows Server Hyper-V can help administrators see greatly reduced management burdens. Taking things one step further, Windows Server Hyper-V integrates seamlessly into Microsoft System Center products,

including the new Microsoft System Center Virtual Machine Manager, which provides centralized administration of virtual machine infrastructure and enables increased physical server utilization and rapid provisioning of new virtual machines by the administrator and authorized users. Future versions of System Center Virtual Machine Manager are scheduled to include even more advanced-provisioning tools, like automated virtual machine configuration.

Summary

Virtualization plays an increasingly critical role at all levels of IT, from the desktop through the data center. Both Windows Server 2008 and Quad-Core Intel Xeon processors offer built-in virtualization technologies, helping make organizations more agile and IT operations more robust and efficient. Intel Xeon processor-based systems running Windows Server 2008 are an ideal platform for all virtualizations solutions, helping IT organizations to significantly reduce operating costs, increase server utilization and availability, and achieve better return on investment.



For More Information

For more information about Intel Xeon processors, visit www.intel.com/products/server/processors/index.htm.

For more information about the Intel and Microsoft solutions, visit www.intelalliance.com/microsoft.

For more information about Windows Server 2008, including Windows Server Hyper-V, visit www.microsoft.com/windowsserver2008/default.mspx.

[†] Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform software enabled for it. Functionality, performance or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

^Δ 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/ for details.

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