Server virtualization is helping IT organizations improve data center productivity in fundamental ways. It lets you consolidate multiple operating systems and applications per physical server, reducing the size and costs of your IT infrastructure, while enabling you to deploy new applications in minutes. Virtualization also lets you move running applications from one server to another without downtime, for flexible workload management, high availability during planned maintenance or unplanned events. Investment in virtualization solutions is an intelligent business decision: the benefits in utilization, energy savings, manageability, service levels and cost models can be dramatic.
To gain full value of virtualization, you need servers that are built to handle the heavy and ever-changing demands of a virtualized and consolidated computing environment. To help you get maximum benefits from virtualization, Intel has built a better physical server platform with unique hardware-assist features to enhance the virtual data center. The Intel® Xeon® processor 5500 series is the first of this new generation of server platforms built with higher I/O bandwidth for higher virtualization performance plus multi-generation VM migration for unparalleled flexibility in virtualized environments. Next-generation Intel® Virtualization Technology (Intel® VT) enhances native virtualization performance by up to 2.1x¹ and reduces roundtrip virtualization latency by up to 40 percent² with hardware-enhanced technologies built into Intel® processor, chipset, and network adapter.

“Choosing the right hardware platform for server virtualization is just as important as choosing the right virtualization software.”³

—IDC

Superior Virtualization through Comprehensive Hardware Support

Servers of just a few years ago were designed to host a single operating system. Successful virtualization with these systems requires software that can emulate a complete hardware environment for every guest operating system. This is a compute-intensive process that introduces significant performance overhead. It can slow application response times, limit scalability, and create complexity that can impact reliability and security. Mixed server environments can also compromise the benefits of virtualization: as new servers are added, the inability to migrate VMs across different generations of servers limits data center flexibility.

Intel Virtualization Technology (Intel® VT) addresses these challenges at the silicon level, by providing comprehensive hardware assists that boost virtualization software performance by up to 2.1x¹, improve application response times and provide greater reliability, security and flexibility. These integrated hardware assists accelerate fundamental virtualization processes throughout the platform to reduce latencies and avoid potential bottlenecks. They also reduce the demands placed on the virtualization software, so more processor cycles are available for running business applications, and they enable VM migration across multiple generations of Intel® processor-based servers. As a result, you can consolidate more applications and heavier workloads per server to get better value from your server and software investments.

Intel works with VMware, Microsoft, Citrix, Parallels and many other virtualization software vendors to help ensure that Intel virtualization technologies are broadly supported in today’s and tomorrow’s solutions, so they deliver high value while being completely transparent to IT organizations and end-users. The functionality of your virtualization solutions is unchanged. Your virtual servers are simply more responsive, more scalable and more reliable.
The Processor: Intel® VT-x

Better Virtualization Support in Intel® Processors

Intel VT-x helps to improve the fundamental flexibility and robustness of software-based virtualization solutions. It reduces VMM interventions by eliminating the need for the VMM to listen, trap and execute certain instructions on behalf of the guest OS as is required in software-only virtualization. It also provides hardware support for transferring platform control between the VMM and guest OSs, so when VMM intervention is required, handoffs are faster, more reliable and more secure.

In addition, Intel VT-x has VM migration features that protect your IT investments and enhance flexibility for fail-over, load balancing, disaster recovery and maintenance:

- Intel® VT FlexPriority: When a processor is performing a task, it often receives requests or “interrupts” from other devices or applications that need attention. To minimize the impact on performance, a special register in the processor (the APIC Task Priority Register, or TPR) monitors the priority of tasks, so only interrupts that have a higher priority than the currently running task receive immediate attention. Intel FlexPriority creates a virtual copy of the TPR which can be read, and in some cases, changed by guest OSs without VMM intervention. This can deliver major performance improvements for 32-bit OSs that make frequent use of the TPR. (For example, it can improve performance by as much as 35 percent for applications running on Windows Server® 2000.)

- Intel® VT FlexMigration: One of the key benefits of virtualization is the ability to migrate running applications from one physical server to another without downtime. Intel VT FlexMigration is designed to enable seamless migrations among current and future Intel processor-based servers, even though newer systems may include enhanced instruction sets. With this technology, hypervisors can establish a consistent set of instructions across all servers in the migration pool, enabling seamless migration of workloads. The result is a more flexible and unified pool of server resources that functions seamlessly across multiple hardware generations.

The Chipset: Intel® VT-d

Better Virtualization Support in Intel® Chipsets

As more guest OSs are consolidated per server, the movement of data into and out of the system (I/O traffic) increases and becomes more complex. Without hardware assistance, the VMM is directly involved in every I/O transaction. This not only slows down data movement, but also increases the load on server processors due to the higher VMM activity. It’s as if every shopper in a busy shopping mall had to enter or exit the mall through a single door and get directions only from the mall manager. This would not only slow down customers, but would also prevent the manager from attending to other pressing issues.

Intel VT-d speeds data movement and eliminates much of the performance overhead by reducing the need for VMM involvement in managing I/O traffic. It accomplishes this by enabling the VMM to securely assign specific I/O devices to specific guest OSs. Each device is given a dedicated area in system memory that can be accessed only by the device and by its assigned guest OS.

Once the initial assignments are made, data can travel directly between a guest OS and its assigned devices. I/O traffic flows more quickly and the reduced VMM activity decreases the load on the server processors. Security and availability are also improved, since I/O data intended for a specific device or guest OS cannot be accessed by any other hardware or guest software component.

The Network: Intel® VT-c

Better Virtualization Support in Intel® I/O Devices

As businesses deploy more and more applications in virtualized environments, and as they take advantage of live migration to save power or boost availability, the demands on virtualized I/O increase significantly. Intel VT-c optimizes the network for virtualization by integrating extensive hardware assists into the I/O devices that are used to connect your servers to your data center network, storage infrastructure and other external devices. In essence, this collection of technologies functions much like a post office that sorts an
A Better Platform for Virtualization

The Intel Xeon processor 5500 series is better physical platform for virtualization, with unique hardware-assist features to enhance the virtual data center and help tame server sprawl. The Intel Xeon processor 5500 series, built on Intel® Microarchitecture, codename Nehalem, expands the benefits of virtualization with innovations that boost performance, enhance I/O, and enable servers of different generations to be combined in the same virtualized server pool, facilitating application failover, load balancing, and disaster recovery capabilities.

These technologies are fully integrated, thoroughly tested and widely supported by leading virtualization software solutions. They provide IT organizations with a proven, industry-leading foundation for optimizing the value of their server and virtualization investments.

For the latest information about Intel Virtualization Technology, visit the Intel Web site at: www.intel.com/technology/virtualization/server

For detailed information about Intel VT-c and VT-d visit: www.intel.com/go/vtc