



Solution Recipe: Intel® Server Platforms Enhanced with Intel® Virtualization Technology





Preface

Intel has developed unique Solution Recipes that will enable its channel members to provide complete solutions to their customers, backed by top-quality technology and support. A solution recipe is a comprehensive document that describes how to combine Intel®-based ingredients to create new technology solutions for common business challenges. This recipe examines the need for a secure, robust, and efficient virtualization experience, which can be addressed using hardware-enhanced virtualization technology available with Dual-Core Intel® Xeon® processor-based servers. When you are ready to deploy this recipe, please refer to the related Deployment Guide, which includes step-by-step instructions. You can find the guide by visiting: <http://www.intel.com/go/5000sequence>

Common Notation and Terms

RAS: Industry acronym for reliability, availability, and serviceability.

Virtual Machine Monitor (VMM): The host software that delivers virtualization capability.

Virtualization: The process by which a number of different execution environments can coexist on a single server.

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Addressing New Market Opportunities

Companies large and small, across all markets and regions of the globe, rely on older, mission-critical applications and line-of-business solutions in their daily operations. It's expensive and risky to port these functions to new platforms. While these legacy applications may still adequately meet basic business needs, organizations also need the ability to react quickly and adapt to maintain a competitive advantage.

With virtualization technology, a computer or server can run multiple operating systems and applications on the same machine in independent partitions or "containers." In other words, virtualization allows one computer to act as if it were several computers working in parallel.

Many companies can use virtualization to maintain their aging software without putting their environments at risk of significant downtime. Virtualization is a proven IT approach that shares resources to help lower costs, optimizes utilization, and creates an infrastructure where supply more seamlessly meets demand. Your customers can bring capacity online as needed because it's as simple as starting a virtual machine.

To help small and medium-sized customers reach their goal of doing more with less, you can offer them smart solutions that simplify test and development environments, take advantage of server consolidation, enable remote legacy application management, and respond more quickly to shifting workload requirements. Technological advancements in virtualization make it all possible.

But software alone cannot deliver the security and performance for virtualization that today's companies require. Using Dual-Core Intel® Xeon® processor-based servers with native Intel® Virtualization Technology (Intel® VT), your customers can improve reliability, performance, and system availability. Along with enabling faster industry innovation, Intel VT helps extend the core platform architecture so that companies can significantly reduce their total cost of ownership.

Solution Overview

Virtualization is a solution that can enable a more secure, robust, and efficiently managed information technology infrastructure. By combining hardware-enhanced virtualization technology available with Dual-Core Intel® Xeon® processor-based servers and key software, customers of all sizes can better realize these benefits and help gain performance headroom and software compatibility.

In software-only virtualization solutions, the Virtual Machine Monitor (VMM) controls physical server resources so that it can manage the demands of multiple “guest” operating systems. To provide that level of control, the VMM runs in the space traditionally reserved for the operating system, and guest operating systems run in the space traditionally used for applications. Because the operating systems are not designed to run in this application environment, complex software workarounds are required for them to function reliably. This creates significant issues, including:

- Potential incompatibility with legacy operating systems, which increases testing and validation requirements when consolidating legacy applications onto new servers.
- Increased likelihood of software conflicts due to the complexity of the VMM application.
- Additional performance overhead necessary to handle the complex software workarounds.
- Dependent VMM and operating system development, so the VMM vendor must continually adapt to operating system upgrades and patches (and vice-versa).
- Synchronized upgrades and patching in IT environments, which adds to complexity, expense, and risk.

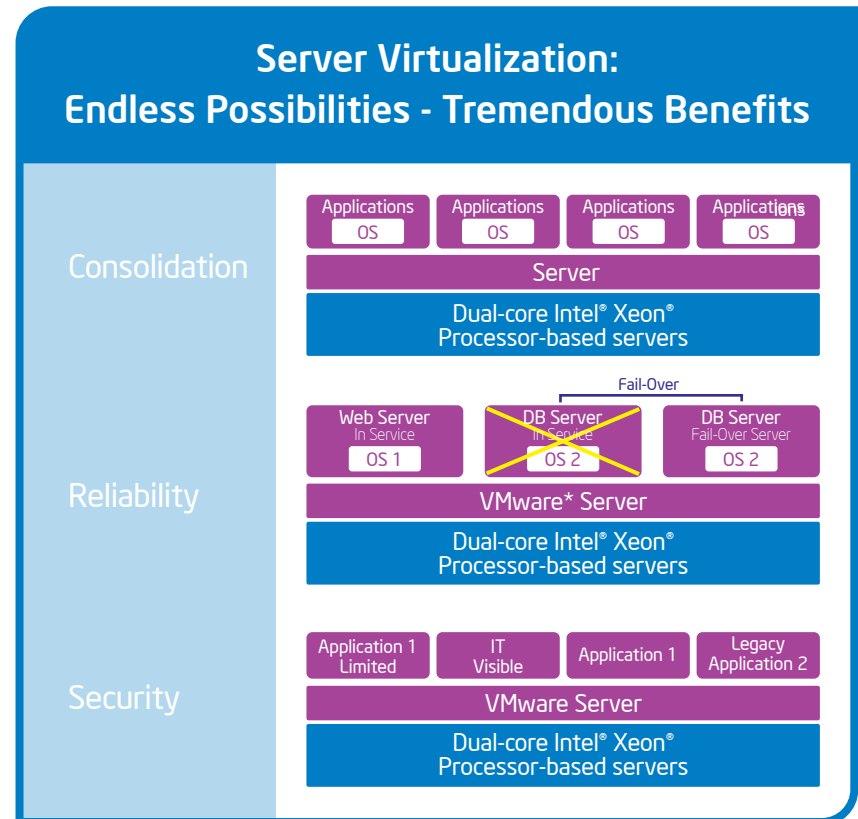


Figure 1. Virtualization helps companies consolidate diverse operating systems into virtual machines on high performance servers.

Intel VT provides hardware-based functionality that works with compatible virtualization software to address the challenges of software-only solutions. Specifically, Intel VT provides:

- A new, privileged space for the VMM that reduces the need for VMM intervention and allows guest operating systems to run directly on hardware.
- Handoffs between the VMM and guest operating systems that are supported in hardware, reducing the need for complex, computer intensive, time-consuming software transitions.
- Hardware-based memory protection, in which processor-state information for the VMM and each guest operating system is retained in dedicated address spaces, accelerating transitions and helping to ensure process integrity.

The full capacity of Intel VT can be found natively in Dual-Core Intel Xeon processor-based servers. To resolve the difficulty of porting outdated software and operating systems to new hardware, your customers can use this technology to migrate legacy applications and their existing operating systems onto virtual partitions with no modifications necessary. Plus, using these servers with Virtual Machines (VMs) means that pre-built operating-system images can be installed in no time, and solutions can be up and running quickly. Companies using Dual-Core Intel Xeon processor-based servers with Intel VT can protect themselves from server downtime because software faults and network attacks remain

isolated by a virtual partition. It's easy to create duplicate virtual machines for failover protection. If one application instance fails, business continuity is not interrupted—a cost-effective approach that reduces risk and potential losses from downtime.

From a management perspective, virtualization using Dual-Core Intel Xeon processor-based servers means virtual servers can be deployed and managed efficiently from a common interface. Server resources (processor, memory, and I/O) can be allocated dynamically as well as seamlessly; and running applications, workloads, and sessions can be moved from one physical server to another. Virtualization also provides control over each partition, allowing any virtual machine to be managed without affecting other activities on the platform.

Many of your customers also struggle to safely adopt new technology that can help promote business expansion. With virtualization on Dual-Core Intel Xeon processor-based servers, a single platform can be used to host multiple test environments and multiple iterations of each software stack. New and upgraded versions of an operating system or application can be tested on the same production platform without disrupting the production environment, helping to eliminate the need for costly duplicate environments. This delivers the flexibility to provision or resize a virtual partition in minutes to accommodate new applications and increased workloads.



Key Technology

An optimal virtualization solution includes a combination of virtualization software and hardware. To achieve the full benefits of virtualization, plus additional security and performance, Dual-Core Intel Xeon processor-based servers are the platform of choice.

Intel® Dual-Core Technology

Provides an upgrade in processing capacity at reduced power-consumption levels.

Fully Buffered DIMM Memory (FBDIMM)

Enables faster, more reliable access, delivering up to three times more throughput and three times more memory bandwidth than previous Intel Xeon processors. It also offers lower latency at higher memory loadings and provides greater capacity, protection, and availability¹, which is especially critical for secure virtualization.

Intel® I/O Acceleration Technology (Intel® I/OAT)

Intel® I/O Acceleration Technology (Intel® I/OAT) is a server platform network I/O accelerator that takes a platform approach to addressing network traffic problems by breaking up the data-handling job among all of the components that make up the platform. Servers based on Dual-Core Intel Xeon processors provide top speeds to support virtualization. Intel I/OAT delivers responsiveness, supports utilization, scales seamlessly, and tightly integrates with multiple operating systems and VMMS.

Intel® Core® Microarchitecture

Offers high performance per watt, with unsurpassed energy efficiency.

Intel® Smart Cache

Enables the cache memory to perform optimally with the greatest power efficiency, enabling greater multi-threaded performance and system responsiveness.

Hyper-Threading Technology (HT Technology)

Makes it possible for one physical processor to appear and behave as two virtual processors. For customers of all sizes, HT Technology offers more efficient multitasking and system responsiveness. Users enjoy improved performance running multiple applications simultaneously, which is critical in a virtualized environment. For IT managers, HT Technology means more efficient use of processor resources, greater throughput, and improved performance.

Intel® Virtualization Technology (Intel® VT)

Permits one hardware platform to function as multiple virtual platforms. This technology offers improved manageability, which helps limit downtime and maintain worker productivity.

¹ Source: <http://www.intel.com/technology/magazine/computing/fully-buffered-dimm-0305.pdf>



Solution Benefits

Benefits for Intel® Channel Partner Program Members

Taking advantage of Intel VT can help you expand into new markets. For instance, you can sell complete solutions to customers such as universities or IT training centers that require hands-on learning environments. In such a training environment, students can work with five to ten virtual machines running on a Dual-Core Intel Xeon processor-based server that administrators can then easily discard and replace with a new image for the next class.

With Intel VT, you also can extend your service offerings to customers, such as providing remote management of virtual machines using the VMware* remote console. You can gain remote access to a customer's virtual machine, even when remote management capability isn't provided by the particular operating system or application. Plus, you are able to create separate, independent environments inside a single computer. This means that you can provide a dedicated service environment—or partition—in which tasks and activities run independently, making them invisible to and isolated from your customer's users.

Benefits for Your Customers

Intel VT is helpful for any of your customers who want to maximize security, robustness, and interoperability at the hardware level. Dual-Core Intel Xeon processor-based servers help companies of all sizes increase their ability to respond to business needs while enjoying better manageability and controlling costs. Key customer benefits include:

- **Flexibility through consolidation.** Through server virtualization, diverse operating systems and applications can be consolidated quickly and easily on 2-way to 16-way and larger platforms for more efficient use of server space.
- **Simpler operating system and hardware migrations.** Server virtualization enables legacy applications and their existing operating system versions to be migrated without modification onto virtual partitions.
- **Streamlined testing and development.** A single platform can host multiple test environments and multiple iterations of each software stack.
- **Increased business agility.** A virtual partition can be provisioned or resized in minutes to accommodate new applications, increased workloads, and system maintenance.
- **Integrated security and enhanced availability.** Software faults and digital attacks are isolated within each virtual partition, and failover partitions provide an easy, cost-effective approach to tailoring availability.





- **Faster performance.** Most virtualization solutions add a layer of software, which introduces processing overhead that can slow application performance. Using Dual-Core Intel Xeon processor-based servers helps maintain performance when using virtualized machines.
- **Cost reduction.** Server virtualization with Dual Core Intel Xeon processor-based servers helps lower operating costs for maintenance, power consumption, and cooling. By taking advantage of virtualization using software and silicon, companies can have a more controlled, efficient environment.
- **Enhanced operating system compatibility.** IT organizations will be able to support a wider range of operating system versions on a consistent hardware and VMM platform, including 64-bit operating systems that cannot be supported on today's software-only solutions. It also enables the operation of unaltered operating systems without the need for binary translation.
- **Balanced platforms with leading reliability, availability and serviceability (RAS).** The Dual-Core Intel Xeon processor-based server builds on the industry-leading multi-processor platform's reliability, availability, and serviceability, making it the optimal virtualization and consolidation platform. Intel's balanced platform technology strategy includes processor innovations such as multi-core, hyper-threading, built-in virtualization, and management capabilities, but extends beyond the processor to include chipset, memory, I/O, storage, and network innovations, all of which contribute to a robust and flexible virtualization environment.

Solution Recipe

Dual-Core Intel Xeon processor-based servers running VMware VMM software can be a great platform for consolidating legacy applications that have been running on unsupported hardware and operating systems. Intel has developed a deployment guide (<http://www.intel.com/go/5000sequence>) that demonstrates how older operating systems can be run on a virtual machine to help migrate applications to this platform and save money on infrastructure and support costs.

To Plan a Successful Legacy Application Migration:

- Determine “best-fit” applications—identify those applications that are custom, no longer supported, or running on old, unreliable hardware
- Determine hardware requirements for applications
- Acquire licenses for VMware Server and other software
- Decide on the right Dual-Core Intel Xeon processor-based server configuration for deployments
- Assess driver compatibility—conduct lab tests to make sure all drivers exist for the virtualized environment
- Automatically convert existing environments
- Reduce testing cycles

Software Architecture

For a Dual-Core Intel Xeon processor-based server environment with VMware Server software, you can provision virtual machines for any system, and the software can manage an operating system and application as a single unit by encapsulating them into virtual machines.

In order to support each potential customer, you should be familiar with both VMware Server software and the Microsoft* Windows Server* 2003 operating system. Your customers need to license a Windows Server 2003 Operating System. The VMware Server software is provided free of charge from VMware.

System Architecture

The Dual-Core Intel Xeon processor-based server platform—coupled with VMware Server software—delivers the ideal high-performance, low-cost solution for small and medium-sized businesses needing to consolidate multiple servers. Free of charge from VMware, the VMware Server software is easy to set up and comes with built-in hooks for Intel VT support.

Components Necessary to Build

- Dual-Core Intel Xeon processor-based servers with native support for Intel VT
- VMware Server software, which enables partitioning of a physical server into multiple virtual servers
- VMware Server Console, which provides remote client-side monitoring and management of virtual servers
- Microsoft Windows Server 2003 operating system with Service Pack 1
- Intel® PRO/1000 PM Network Connection
- Guest operating system, such as Microsoft* Windows* NT* Server 4.0; Novell* NetWare 4.2, 5.1, 6.0, and 6.5; Red Hat* Enterprise Linux* 2.1, 3, and 4 (AS, ES, and WS), etc.



Solution Support

Intel has thoroughly tested and verified the components in this virtualization technology solution recipe. Please continue to use your existing Intel® Support Services (<http://www.intel.com/go/Channel/Support>) for information on Intel®-based hardware, including Intel® Processors, Intel® Desktop and Server Boards, and associated drivers. For your convenience, Intel has worked with several independent

software vendors, open source vendors, and application vendors to streamline technical support for this solution. For more information on the third-party hardware and software products, please download the Solution Deployment Guide (<http://www.intel.com/go/5000sequence>) to obtain the specific list of vendors and contacts.

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