SOLUTION BRIEF
Intel® Xeon® Processor 7500 Series
Heathcare Datacenter

Demonstrating Scalable Performance for Siemens Soarian® Clinical Suite on Virtualized Intel® Xeon® Processor-based Servers

"The Siemens partnerships with Intel and VMware have allowed us to make great strides in improving service levels and costs for many of the mission critical applications that we provide. Our continuing lab efforts are yielding ever more exciting capabilities for availability, scalability and server consolidation.

The improvements are easy to see on the Intel Xeon® processor 7500 series. Coupling that with specialized virtualization and multi-tenancy, we expect our customers to see real benefit. If they run hardware onsite, they will get the best guidance Siemens can provide for optimizing configurations. The vast majority of those who choose to have applications hosted in our healthcare cloud environment leveraging our medical grade infrastructure are going to see better performance and availability."

– Dan Emig,
VP, Information Technology, Siemens

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EXECUTIVE SUMMARY

As large health care organizations strive to increase the quality and efficiency of patient care in today's continually changing clinical and regulatory environments, the ability to quickly and cost-effectively deploy, scale and adapt core clinical applications, such as Soarian® Clinicals, is a key advantage. In traditional deployments, server utilization is often about 10 percent or even lower, resulting in complex and costly infrastructure that consumes substantial space, power, cooling, and administrative resources.

More dense, flexible, and cost-effective solutions are needed, but they must be powerful and resilient to address the stringent service level requirements of the health care industry and to enable cost-effective, non-disruptive growth. The latest generation of four-socket, eight-socket, and larger Intel® Xeon® processor 7500 series-based servers running VMware vSphere™ offers a solution—a virtualized computing platform designed specifically to handle heavy workloads in mission-critical environments.

To verify the performance and scalability of Soarian Clinicals on this powerful new platform, Siemens, Intel, and VMware are conducting a series of tests using automated test scripts that closely simulate the production workloads of a large health care facility. Results to date have shown that:

- Soarian Clinicals can be successfully virtualized on the latest generation of Intel Xeon processor-based servers and virtual machines configured with four virtual CPUs deliver the best processing efficiency.[1]
- Four-socket servers based on the Intel Xeon processor 7500 series support more than twice the total virtualized workload of two-socket servers based on the Intel Xeon processor 5500 series.[1]
- The impact of virtualization is nonlinear, so the capacity planning algorithm under development by Siemens and Intel will provide valuable information for further optimizing utilization and total cost of ownership (TCO).[1]

This paper provides an overview of the combined solution and the test results. It offers useful information for any health care IT organization looking to increase the value of a new deployment or virtualize and consolidate an existing landscape to support rapid growth with reduced space, power, cooling, and administrative costs.

Optimizing the Quality and Efficiency of Patient Care

Soarian Clinicals is an enterprise-wide healthcare information system intended to be used throughout the continuum of care by healthcare providers and administrative personnel to document patient information and to electronically display, store, retrieve, transfer, exchange, report, and print patient information. Soarian Clinicals enables the healthcare enterprise to design, coordinate, and adapt processes using Soarian's healthcare process management tools, such as workflow and rules engines, and work lists. It supports the healthcare providers' operational and administrative initiatives with functions such as ordering, scheduling, clinical documentation, assessment, care planning, and reporting. It also includes tools to support a healthcare provider's use of standard practices and terminology.

Since Soarian Clinicals has a direct impact on patient care, maintaining the highest levels of performance and uptime is essential. At the same time, health care IT organizations need to be increasingly cost conscious, and many are actively seeing ways to reduce total costs while maintaining or improving service levels. A traditional implementation may include multiple servers to support Web, application, database, and utilities components across test, production, and training environments. Some of this capacity is fully-utilized only periodically, yet still requires full-time maintenance.

Server virtualization offers a way to consolidate the physical infrastructure and to use available capacity more effectively. In many scenarios, it can help IT organizations reduce overall TCO, provide higher availability, and take advantage of new upgrade methodologies to grow the solution more easily and cost-effectively.

Adding Value through Virtualization and Consolidation

Today's multi-core Intel Xeon processor-based servers provide up to 20 times [2] the performance of single-core servers that were available just a few years ago . Larger and more resilient server configurations add to these advantages, providing tremendous capacity for consolidating heavy workloads in the health care data center. VMware vSphere helps IT organizations take full advantage of this scalable capacity by providing comprehensive support for highly reliable virtualization. Multiple applications and workloads can be hosted securely in isolated virtual machines on each physical system to simplify infrastructure and reduce data center costs (Figure 1)[3].

As workloads grow, health care IT staff

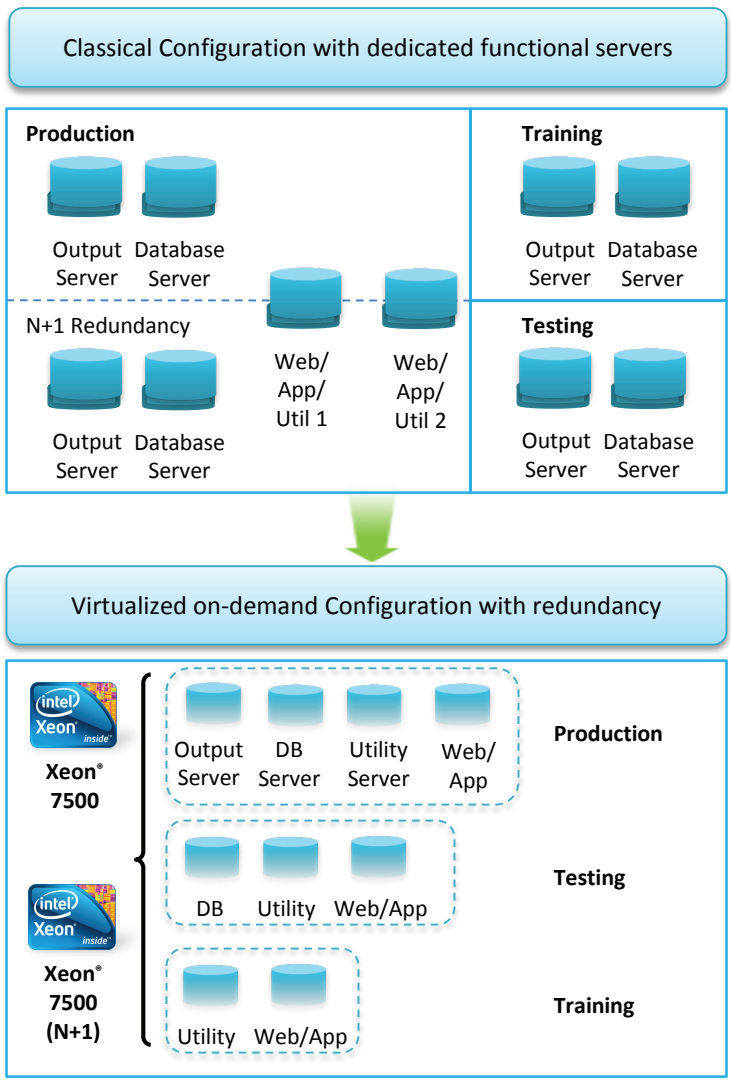

Figure 1. Consolidation* of Soarian Clinicals on virtualized Intel® Xeon® processor 7500 series-based servers can reduce data center footprints and provide a more flexible and scalable foundation for growth. [3]

* Note: Actual deployment configuration may vary depending on requirements and customizations.

can provision new virtual machines on existing systems to scale capacity. Server resources can be dynamically allocated based on workloads and service level requirements, and virtual machines can be migrated without downtime among physical servers for advanced workload balancing, high availability, and disaster recovery. The result is a more dense, flexible, and cost-effective infrastructure that can be scaled and adapted more easily to support growth and change.

Powerful and Resilient Servers

Intel Xeon processor-based servers support the full range of health care data center requirements. Two-socket servers based on the Intel® Xeon® processor 5500 series provide industry-leading performance and energy-efficiency for mainstream business and infrastructure applications. More important for mission-critical Soarian Clinicals deployments are four-socket, eight-socket, and larger servers based on the Intel Xeon processor 7500 series. These servers are specifically designed to support demanding workloads in environments where uninterrupted operation is essential.

With up to 64 cores, 128 threads, and 2 TB of memory, a single eight-socket server based on the Intel Xeon processor 7500 series provides ample capacity for all but the most extreme workloads. These servers also deliver an array of new reliability, availability, and serviceability (RAS) features to improve data integrity and system resilience. With these advancements, Intel® Xeon® processor 7500 series-based servers effectively close the gap between proprietary RISC architectures and industry-standard solutions, delivering comparable or superior capabilities at a fraction of the cost.

Scalable Virtualization

VMware vSphere is optimized for Intel® Virtualization Technology (Intel® VT), which provides hardware assists for core virtualization processes throughout the server platform. With this support, it scales readily to deliver optimized performance for heavy workloads. Virtual machines can be configured with up to eight virtual CPUs and 256 GB of memory and the vSphere platform can support up to 40 GB/s of network bandwidth and more than 300,000 I/O operations per second [4]. In combination with enterprise-class servers based on the Intel Xeon processor 7500 series, even very demanding applications, such as Soarian Clinicals, can now be successfully virtualized on industry-standard servers.

Testing Performance and Scalability for Soarian Clinicals

To demonstrate the practicality and value of hosting Soarian Clinicals on Intel Xeon processor-based servers running VMware vSphere, Siemens is working with Intel and VMware to explore the performance and scalability of the combined platform. The test methodology is designed to verify that health care IT organizations can meet production service level agreements (SLAs) using cloud computing and shared infrastructure solutions.

The Workload

To provide a realistic simulation of production workloads, acceptable response times were established for approximately 100 Soarian Clinicals activities. The activities represent the full range of clinical and administrative tasks in a large health care facility, and the response times are based on real-world health care requirements. In the test environment, automated scripts simulating those activities in clinically relevant workflows are run repeatedly while varying virtual and physical configurations.

The scripts were first applied to non-virtualized two-socket (8-core) Intel Xeon

Summary of Performance and Scalability Results[1,5]

TEST ENVIRONMENT	VIRTUAL CONFIGURATION FOR WEB/APP COMPONENTS	KEY OBSERVATIONS	CONCLUSION
Multiple Two-Socket Servers – Intel® Xeon® Processor X5530			
Virtualized (Two physical servers)	8 vCPU	▪ Significant virtualizaiton overhead	Not Optimal
	2 vCPU	▪ Required too many virtual machines ▪ Significant management overhead	Not Optimal
	4 vCPU	▪ Low virtualization and management overhead ▪ Highest workload density	Optimal Configuration
A Single Four-Socket Server – Intel® Xeon® Processor X7560			
Virtualized (One physical server)	8 vCPU	▪ Significant virtualization overhead	Not Optimal
	2 vCPU	▪ Required too many virtual machines ▪ Significant management overhead	Not Optimal
	4 vCPU	▪ Low virtualization and management overhead ▪ Good workload density ▪ Largest overall capacity	Optimal Configuration

processor 5500 series-based servers to establish a baseline for comparing virtualized performance. The workload was increased until response times exceeded the established limits or until other preset boundary conditions were exceeded (e.g. CPU utilization). The un-virtualized servers successfully ran the following load:

- 3,000 user sessions per hour
- 40,000 clinical result transactions per hour
- 5,000 patient care orders per hour
- 3,000 nurse assessment sessions resulting in 32,000 document patient operations per hour
- All associated administrative and background processing.

Virtualization on Two-Socket Servers

Once the baseline was established, the workload was applied in a variety of virtualized test scenarios using the same physical server configurations (two-socket Intel Xeon processor 5500 series-based servers). Hardware and software configurations were designed to optimize scaling, load balancing, licensing, availability, and overall cost of ownership. Results for these tests showed that:

- There are no technical barriers to virtualization.
- Virtual machines configured with four virtual CPUs deliver significantly better performance efficiency than virtual machines configured with either two virtual CPUs or eight virtual CPUs.

Scaling the Virtual Environment on a Four-Socket Server

Key tests were rerun on a four-socket (32-core) Intel Xeon processor X7560 based server to determine if virtualization can be implemented successfully in a more dense and consolidated server environment. In this series of tests, all software components, including the database and utilities, were hosted in virtual machines on the same physical server. Test results showed that:

- A single four-socket Intel Xeon processor 7500 series-based server can host all Soarian Clinicals software components and run heavy production workloads, while leaving substantial headroom for growth. [5]
- The four-socket server can handle 2.3 times the application workload of the smaller two-socket server. [1]

These results can help IT organizations plan capacity more effectively for farmed configurations of four-socket, eight-socket, and larger Intel Xeon processor 7500 series-based server, which they can use to improve infrastructure utilization, reduce TCO, and provide capacity on demand for growing workloads.

Next Steps

Siemens, Intel, and VMware are focused on providing highly optimized solutions that help health care organizations take full advantage of virtualization on industry-standard servers to enable better performance and higher availability at lower total cost. Siemens anticipates conducting additional tests with Soarian Clinicals to further optimize physical and virtual configurations, with the goal of providing validated and highly optimized reference architectures and sizing information. These anticipated tests will also focus on enhancing resiliency and operational efficiency, by taking advantage of advanced functionality in VMware vSphere and Intel Xeon processor-based servers to simplify and improve installations, upgrades, and business continuity.

Conclusion

The latest Intel Xeon processor 7500 series-based servers running VMware vSphere provide breakthrough support for virtualizing and consolidating demanding, mission-critical applications, such as Soarian Clinicals. The tests documented in this paper demonstrate the performance and scalability of the platform for hosting the production workloads of large health care providers. They also provide information that may help health care IT organizations configure their physical and virtual environments more effectively to support rapid growth, while minimizing data center space, power, cooling, and administrative requirements.

"For healthcare providers who must meet strict service and cost requirements, Siemens Soarian Clinicals deployed on Intel Xeon processor 7500 series-based hardware maximizes server utilization through consolidation, lowers cost of growth through efficient scaling, and enables higher availability through advanced virtualization.""

– Pauline Nist, General Manager, Mission Critical Segment, Intel

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Get More Information

Resources are readily available to support deployment and optimization of Soarian Clinicals on Intel Xeon processor-based servers running VMware vSphere. Visit the following Web sites for more information or contact your Siemens Technology Services representative.

Soarian Clinicals: www.usa.siemens.com/SoarianClinicals

Intel Xeon processor-based servers: http://www.intel.com/itcenter/products/xeon/index.htm

VMware vSphere: http://www.vmware.com/solutions/industry/healthcare/

Note: The information provided in this paper is based on interim results of an ongoing project to define highly optimized reference architectures for Soarian Clinicals running in VMware virtual machines on Intel Xeon processor-based servers. Although the information may be useful for customers considering virtualized deployments, it should not be used as a configuration guide. For additional guidance and support, please contact your Siemens Technology Services representative .

[1] Intel and VMware internal estimates based on tests measuring Soarian Clinicals performance on a four-socket server configured with the Intel Xeon processors x7560 and 256 GB of RAM and a two-socket server configured with the Intel Xeon processor x5530 and 32 GB of RAM. Tests were conducted on each server using virtual machines configured with 2, 4, and 8 vCPUs. Initial testing was concluded in August, 2010. Additional tests are planned to provide more detailed capacity planning algorithms for further optimizing utilization and TCO.

[2] Source: Intel Xeon Processor 7500 Series product brief http://www.intel.com/Assets/en_US/PDF/prodbrief/323499.pdf

[3] Source: Intel Internal Estimates

[4] Source: VMware performance measurements as referenced at http://www.vmware.com/solutions/business-critical-apps/performance.html as of March 10, 2011.

[5] Real-world implementations require at least two physical servers for redundancy and high availability. However, in a virtualized environment, the spare capacity on each server can be utilized efficiently for other workloads.

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This collaborative, strategic testing effort represents ongoing research to leverage newer, emerging technologies with Siemens Soarian Clinicals' suite of applications. Configurations may not be readily deployable in the hospital or productions environments until additional validation is completed for recommendations on specific, optimized configuration models.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

Configurations: [describe config + what test used + who did testing]. **For more information go to** http://www.intel.com/performance

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