



Kronos Workforce Central on VMware Virtual Infrastructure

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VALIDATION TEST REPORT

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Introduction

This document provides the following technical information to direct planners and installers as they consider running Kronos Workforce Central (WFC) on VMware® virtual infrastructure:

- Basic guidance on the architecture of Kronos Workforce Central, as well as the value of running applications on the VMware platform.
- Brief summary of results from tests performed jointly by VMware and Kronos that characterized the performance and functionality of Kronos Workforce Central applications on VMware virtual infrastructure.
- Best practices for using the two product sets together in a datacenter.

VMware and Kronos

Kronos and VMware conducted extensive testing of Kronos software products on VMware virtual infrastructure. The tested products demonstrated remarkable stability running on the VMware platform, and support advanced VMware capabilities such as VMware vMotion™, VMware High Availability (HA), VMware Distributed Resource Scheduling (DRS), and cloning. Testing also shows that Kronos applications meet expected performance levels when they run on VMware virtual infrastructure. When configured properly, VMware resource management capabilities ensure that Kronos solutions have the resources needed to meet guaranteed performance Service Level Agreements (SLA) during peak loads.

VMware's virtualization builds important business continuity capabilities into datacenter infrastructure. Being part of virtual infrastructure makes these capabilities transparent to the operating system and any applications that run in virtual machines (VM), such as Kronos Workforce Central. These features are easily configured and used by all virtual machines on a physical system, reducing the cost and complexity of higher availability.

Finally, you can simplify and expedite upgrades of Kronos Workforce Central by leveraging the capabilities of VMware virtual infrastructure to achieve:

- Rapid creation of the application environment – no delay for new hardware.
- More test runs, better mitigation of risk.
- Reduced downtime during production rollout.

Note: In this document, VMware refers to both ESX®, ESXi™, and the features/functionality provided by VMware virtual infrastructure software, VMware Infrastructure 3x or vSphere™. VMware virtual machines are scalable, include new computing and infrastructure services, and a Fault Tolerance (FT) feature that provides for zero downtime availability of single-Central Processing Unit (CPU) virtual machines. New versions of VMware virtual infrastructure software are backward-compatible with earlier releases.

VMware Virtual Infrastructure

VMware's leading virtualization solutions provide multiple benefits to system administrators and end users. VMware virtualization creates a layer of abstraction between the resources required by an application and operating system, and the underlying hardware that provides those resources. Benefits include:

- **Consolidation** – Multiple application servers can be consolidated onto one physical server, with little or no decrease in overall performance.
- **Ease of Provisioning** – VMware virtualization encapsulates an application into an image that can be duplicated or moved. This greatly reduces the cost of application provisioning and deployment.
- **Manageability** – VMware vMotion allows you to move virtual machines from one ESX host to another with no downtime. This simplifies common operations like hardware maintenance and reduces planned downtime.
- **Availability** – Unplanned downtime can be reduced and higher service levels can be provided to an application. During an unplanned hardware failure, VMware High Availability restarts affected virtual machines on another host in a VMware cluster.

Kronos Workforce Central and Virtual Deployment Architecture

For the tests described in this document, the deployed Kronos-VMware infrastructure architecture consisted of one non-virtualized database server; a VMware cluster of four host servers (each host running four virtual machines); and five additional servers that generate loads to run tests and check performance. Test configuration details for the database server, VMware ESX host servers, and the five servers used to generate test workloads, are described below.

One Non-Virtualized Database Server:

Xeon Dual Core, 2 processors; 4 GB RAM;
6 SCSI disks, each 143 GB; 15 SCSI disks, each 73 GB;
PERC 6i controller;
Windows 2003 SP2; SQL Server 2005 SP2



ESX Host Machines in VMware Cluster:

Xeon Quad Core, 2 processors; 12 GB RAM;
2 SCSI disks, each 73 GB;
PERC 6i controller; each host running VMware ESX 3.5
Each virtual machine on host running Windows 2003 SP2; Workforce Central 6.0.8



Five Load Generator Servers:

Xeon, 2 processors; 2 GB RAM;
1 SCSI disk, 73 GB;
Windows 2003 SP2; Impetus Sandstorm 4.1.2

In a real-world testing scenario, load generator servers might be replaced with web browsers processing user requests.

Testing Process and Results

Testing demonstrated that the Workforce Timekeeper (WTK) version 6.0 application is capable of scaling to a 384,000-employee database on Microsoft SQL Server with VMware ESX 3.5 running on host servers in a VMware cluster to provide vertical scalability of application servers.

The tests conducted were for the following use cases:

- Pay period end – 150 home employees for each supervisor.
- Sign-off – Batch operation signs off all employees.
- Time and labor collection – Both applet and HTML versions of the timecard.
- Shift change – Quick Timestamp feature of Workforce Timekeeper.

Results Observed

The results of the tests performed on the Workforce Central deployment on VMware virtual infrastructure demonstrate that Workforce Timekeeper successfully meets the needs of a 384,000-employee company.

Note the following high-level throughput metrics:

- 3,750 managers close their pay period in a 6-hour time frame.
- Sign off 384,000 employees in an off-hours 3-hour time window.
- Process the timecards of 20,000 professional employees who entered their data for a pay period in a 2-hour time window.
- Handle a shift change of over 100,000 employees.

The test system met all throughput objectives while maintaining required end-user response times with expected levels of system use.

This benchmarking exercise demonstrated that Workforce Central components can successfully scale to support a database of 384,000-employees, in a specific virtual infrastructure configuration using a set of well-defined test use cases. The results exceeded performance for systems conforming to current Kronos sizing guidelines that are designed to support a maximum employee count of 250,000.

For detailed information about the test methodology, benchmark goals, tools and configuration, workloads and test results, refer to your Kronos representative. The information is available under a suitable non-disclosure agreement.

Best Practices for Deployment

Testing completed in the Kronos performance lab provided the following recommendations for configuring and deploying Workforce Central in a VMware virtual infrastructure environment. Keep in mind that these recommendations assume that the hardware specified is dedicated to the Kronos suite of applications. If production systems have other applications running on the same physical hardware, you will need to consider peak usage scenarios and overall system usage. Note that these are general recommendations, not rules. Understand the business requirements of each customer when planning resources for a specific deployment configuration.

VMware System Configuration

While VMware virtual infrastructure has a multitude of options to tune workloads, the general recommendation when running Workforce Central in a VMware virtual environment is to keep the configuration as simple as possible. During the testing of Workforce Central deployments on the VMware platform, optimal results were obtained when running VMware virtual infrastructure with an 'out-of-the-box' configuration, and default settings used for system parameters and tuning options.

Hardware

The following list describes minimum specifications for physical hardware to get optimal performance of Workforce Central running on VMware virtual infrastructure. Actual hardware requirements for deployment in a customer's virtual environment depend on specific customer use cases.

- Dual-core or quad-core systems based on AMD or Intel processors running at 2 GHz or greater.
- 4 GB memory for each processor core.
- 1 GB Ethernet adapter for each system for non-DCM deployment.
- 1 GB Ethernet adapter for every 4 virtual machines.

Software

- ESX 3.5 or later; ESX 3i or later.
- Workforce Central v6.0 or v6.1.

Virtual Machine Configuration

Memory Allocation

Configure VMware virtual machines to have between 2 and 4 GB of memory. If the Workforce Central instance running within the virtual machine executes reports, then configure 4 GB of memory for the virtual machine. If no reports are being executed, 2 GB of memory is adequate for the virtual machine memory size.

Virtual CPU Allocation

Configure VMware virtual machines with up to two virtual CPUs (vCPU) for each virtual machine. More virtual CPUs provide only a minimal increase in throughput because most Workforce Central applications become memory constrained before they can take advantage of additional CPU resources. In general, dual-virtual CPU virtual machines provide a good balance between response time and system resource usage.

Configure VMware virtual machines used for DCM as single vCPU virtual machines.

System Resource Allocation

Do not over-commit system resources during peak-period processing. Over-commitment of resources leads to poor system response times and reduced throughput. The total amount of memory configured for all active virtual machines should not exceed the physical memory in the system. To calculate VMware virtual infrastructure memory overhead, refer to the *VMware Performance Tuning Best Practices for ESX 3*.

The total number of virtual CPUs for all active virtual machines should not exceed the number of physical cores in the system. The general recommendation is one core for each virtual CPU.

Monitoring Virtual Machine Usage

Because of the way that VMware virtual infrastructure handles time and timer interrupts, some frequently used counters in the Windows Performance Monitor may not be accurate in a virtual machine. To monitor performance of virtual machines, use the VMware Infrastructure (VI) Client or esxstop utility.

DCM Application Configuration

If you use Data Collection Manager (DCM) on Workforce Central v6.0:

- Use the smallest number of communication channels per virtual machine that are required to meet your service level objectives. Based on Kronos performance testing, a general recommendation is to configure no more than four concurrently active communication channels per virtual machine. If you need to increase this number, do so carefully based on your service level objectives and overall system utilization.
- Do not leave Communication Monitor running on VMware virtual machines because of the high overhead of CPU consumption.

Conclusions

Together, Kronos and VMware validated the ways data centers can meet enterprise service level agreements by deploying Kronos in virtualized environments. The performance tests show with certainty that running Kronos inside VMware virtual machines provides an effective, production-ready platform. In fact, performance with VMware virtual infrastructure is very close to performance on physical machines.

Kronos is pleased with the results of these benchmark performance tests, but note that specific response times in a production environment can differ from the test results. Performance varies by workload, application requirements, system design, and implementation. This report does not guarantee system performance. For specific customer applications, run relevant performance tests when planning capacity or evaluating products.

Monitoring performance metrics, such as throughput by virtual machine and average virtual machine CPU usage, can help organizations size and design virtualized environments to meet their own targets. The number of actual users and transactions that can be supported in specific production environments will depend on the applications used and the intensity of user activity.

Performance testing shows that a consolidation approach, which runs multiple Kronos virtual machines, can scale to meet an organization's capacity needs. With added benefits such as management and administrative flexibility, strong isolation, and higher availability, VMware virtual infrastructure can serve as an ideal platform for Kronos consolidation.

Resources

For more information about VMware and Kronos products, refer to the following sources:

VMware Resources:

- VMware official website:
<http://www.vmware.com/>
- VMware Infrastructure 3 and ESX 4 product Web site:
http://www.vmware.com/products/data_center.html
- VMware download Web site:
<https://www.vmware.com/download/>
- VMware support Web site:
<http://www.vmware.com/vmtn/>
- VMware Performance Tuning Paper:
http://www.vmware.com/pdf/vi_performance_tuning.pdf
- System Compatibility Guide for a complete list of compatible hardware:
http://www.vmware.com/pdf/vi35_systems_guide.pdf
- Storage/SAN Compatibility Guide for a complete list of compatible storage devices:
http://www.vmware.com/pdf/vi35_san_guide.pdf
- I/O Compatibility Guide for a complete list of compatible networking devices:
http://www.vmware.com/pdf/vi35_io_guide.pdf

Kronos Resources:

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