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1.0 Introduction

This document provides direction to those interested in running Picis CareSuite® on VMware Infrastructure 3 or VMware® vSphere™ 4. It provides basic guidance on the architecture of Picis CareSuite, as well as the value of utilizing the VMware platform. The results of recent testing done jointly by VMware and Picis are covered, where the performance and functionality of Picis CareSuite on VMware infrastructure version 3.5 update 3 are characterized. Finally, some best practices for utilizing the two product sets together in your datacenter are outlined.

2.0 VMware and Picis CareSuite Overview

By leveraging VMware virtualization technology, Picis is able to implement our full suite of products while still allowing our clients to gain the benefits that the VMware Infrastructure software provides, such as the following:

- **Hardware Cost Savings** – Thousands of dollars can be saved by using virtual machines instead of physical hardware for running the multiple processes that support our Picis CareSuite products.

- **Server Consolidation** – A consolidation ratio of about 6:1 can be achieved by utilizing VMware Infrastructure with a Picis CareSuite implementation.

- **Resource Cost Savings** – Power and cooling costs are greatly reduced as well as associated costs for connecting numerous servers to SAN storage, e.g. cabling and port costs, etc.

3.0 VMware Infrastructure 3 and VMware vSphere 4

VMware’s leading virtualization solutions provide multiple benefits to IT administrators and 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. A summary of the value of this abstraction layer includes the following:

**Consolidation:** VMware technology allows multiple application servers to 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, greatly reducing the cost of application provisioning and deployment.

**Manageability:** Virtual machines may be moved from server to server with no downtime using VMware® VMotion™, which 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. VMware® High Availability (HA) ensures that in the case of an
unplanned hardware failure, any affected virtual machines are restarted on another host in a VMware cluster.

4.0 Picis CareSuite Architecture and Deployment Strategy

The Picis CareSuite system is based on multi-tier client-server architecture. The database tier is on database server running SQL Server and the middle tier is made up a Network Communication Server which handles messaging, printouts and inbound and outbound interfaces for certain perioperative products (Anesthesia Manager, Critical Care Manager, etc). In addition, there are some servers supporting interfaces and background processes for other perioperative products (OR Manager, Quality Manager, etc).

Deployment of the software to the database and middle-tier are handled by Picis staff and/or partners trained in the steps required to implement our software suite. The deployment of the workstations software is performed by the client after the proper workstation installation package configurations have been created by Picis and/or an implementation partner company.

A typical layout of the backend of the CareSuite perioperative information system is as follows:
5.0 Testing Process and Results

To characterize the performance of Picis CareSuite on VMware Infrastructure performance tests were carried out jointly by VMware and Picis. The configuration tested and the results are summarized below.

Hardware Configuration
Network Communication Server (1) – with 1 CPU (dual-core), 4 GB RAM, and 72 GBs of mirrored local storage
Background Server (5) – with 1 CPU, 1 GB RAM, and 10 GBs of mirrored local storage

Virtual Machine Configuration
VMware Server – Dual quad-core CPUs @ 1.86GHz, 32 GB of RAM, and 500 GB RAID 10 LUN connected with 4Gb SAN fabric.
- Network Communication Server (1) – with 2 vCPUs, 4 GB RAM, and 72 GB storage.
- Background Server (5) – with 1 vCPU, 1 GB RAM, and 10 GB storage.

Workload Used
The workload used was an average typical daily load of the backend processes used to support the Picis CareSuite functions in a production environment at a facility with just under 30 operating rooms. Examples of functions performed on the VMware machines were as follows:

- ADT messages received and processed
- Clinical patient printouts processed
- Patient data synced across Picis databases

The virtual machines listed above support production and test/staging environments. The data gathered was from the production machines only.

Results Observed
The results observed indicated that the virtual machines performed slightly better than the physical hardware equivalents even during peak hours. Below is a sampling of some of the functions and transactions captured for an average day of utilization:
The results experienced during our testing are indicative that there is no adverse impact on the performance of the Picis processes relevant to implementing on a virtual versus a physical environment.

6.0 Deployment Best Practices

In this section, we will outline some best practices we believe will benefit both IT administrators as well as users of the Picis CareSuite system on VMware:

- **Storage configuration**: It is recommended that SAN storage be utilized, when possible. A dedicated RAID 10 LUN should be allocated to the VMware ESX server housing the virtual machines supporting the Picis applications.

- **Resource allocation**: The number of virtual machines implemented relevant to the resources required should be such that the amount of CPU utilization of the VMware ESX server should not consistently exceed 50%.

- **Provisioning**: Templating and cloning of Virtual Machines can be used to reduce deployment time of machines needed for additional Picis environments, e.g. training or other staging/testing environments or for scaling the environments as more Picis products are added on.

- **Availability**: We recommend using VMware HA and VMware FT to increase service levels and decrease unplanned downtime. Disaster recovery options such as VMware’s Site Recovery Manager (SRM) should also be considered.

7.0 Technical Support

Information on how to obtain technical support is available in the Picis Support Manual that can be found on the User Community section of the Picis web site listed below.
8.0 Conclusions

Overall, testing results show that running Picis CareSuite on VMware Infrastructure performs very well. Furthermore, it has potential to reduce cost, increase service levels and simplify the manageability of the application.

9.0 Resources

Customers can find more information about VMware and Picis CareSuite products via the links listed below:

VMware official website: http://www.vmware.com/

Picis Web site: http://www.picis.com/

VMware Infrastructure 3 and vSphere 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/


