

VIRTUAL DESKTOP INFRASTRUCTURE: DOES IT MAKE SENSE FOR HOSPITALS?

Global Institute for Emerging Healthcare Practices



What is VDI?

Desktop virtualization or virtual desktop infrastructure (VDI) is a server-centric computing model that provides an end user experience equal to a traditional PC desktop, but is hosted and managed from a centralized data center. The virtual desktop can be accessed securely from any location, any time, on any device, offering enterprise mobility.

Executive Summary

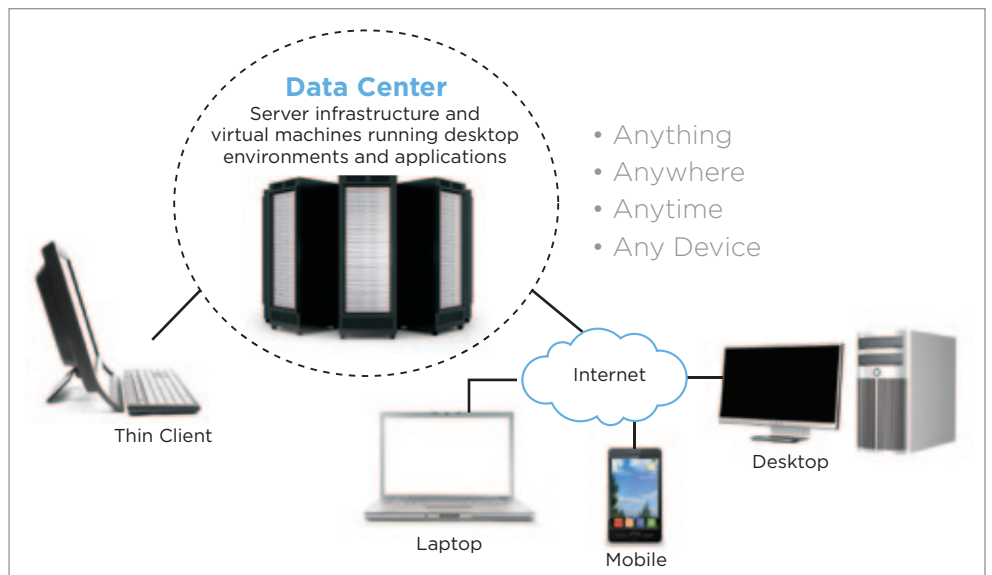
Virtualization is the current hot topic for technology and a long-term strategy for many IT organizations. Significant financial savings and other benefits have been documented for server and storage virtualization with numerous companies already in the advanced planning or rollout stages. What about Virtual Desktop Infrastructure (VDI)? Is it the next step for additional cost savings and increased efficiency? Does VDI offer benefits that are critical to hospitals?

The answer for hospitals is a “Qualified Yes.” VDI offers data and access security, HIPAA compliance, and end user flexibility that are increasingly important in a healthcare environment. Session roaming enabled via smart card or biometric authentication allows employees to access their applications as they move from device-to-device or location-to-location throughout the enterprise. In addition, new VDI thin clients are less than one-third of the cost of traditional PCs, can be provisioned in minutes compared to hours or days and dramatically reduce desk side-related support.

Currently, no vendor offers a comprehensive VDI solution that addresses the unique requirements of healthcare organizations. As such, architecting the right solution requires an understanding of vendor offerings and how they can be integrated to address specific business needs. Unlike server virtualization, VDI is not a technology-driven project. To maximize value, successful implementations have followed a use-case approach to define requirements, followed by solution lab, pilot testing and rollout.

The number of successes is growing and with the right approach and blend of operational and technical expertise, the work of designing and implementing the right VDI solution can be done within a few months yielding a quantifiable ROI in less than one year.¹

Figure 1. Virtual Desktop Model



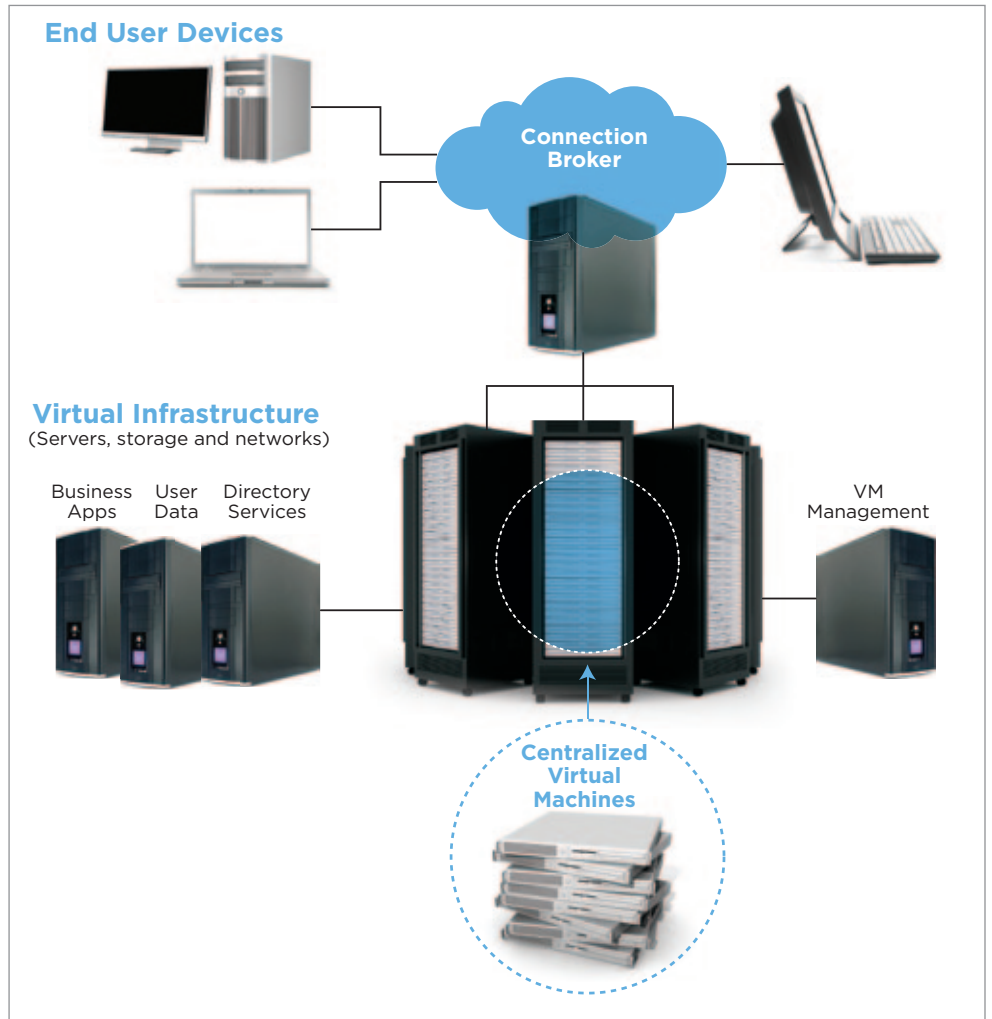
VDI Architecture Overview

Virtual desktop infrastructure introduces an innovative way to provision and manage desktops by allowing IT administrators to host user desktops running as virtual machines on servers in the data center.

Virtualization separates operating system, applications and data from the underlying hardware enabling IT staff to change, update and deploy each component independently in response to changing business requirements and user needs. Users access the virtual desktops and applications from an end user device and get the same or better user experience as if the applications were loaded on their local systems.

VDI is a solution composed of several core components configured to provide the optimal user and IT management experience. The major VDI components are depicted below and described in the following paragraphs.

Figure 2. VDI Architecture



End User Devices

VDI can accommodate several different types of end user devices. Traditional desktop PCs and laptops running Windows, Linux and Mac OS X can access their virtual desktops using remote display protocols, such as ICA, RDP, ALP and PCoverIP. Wired/wireless desktops and laptops can be deployed providing access to virtualized applications. Older PCs can be configured with VDI software (e.g., Sun Secure Global Desktop) and repurposed as new devices. Thin and ultra-thin devices such as those available from Wyse, HP, Citrix and Sun are a natural fit for VDI, given their stateless configuration and low cost of ownership. Hybrid solutions are also available that can stream applications and other services using VDI.

Next generation solutions will enable users to “check out” their virtual machine to a local, secure machine in order to work offline. This is particularly valuable to users who travel or need to spend some part of their day disconnected from the network. When the user is finished working, he or she can check the desktop back into the system where changes are automatically updated.²

Infrastructure and Management Services

Besides the end user devices, the remainder of the VDI architecture resides in the data center and includes the following core technologies:

- **Access security and state management services** restrict access to authorized users and keep track of the state of each end user’s session, both in terms of location and whether it is active or inactive. This capability is extremely useful for mobile users who frequently change locations and need immediate access to their applications and associated patient information.
- **Connection broker** is the “traffic cop” that directs the incoming user request to the proper virtual machine (VM). The broker dynamically provisions the virtual machine by pulling the user’s profile from storage and combining it with the appropriate role-based image or template.
- **Image management** allows an organization to create and maintain desktop images consisting of operating system, drivers, applications, files and settings. The images, typically role-based (e.g., nursing, physician, ancillary clinical, business administrator, etc.), support the “create once” “use many times” philosophy that is a major benefit for implementing VDI. Advanced features that allow for “linked clones” or “pooled images” based on a master image further simplify key administrative tasks such as patch and update management.
- **Centralized Virtual Desktop Servers** host virtual machines in the data center and provide services management, monitoring, scheduling and provisioning services. They also provide back-up, failover and recovery of the virtual desktop machines.
- **Optimized Virtual Desktop Storage** uses different storage strategies (e.g., storage area networks [SAN] and network attached storage [NAS]) to provide the best possible end user performance. In addition to virtual machines, the storage infrastructure hosts the organization’s applications, user profiles and user data.
- **User Profile and User Data Management** facilitates the real-time assembly of an operating system from a pool, and combines user data and applications without the need for creating a dedicated virtual machine image for each user.
- **Hypervisor** is a software layer that separates the underlying hardware from the operating system and installed applications residing on a VDI server. The hypervisor enables and manages how multiple virtual desktop machines run and access the underlying server hardware.



Costs and Benefits

Clearly there are numerous hardware, software and configuration options to consider. The associated costs and benefits will therefore vary based on the architecture and components implemented. The next sections provide an overview of typical costs, potential benefits and a summary of one hospital's experience implementing a VDI.

Cost Considerations:

Hardware Costs: A VDI solution requires servers to host virtual desktops, management and licensing servers. Additional servers may be required to support redundancy and failover requirements. Incremental storage is required for hosting user profiles and, potentially, user data. In terms of devices there will likely be a combination of re-purposed PCs (no additional hardware costs) and new thin or ultra-thin clients.

Software Licenses and Maintenance: The design of your physical infrastructure will affect the software and maintenance costs as there are a variety of licensing scenarios that include “per processor” or “per server” options. The optimal design will consider server sizing, performance, availability and licensing. Licensing requirements for operating system and applications continues to evolve as vendors embrace desktop virtualization. In the near term, these costs are not expected to be dramatically different from a traditional desktop environment.

Ongoing Operations: A system administrator will be required to manage the VDI infrastructure with additional resources supporting other infrastructure elements such as the SAN environment, network, etc. A reduction in desk side support requirements may present a learning and growth opportunity for existing IT resources in supporting virtual desktops remotely.

Other Potential Costs: Other cost considerations may include the following.

- Network infrastructure upgrades may be necessary if existing performance is marginal
- Specialty software and hardware to provide additional security, allow users to move easily from one device to another and support mobile printing

Benefits

Trade magazines, vendor literature, and technology blogs cite a wide-range of benefits from VDI, including cost savings, better resource management, improved data security and increased flexibility. Some benefits are directly attributable to VDI, while others are highly dependent on the selected architecture and installed solution. The following table provides a summary of potential benefits and related considerations.

Benefit Area: Energy Savings

- VDI thin clients use as few as 4 watts compared to 90 to 160 watts for traditional workstations. Thin clients generate less heat so HVAC costs are less.³
- In the data center, infrastructure services can lessen the impact of additional energy needs through server load balancing for batch jobs and automated shut down of idle virtual machines.⁴
- **Considerations:**
 - Savings for thin clients only with some offset for additional energy needs in the data center.



Benefit Area: Cost Savings — Back End Servers and Desktop Management

- Organizations can leverage existing SAN or NAS infrastructure for the VDI solution.
- Desktop management costs decline by simplifying and standardizing the server hardware and client devices.



Benefit Area: Cost Savings — End User Devices

Three areas of costs savings:

- VDI thin clients are significantly less expensive than desktops (thin clients are \$200 - 300, desktops are typically \$1100, and laptops are even more). A Forrester Total Economic Impact study indicated that virtual desktops are less than half the cost of physical desktops.⁵
- Refresh cycle for VDI thin clients is 7 years or more compared to 3 - 5 years for a typical desktop.
- Re-purposed PC workstations for VDI use extends the life of desktops that otherwise would be discarded. Savings cited for re-purposed PCs include the one-time cost to reconfigure the desktop for VDI use.
- **Considerations:**
 - Savings for thin clients only.



Benefit Area: Improved Efficiency — Desktop Management

- Fast provisioning for new users. A new VDI workstation can be set up in less than 15 minutes compared to hours or days to procure and provision a traditional workstation.
- Fewer IT desktop resources needed to support the same number of end users. Thin clients require little or no desk side support. One support full time employee (FTE) can handle 1,100 users compared to 200 traditional workstation users. One healthcare provider was able to reduce their PC support organization from 85 to 35 FTEs.
- Fewer help desk calls if the organization implements user self-service capabilities, e.g., password enrollment/resets.
- Fewer desktop-related problems: Support calls reduced by 60% to 70% on average, in some cases as much as 80%.⁶
- **Considerations:**
 - Savings will depend on the device configurations.
 - Number of calls will depend on the implementation of self-service capabilities in conjunction with the VDI.



Benefit Area: Improved Data Security

- No local data on the desktop devices — all data is kept within the confines of the data center.
- No data can be downloaded from the desktop onto a USB device (unless the user has specific permissions).
- **Considerations:**
 - Depends on end-user device configuration.



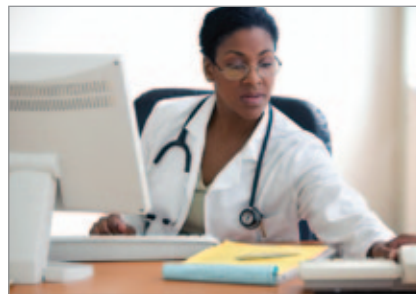
Benefit Area: Enhanced User Experience

- Better performance — Desktops can run on faster server hardware with reduced latency in applications (as resources reside in the same place).
- Quicker problem resolution since everything is located in the data center.
- Desktop resources (memory, applications and disk) can be modified with little or no interruption to a user's workday.
- Any device, any location access without compromising security.
- Ability to incorporate dual-factor authentication such as biometrics or proximity card readers.
- Desktop disaster recovery through regular backups of all desktop data.
- Quiet workspace — thin clients have no moving parts so there is no white noise generated from spinning fans and disk drives.
- **Considerations:**
 - Depends on end user device and secure, mobile extensions.



VDI Impact: One Hospital's Implementation

The following study completed by Forrester describes one hospital's experience implementing an enterprise VDI solution. While these statistics relate to this organization's specific needs and environment, they can be generalized to other hospitals. For details on the study findings please refer to "Total Economic Impact of VMware Virtual Desktop Infrastructure — Healthcare Industry."⁷



Hospital:

- Acute care hospital with level 1 trauma center, separate women and children's hospital, outpatient center and administration buildings.
- 5,600 employees including 2,000 nurses, 850 physicians in 160 private offices.
- 44,000 inpatient visits, 115,000 ED visits, and 500,000 outpatient registrations.

VDI Implementation:

- Electronic medical record (EMR) implementation required replacement of more than 1,600 of 3,300 PCs. Hospital purchased thin clients and repurposed some PCs, no new PCs were purchased.
- Besides the device cost savings, the hospital wanted to improve data and endpoint security. Using thin clients with no USB ports makes it harder for data to be inadvertently removed from the hospital on USB memory sticks or other portable storage devices.
- Primary user groups were nurses and physicians.
- Started with a pilot for one floor and expanded to entire building in one month.
- Applications running on the virtual desktops include Streamline Health's Access, Anywhere, Eclipsys TDS 7,000, McKesson PACS, Image Viewer, GE Imagecast, and Centricity Enterprise.
- Implementation has expanded to include back-office functions such as patient accounting.

Result Highlights:

- ROI was 122% with a break-even point of less than one year.
- Financial benefits included PC savings, reduced support costs, increased worker productivity and energy savings totaled \$3.8 million over four years. Other benefits were data security, end user flexibility and scalability.
- Costs for hardware, software, maintenance, and implementation were \$1.7 million.
- Hospital cited HIPAA regulatory concerns eliminated since no data are stored locally.

Building the Right VDI Solution for Your Organization:

VDI is not a technology-driven project but an end-user initiative to meet the demands of mobile professionals as they access critical and sensitive patient data. Building the right solution for your organization starts with understanding end user needs for access, application usage, printing, security and mobility. A use case or scenario-based approach is the best method for systematically identifying the needs and understanding the workflow and process requirements to support care providers and administrative staff – which then drives the architectural design and VDI components.

The following approach has helped a number of hospitals and other organizations get started successfully.



Step 1: Define Goals and Objectives. There are many reasons for implementing a VDI solution. For healthcare the primary ones include improved mobility, clinician efficiency, improved data security and compliance, lower costs and lower energy consumption.

Step 2: Inventory Applications and Develop End User Profiles. Leverage existing application inventories to map applications to end-user roles (e.g., nurses, physicians and business office staff) will speed the development of profiles.

Step 3: Define Use Cases. Creating use cases that address scenarios that are specific to your environment. This will ensure that applications will function properly in the new VDI environment. Examples may include application access, application usage, device contention, user mobility, printing, audio/video and digital image display.

Step 4: Build Application/OS Images and Establish a VDI Solution Lab. A typical VDI solution lab will be a scaled-down version of a production environment, making use of existing hardware, network and virtual desktop infrastructure where possible. The solution lab may incorporate both static (persistent) and dynamic virtual machines associated with your user profiles.

Step 5: Execute Use Cases. Representatives from IT and the user community should exercise the functionality of the applications in the lab following the use case scenarios. These are helpful in making sure that all aspects of application use and workflow are tested.

Step 6: Enhance VDI Solution. At this time the team may introduce other technology components to support the hospital's overall solution in order to enhance functionality or address additional use cases requirements.

Step 7: Pilot in one unit, gather feedback, and refine the configuration as needed.

Bottom Line

Virtual desktop Infrastructure does work for hospitals. It provides a broad range of economic and efficiency benefits that outweigh the additional costs. It reduces the cost, complexity and pain of desktop provisioning and management, and extends the life of aging hardware. Especially important for healthcare, VDI protects patient data, devices and core services, and enables secure access from anywhere. End users enjoy the same user experience and have the added flexibility to quickly move their session from one device to another.

Building the right solution should follow a use case approach starting in a lab environment, quickly ramping up to a pilot, and then a full rollout within a few months.

“... Because doctors can log in to their applications quickly from any clinic location, they’re able to see more patients. Users also log fewer trouble tickets and annual energy savings are estimated at \$131,655.”

Denver Health, CIO 100 Award Recipient for 2008 for innovative use of technology

About the Authors

Jeff Eagan is a Solution Director for CSC’s Virtual Desktop Services.

Chris Hutcherson is a Senior Technical Specialist with CSC’s Global Healthcare Sector.

Fran Turisco is a Research Principal with CSC’s Emerging Practices. Emerging Practices is the applied research arm of CSC’s Global Healthcare Sector.

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BUSINESS SOLUTIONS
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OUTSOURCING

Healthcare Group

3170 Fairview Park Drive
Falls Church, VA 22042
+1.800.345.7672
healthcaresector@csc.com

Worldwide CSC Headquarters

The Americas

3170 Fairview Park Drive
Falls Church, Virginia 22042
United States
+1.703.876.1000

Europe, Middle East, Africa

Royal Pavilion
Wellesley Road
Aldershot, Hampshire GU11 1PZ
United Kingdom
+44(0)1252.534000

Australia

26 Talavera Road
Macquarie Park, NSW 2113
Australia
+61(0)29034.3000

Asia

20 Anson Road #11-01
Twenty Anson
Singapore 079912
Republic of Singapore
+65.6221.9095

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