



VMware® View™ Reference Implementation for Norton Healthcare

REFERENCE IMPLEMENTATION

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About Reference Implementations

Reference implementations describe how particular customers have architected their virtual desktop environment and deployed VMware® View™. As compared to reference architectures, reference implementations focus on actual customer environments and include deployment information regarding each layer, from the client access devices, access infrastructure, virtual infrastructure, VMware View desktops, and finally, session management.

Introduction

Norton Healthcare, the largest health care system in the Louisville, Kentucky region, has a network of five hospitals and eleven immediate care centers with over 10,000 employees.

To continue to provide superior patient care, Norton's health practitioners require ready access to a wide array of information and applications. Norton's IT team is responsible for ensuring that all systems are readily accessible to Norton employees at any of the organization's locations.

While Norton was able to use Citrix MetaFrame and thin clients to deliver its main healthcare information system to employees, staff members increasingly felt limited by having access only to a single published application. As Customer Service Director Brian Cox put it, "People needed access to a broader span of functionality. They wanted something that looked and felt like a normal PC and could accommodate various different applications, depending on what they needed."

The decision to reexamine how applications were delivered was also influenced by the fact that the existing application delivery system frequently suffered from spotty performance. "A lot of our thin clients are located on mobile carts that can be wheeled from room to room," said Cox. "Naturally, these devices use a wireless connection. If that connection was ever disrupted, they'd lose their connection to the main healthcare information system—which resulted in plenty of IT support calls to our department."

Requirements

Like other healthcare providers, Norton Healthcare had to balance caregivers' needs for access and availability to desktops, applications, and patient records, against IT requirements for security, efficiency, and ease of management. The needs and requirements are summarized below:

Caregiver needs:

- Immediate access to desktops, applications, and patient records
- No downtime (this can never be an option in health care)
- Availability on any device and the ability to share workstations
- A familiar user experience that can accommodate IT changes
- Full PC-like peripheral support

IT requirements:

- Easy management of disparate desktops and applications
- Security and compliance
- Rapid provisioning, update, and roll-out of new services
- High availability
- Cost reduction

Norton Healthcare's Virtual Desktop Infrastructure (VDI) solution needed to address:

- Hospital staff requirements for access to an increasing number of applications and functionality
- Disruption of access to critical healthcare applications
- Time-consuming and resource-intensive application upgrades

Solution

After an extensive in-house proof of concept (POC) process, Norton selected VMware View as the platform for their VDI infrastructure. This robust, simple, and easy to use end-to-end VDI solution allowed Norton Healthcare to migrate from Citrix MetaFrame to VMware View, using thin clients to access virtual desktops. The installation process required very little user training as compared to other VDI offerings in the market.

This solution exceeded all goals for both caregivers' needs and IT requirements and was also able to address user perception concerns about using VDI instead of traditional desktop computing. The projected timeline for VDI deployment was estimated at six months. This goal was achieved via a phased rollout, initially to a few departments and later to the rest of the user population. The gradual approach allowed Norton Healthcare to understand user requirements and proactively address previously unforeseen problems.

About VMware View

Built on the industry-leading virtualization platform, VMware View is a virtual desktop solution that helps to manage operating systems, hardware, applications, and users independently of each other while delivering a familiar desktop experience to users.

It delivers rich, personalized virtual desktops to any device, with all the benefits of centralized enterprise desktop management. VMware View lets IT run virtual desktops in the datacenter while giving users a single view of all their applications and data in a familiar, personalized environment, on any device at any location. VMware View helps to:

- Lower costs by centralizing management, administration, and resources
- Increase security by moving data from desktop devices into the datacenter
- Improve business agility with faster provisioning
- Enhance user flexibility with universal access

Norton Healthcare's VMware View Solution

The Norton Healthcare solution uses the following components:

- Wyse Thin OS and Windows XP Embedded (XPe) thin clients (older clients repurposed to extend usable life)
- 1,000 Win XP virtual desktops
- IBM 3850s M2 (4 CPU/quad core servers) with 128GB RAM
- 10 virtual machine desktops per core, 8GB each
- Applications installed on the virtual machine template:
 - Meditech Client/Server
 - McKesson Picture Archiving and Communication System (PACS)
 - Office Applications
- Local Area Network (LAN) and Wide Area Network (WAN) access
- VMware View Security Server for remote access
- Fibre Channel Storage Area Network (SAN) storage
- Distributed Resource Schedulers (DRS) and VMware VMotion™ for high availability (HA)

Design Approach

Each VMware View Reference Architecture leverages basic design principles and best practices. Using a building block approach allows for the flexibility of creating a comprehensive virtual desktop infrastructure that performs or exceeds desired goals and functionality while maintaining a logical, straightforward architecture.

The VMware View reference architecture begins with the Client Access Devices layer and continues through the Session Management layer (see Figure 1). This approach provides a clear definition of services necessary to allow each functional area to be defined independently from the others, while still providing a cohesive structure for addressing the interdependency of all solution components.



Figure 1. VMware View Component Sub-layers

Client Access Devices

The client access device layer consists of the hardware and software components needed to deliver a PC-like experience. Sub-layers include:

- Client device
- Client software
- Peripheral support

Desktops were deployed in the following areas:

- Clinical areas where physicians, nurses, and ancillary hospital staff had access
- Immediate Care Centers
- Physician offices
- Remote users, including home transcriptionists, software developers, and other healthcare providers, such as doctors affiliated with Norton

Client devices included:

- Wyse S10 terminals used to access the virtual desktops
- 60 Desktop PCs, mostly used as secondary systems in IT
- 950 VMware View Desktops hosted on IBM 3850s M2 machines with 4-way CPUs and 128GB of RAM
- 500 Workstations on Wheels (WOW) with wireless capability accessing virtual desktops
- Norton total PC footprint of 6,000, spread across five hospital campuses and 60 physicians' offices

All users were provided with access to the following client software:

- Windows XP SP3
- Meditech Client/Server
- McKesson PACS
- Microsoft Office
- Company Intranet

Supported peripherals:

- H-P Printers

Access Infrastructure

The networking and connectivity components were designed to facilitate client access. Sub-layers include:

- Local and wide area networking
- Network Load Balancing and optimization with Windows Server 2003 R2 installed in a virtual machine
- VMware View Manager with applications installed in the virtual machine template

Users can access virtual desktops from both LAN and WAN connections. LAN access is provided by a 100 Mbps link to the client devices. Wireless LAN users are on a separate VLAN, with two connection servers to broker connections for LAN users. WAN access is provided by two security servers inside the DMZ, using Windows network load balancer. WAN connections vary from a cable modem in a few clinics to 2 Mbps links, with maximum observed latency at any given time around 25 milliseconds. VMware View desktops are directly connected from existing thin clients and PCs via Remote Desktop Protocol (RDP). End-user benefits include:

- Immediate access to more applications for clinicians
- Lower capital cost for new functionality on thin clients compared to traditional PCs
- Similar experience to traditional PCs in clinical area
- No applications compatibility issues

The Norton Healthcare View architecture provides secure virtual desktop access to 50 physicians' offices over the WAN. Limited web access over the WAN is also provided on a per user basis by applying web filtering policies. Norton Healthcare requires all remote users to establish connections to virtual desktops via an SSL VPN appliance placed in the DMZ. Norton Healthcare also provides secure access to virtual desktops for 100 users connecting from outside the firewall.

VMware View security servers are installed on IBM 8840-41U servers model xSeries 346 using Xeon 3.6GHZ with three GB of RAM each. Norton uses a Cisco Ethernet switch in the VMware View architecture.

Virtual Infrastructure

This layer defines the components and technology used to host the virtual desktop operating systems and supporting VMware View Infrastructure. Sub-layers include:

- Host infrastructure
- Virtual and physical network infrastructure
- Storage infrastructure

Host Infrastructure

Norton Healthcare deployed VMware ESX 3 Server clusters with three EMC DMX FC Symmetrix Arrays, each with 10TB of storage, to host virtual desktop instances. Data stores were partitioned into 337GB logical unit numbers (LUNs), with 26-28 virtual machines hosted per data store. Storage backup is included with the EMC Storage Array. Norton Healthcare uses EMC NetWorker for client backups of server components. EMC storage is configured with RAID 1 (mirroring) to provide a high level of performance and availability for critical applications.

Virtual and Physical Network Infrastructure

Norton Healthcare also leverages VMware Infrastructure 3 (VI3) features such as automated DRS and vMotion to ensure high availability desktops. These features automatically relocate desktops to other servers in case of a memory or CPU spike and have helped the IT staff to segregate demanding workloads and investigate why certain desktops needed more compute resources.

VMware View Manager was implemented to further reduce the number of desktops needed as well as to enhance roaming capabilities. Non-persistent pools offer enough desktops when needed, and users get a consistent desktop each time. VMware View Manager benefits include:

- User desktops allocated from a pool, with user profiles redirected to a network share
- Standard profile redirection instead of any third-party profile redirection software
- Each virtual machine has the software needed for all clinical users

Additionally, users can move from one connecting device to another and immediately resume working. Desktops can easily be refreshed, giving users immediate access to updated virtual machines. Norton Healthcare VDI architecture also provides “Follow Me Desktop” capability, where users have rights to only one virtual machine session at a time, so that when they disconnect and reconnect, they get the same virtual machine they had previously. Norton Healthcare uses a Cisco SAN switch supporting a Fibre Channel SAN network.

Storage Infrastructure

VMware View Composer was implemented to further reduce storage requirements, providing the following storage optimization benefits:

- 70 percent storage reduction per virtual machine
- Virtual machine provisioning time reduced to less than three minutes
- Software update and patch processes streamlined and centralized via a single golden image that is automatically applied to all subsequent new virtual machines

View Desktops

This layer defines the components and configuration of users’ virtual machines. Sub-layers include:

- Virtual hardware configuration
- Virtual desktop guest operating system
- Application deployment methodology
- View Composer configurations

The Norton Healthcare View architecture includes:

- 950 View Desktops hosted on six IBM 3850 M2 machines with 4-way CPUs and 128GB of RAM
- Each virtual machine provisioned with an 8 GB C: drive
- Each virtual desktop guest operating system configured with Windows XP/SP3 with 512MB of RAM
- Use of persistent or non-persistent desktops depending on the user profile
- Clinical users received non-persistent virtual machines due to minimum personalization and similar application requirements
- Desktop density as high as 10 virtual machines per core achieved in some cases
- Each IBM 3850 hosted 160-175 VMware View desktops
- Application deployment via Windows software update service for patches and updates across physical and virtual desktops

- Desktops installed with mission-critical medical applications such as:
 - Meditech Client/Server
 - McKesson PACS imaging
 - Some users also use Health Data Management from 3M and Microsoft Office
- VMware View Composer configured with default settings. VMware View Composer was used to update the applications in the base virtual machine image.

Session Management

This layer defines the deployment and management of a large number of virtual desktops, including integration with existing desktop infrastructure services such as Microsoft Active Directory (AD), for maintaining user and computer accounts. Components and sub-layers control user authentication, virtual desktop provisioning, and deployment as well as user entitlement to desktop resources. They include:

- Desktop provisioning and pool management
- Session monitoring
- Active Directory integration
- Virtual printing

With Sentillion Vergence integrated with VMware View to unify single sign-on (SSO), context management, and strong authentication, caregivers get quick access to their applications and the associated patient data. They are authenticated against Active Directory before being presented with their virtual desktops on thin clients. The virtual desktops are assigned from automated desktop pools, which optimize the architecture with rapid provisioning, patching, and upgrading.

In addition, users are provided with “location awareness” network printing through Active Directory group membership and creation of AD objects for each thin client. Scripts map printers at login and reconnect using VMware View environment variables. Session monitoring is handled by VMware View Manager.

Architecture Design Summary

Figure 2 illustrates the components of Norton Healthcare’s VMware View architecture.

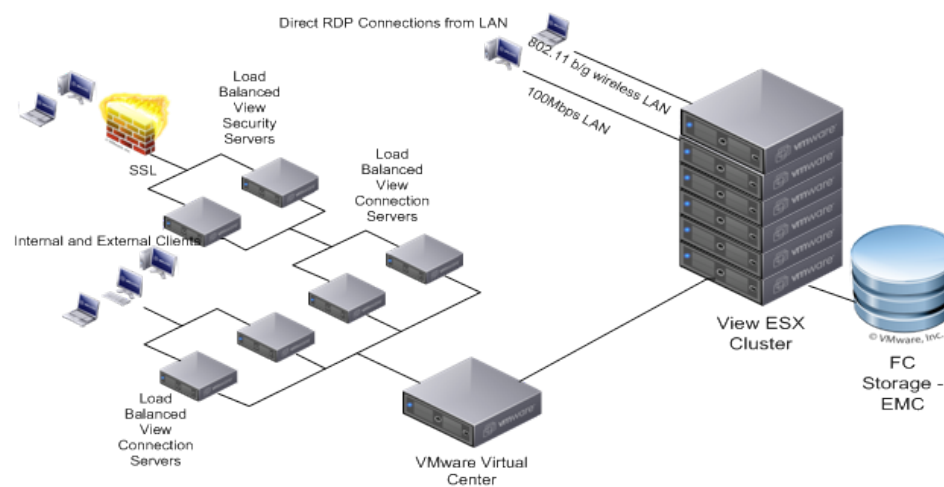


Figure 2. Norton Healthcare Architecture

Figure 3 shows VMware's 1,000-user building block VDI reference architecture with interchangeable components (storage, servers, etc.). Norton was able to use this building-block approach to architect their VDI implementation.

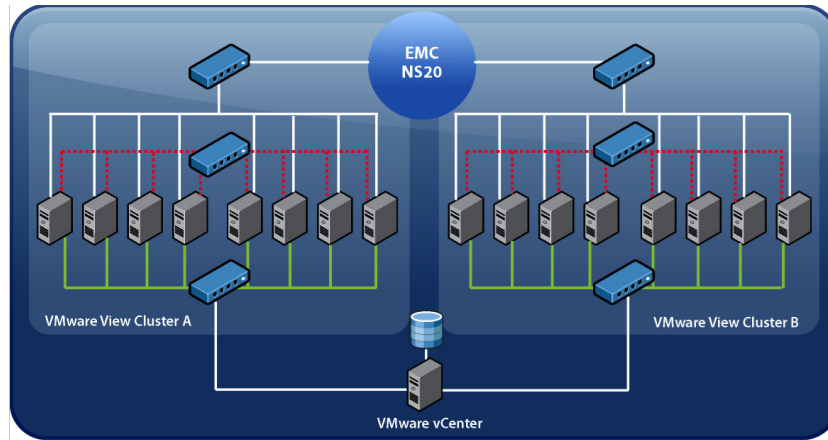


Figure 3. VMware View 1,000-User Building Block

Conclusion

Over the course of six months, Norton Healthcare deployed nearly 950 virtual desktops with VMware View. The results for both users and IT support perspective were dramatic.

Help Desk calls were reduced by 92 percent during a five-month period with VMware View. Norton Healthcare's IT department received only 30 helpdesk calls, compared to 376 Help Desk calls during the same period in the previous year when they were using a Citrix solution.

Additionally, VMware View helps Norton Healthcare to streamline previously time-consuming tasks such as software distribution and application upgrades, and now requires only three full-time IT administrators.

Authors

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Acknowledgements

Brian Cox – Director of IT Customer Service, Norton Healthcare
Raj Mallemapati – Director of Product Marketing, VMware

Links and References

Norton Healthcare case study:

http://www.vmware.com/files/pdf/customers/09Q2_cs_vmw_Norton_english.pdf

VMware View:

<http://www.vmware.com/products/view/>

VMware vSphere™ 4:

<http://www.vmware.com/products/vsphere/>

VMware View Reference Architecture:

<http://www.vmware.com/resources/techresources/1084>

