VDI
Smackdown!

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CONTENT

1. INTRODUCTION

If you are looking for an independent overview of the Server Hosted Desktop Virtualization (VDI) solutions and curious about the different features- and functions each Desktop Virtualization vendor is offering!? This is the whitepaper you definitely must read!

In the current market there is an increasing demand for unbiased information about Desktop Virtualization solutions. This white paper is focused on solutions that are anticipated to have an important role in VDI deployments. An overview of available features of each solution is created to better understand each solutions capability.

1.1 OBJECTIVES

The overall goal of this whitepaper is share information about:

- Application- and Desktop Delivery Solutions overview;
- Explain the different Desktop Virtualization concepts;
- Explain the pros and cons of Virtual Desktop Infrastructure;
- Describe the different Virtual Desktop Infrastructure (VDI) vendors and solutions;
- Compare the features of the various VDI solutions;

1.2 INTENDED AUDIENCE

This document is intended for IT Managers, Architects, Analysts, System Administrators and IT-Pro's in general who are responsible for and/or interested in designing, implementing and maintaining Virtual Desktop Infrastructures.

1.3 VENDOR INVOLVEMENT

All major vendors whose products are covered in the feature comparison, such as Citrix, Microsoft, Quest and VMware have been approached in advance to create awareness of this whitepaper and discuss the different features and functionality.

1.4 CONTACT

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We try to provide accurate, clear, complete and usable information. We appreciate your feedback. If you have any comments, corrections, or suggestions for improvements of this document, we want to hear from you! Please send e-mail to Ruben Spruijt (rsp@pqr.nl). Include the product name and version number, and the title of the document in your message.

2. ABOUT

2.1 ABOUT PQR

"It is easy to complicate simple matters" Very few people have the ability to simplify something that is complicated. Consider the rubber band created by the British inventor Stephen Perry in 1845, for example. Complex and yet straightforward at the same time. PQR stands for the same straightforwardness. But in a different field, namely Information and Communications Technology (ICT) infrastructures, with the focus on:

- Server & Storage Solutions;
- Application and Desktop delivery;
- Virtualization.

"Simplicity in ICT", experience how PQR can make ICT manageable and predictable via solutions that are linked to one another, geared to the future, flexible, inventive and solid at the same time. Work together with a company that likes the result-oriented approach and with personnel who ensure that a solution simply works. ICT has never been that straightforward!

PQR delivers advanced infrastructures with a focus on Server & Storage and Application & Desktop Delivery solutions and the associated migration, consolidation and virtualization paths including network and security. PQR is a Cisco Partner, a Citrix Platinum Solution Advisor, a CommVault Value Added Reseller, and HP Enterprise Specialist Partner, a HP ProCurve Elite Partner, a threefold Microsoft Gold Partner, a NetApp Gold Reseller, an RES Platinum Partner, a VMware Premier Partner and a Websense Platinum Partner. PQR's customers are active in all sectors of society and a significant part of the sales is realized with non-profit organizations, the health care sector, education, local and national government.

PQR is headquartered in De Meern and counts meanwhile over 100 employees. In fiscal year 2007/2008 the company posted sales of € 80.3 million and a net after tax profit of € 5.8 million. www.pqr.nl

2.2 ACKNOWLEDGMENTS

Team leader

Ruben Spruijt, Technology Officer. Ruben Spruijt, born in 1975, studied Computer Science and started his career as a Systems Engineer at A-Tree Automatisering. He has been working as a Solutions Architect at PQR since 2002.

Focusing on Server and Storage, Virtualization and Application Delivery solutions, PQR implements and migrates advanced ICT-infrastructures and has achieved the highest certifications of its most important partners: HP Preferred Partner Gold, Microsoft Gold Certified Partner, Citrix Platinum Solution Advisor, VMware Premier and Consultancy Partner.

In his job, Ruben is primary focused on Application and Desktop Delivery, hardware and software Virtualization. He is a Citrix Certified Integration Architect (CCIA), Citrix Certified Enterprise Administrator (CCEA) as well as Microsoft Certified Systems Engineer (MCSE+S). Ruben has been awarded the Microsoft Most Value Professional (MVP), Citrix Technology Professional (CTP), VMware vExpert and RES Software Value Professional (RSVP) titles.

At various local and international conferences Ruben presents his vision and profound knowledge of 'Application and Desktop Delivery' and Virtualization solutions. He is initiator of PQR's conceptual modes of 'Application and Desktop Delivery solutions' and 'Data and System Availability solutions' and originator of www.virtuall.eu, the solutions showcase of PQR. He has written several articles that have been published by professional magazines and informative websites. To contact Ruben directly send an email to rsp@pqr.nl. Follow ruben on twitter: @rspruijt.

A-Team!

Only through the effort and persistence of the 'VDI Smackdown' team we achieved the goals, a big thanks to them!

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Community effort

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Special thanks

A special thanks to Chris Wolf and Simon Bramfitt of Burton Group (a Gartner Company) for their insights, ideas and opinions with regards to Server-Hosted Virtual Desktops and this whitepaper. Burton Group created an 'In-Depth Research Assessment Server-Hosted Virtual Desktops' with document ID: 68090 really worth reading. Follow Chris and Simon on Twitter

Suggestions and improvements

We did our best to be truthful and accurate in investigating and writing-down the different solutions. When you see improvements please let us know. You will be rewarded with eternal fame ☺. Thank you for helping to make this whitepaper better by emailing rsp@pqr.nl

3. UNDERSTANDING ALL THE APPLICATION AND DESKTOP DELIVERY SOLUTIONS

3.1 INTRODUCTION

Before you do a 'deep dive' in the Virtual Desktop Infrastructure arena, it's important to have an overview of all the 'Application- and Desktop Delivery' solutions.
PQR created the "Application & Desktop Delivery Solutions Overview" to provide a full at-a-glance outline of the various application and desktop delivery solutions. Reading this chapter will give you a complete outline of the diagram and all the application and desktop solutions that are included in it. There are so many delivery solutions available on the market that - often due to a lack of knowledge - their functionalities are frequently mixed up. This paragraph does not aim to describe all application scenarios or their technical advantages and disadvantages, but to give a general idea of the state of affairs in the application and desktop delivery segment, independent of vendors.

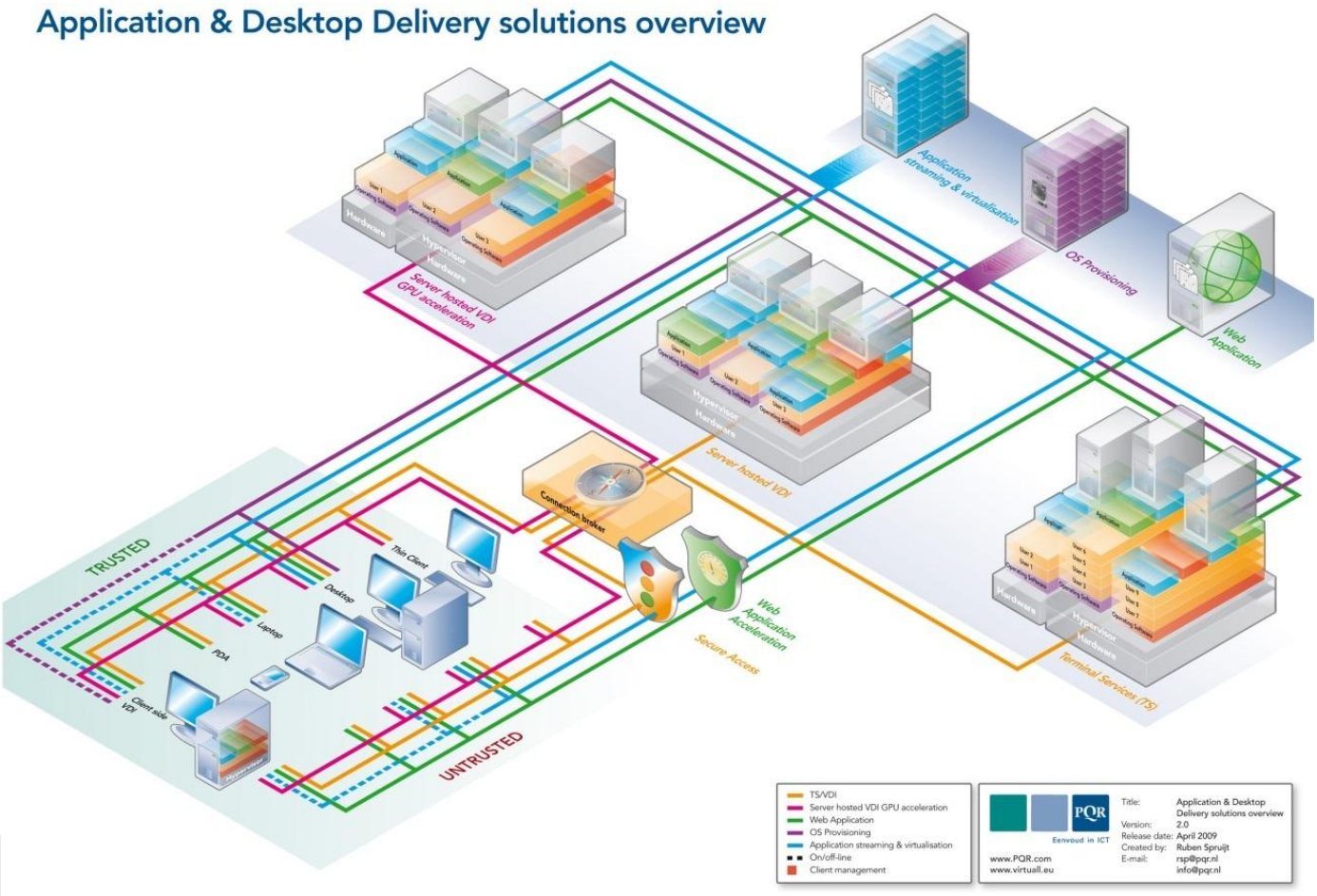


Figure 1, Application and Desktop Delivery Solutions Overview

3.2 TRUSTED AND UNTRUSTED WORK PLACE SCENARIOS

Trusted work places are devices that are connected to the existing IT backend infrastructure via wired or wireless LAN/WAN. Untrusted work places are devices that do not have a secure wired or wireless LAN/WAN connection to the existing IT backend infrastructure. This is, for example, equipment that is connected to a separate network segment for security reasons or because it is used from home or at a work experience location.
Each organization has different work place and application delivery scenarios. For the IT department, it is important to have a good overview of the various work place and application delivery scenarios, since this indicates how the various users work with the applications or what their requirements are.

3.3 SECURE ACCESS

Secure Access solutions provide secure access for untrusted devices to corporate IT. The two parts of the symbol stand for secure (the shield) and access (the traffic light). Depending on the chosen solution, secure access can also be fine-grained.

Solutions that can be used to realize secure access scenarios include Cisco ASA, Citrix Access Gateway, Microsoft Intelligent Access Gateway, and Juniper SSL VPN.

3.4 WEB APPLICATION ACCELERATION

Web Application Acceleration appliances accelerate and secure web-architected applications. We are all confronted with these solutions nowadays: internet applications such as Google, MSN and eBay all use them. Web application acceleration solutions are not just useful for large organizations; however, you could also use them for your own web applications.

Solutions that facilitate web application acceleration and security include packages such as Citrix Netscaler and F5 BigIP.

3.5 CONNECTION BROKER

The connection broker determines which server-hosted remote desktop will be made available to the client. When using a server-hosted virtual desktop infrastructure for this, it is possible to either designate dedicated desktops or a pool of remote desktops. The desktop broker can automatically create, remove or pause remote desktops. There are a number of connection broker suppliers. Citrix with XenDesktop, Microsoft with Remote Desktop Services, and VMware with View are the best-known total solutions. Depending on the supplier, the connection broker may have additional functions, such as a web interface that can create secure (SSL) connections to remote desktops, Directory Services integration, Full USB support, support for various display protocols and integration with Remote Desktop Services (former Terminal Services). Depending on the rules, it is possible to execute applications centrally on a server-hosted VDI or on a terminal server.

3.6 APPLICATION STREAMING AND VIRTUALIZATION

Through application streaming and virtualization, Microsoft Windows applications can be used without changing the local operating system or installing application software at a particular work place. In other words; the application can be executed as if it had been installed locally and can save data and print without the need of any modifications to the local client. Resources such as the CPU, memory, hard disk and network card take care of the execution of these applications.

Application Streaming and Virtualization can make applications available to desktops, laptops, server-hosted VDIs and Remote Desktop Services (TS) platforms. The applications are executed on a "client" platform, without needing to modify the platform.
The advantages of Application Virtualization include: installation, upgrade, roll-back, delivery speed and the ease of application support (management). Installation of applications is no longer necessary, eliminating the possibility of conflicts. The result is a dynamic application delivery infrastructure.

Application Streaming and Virtualization solutions include: Microsoft App-V, VMware ThinApp, InstallFree, Symantec Workspace Virtualization and Citrix Application Streaming with XenApp.

3.7 OS PROVISIONING

OS Provisioning allows workstations to boot up and run from a central image. A single image can be used simultaneously by multiple workstations. The advantage of this is that complete operating systems, including applications and clients, can be made available quickly and securely. It is possible to make a single image available to multiple VDIs, RDS and physical desktop environments without causing conflicts. As a result, it is possible to upgrade or roll-back an OS quickly, simply, and without significant risks. When virtual desktops use OS streaming, (valuable) storage is saved, and the management of virtual desktops becomes relatively simple. This means that virtual or physical machines using OS Provisioning can become —stateless devices.

Citrix Provisioning Server, part of the XenDesktop and XenApp family, Wanova Mirage and the VMware View Composer are solutions that facilitate OS Provisioning.

3.8 SERVER-HOSTED VIRTUAL DESKTOP (VDI)

VDI, Virtual Desktop infrastructure = Dedicated Virtual Desktop
There are two kinds of VDI: server-hosted and client-side. A Server-Hosted Virtual Desktop Infrastructure (VDI) is a dedicated remote desktop solution providing remote access to Windows XP/Vista/Win7 or Linux desktops. The virtual machines are run from within the data center. The virtual infrastructure increases the system's independence, availability and manageability. The implementation of Server-Hosted VDIs means that desktops are no longer bound to a location or end-user appliance. Each user has his/her own unique, personalized, fully independent work place. Programs run and data is processed and stored on a centralized personal desktop. The information is sent to the client screen via a remote display protocol such as Microsoft RDP, Citrix ICA/HDX, Teradici/VMware "PC-over-IP" or VNC. The protocol used for displaying the correct information depends on the operating system, bandwidth, the type of application, and the technical facilities. As with other desktop delivery solutions, VDI consist of various infrastructure components that facilitate management, load balancing, session control and secure access to virtual work stations.

Microsoft, Citrix, Kaviza, Quest, SUN, Virtual Bridges and VMware are all important suppliers within the server-hosted VDI segment.

3.9 SERVER-HOSTED (VIRTUAL) DESKTOP WITH GPU ACCELERATION

The "Graphical Processor Unit (GPU) acceleration" functionality can be added to the server-hosted VDI solution. It provides each (virtual) machine with enough graphic performance to run multimedia, 2D/3D, NextGen and Unified Communications.
Display data is presented to the client device via an optimized remote display protocol. To ensure that the end-users experience the best possible performance, the bandwidth, latency, or local (software) components have to meet extra requirements.

Citrix HDX 3DPro and Microsoft RemoteFX are (upcoming) vendors in this space.

3.10 REMOTE DESKTOP SERVICES (RDS)

Remote Desktop Services (formerly Terminal Services) = "Shared Remote Desktop"
Terminal Services is a solution for the remote access to desktops and applications that are run on a terminal server in a data center, where every user has his or her unique terminal server session. Access to the desktop or application is not tied to a location or end-user machine, and programs are executed centrally on the terminal server.
The data appears on the client screen through a remote display protocol such as Microsoft RDP or Citrix ICA/HDX. Remote Desktop Services consists of various infrastructure components for management, load balancing, session control and support. It has the advantage that applications are made available quickly and securely, the TCO is low, and applications can be accessed irrespective of location or work place.

Suppliers of Remote Desktop Services include Microsoft, Citrix and Quest.

3.11 CLIENT-SIDE DESKTOP VIRTUALIZATION (VDI)

VDI, Virtual Desktop infrastructure = Dedicated Virtual Desktop
There are two kinds of VDI: server-hosted and client-side.
Client-side VDI, also know as Client Hosted Virtual Desktop, is a dedicated local desktop where the virtual machines run locally on the client device. The hypervisor ensures that each virtual machine is hardware-independent, and makes it possible to simultaneously use a number of virtual machines at the same workstation.
The hypervisor plays an essential part in client-side VDI solutions.
There are two kinds of hypervisor: a bare-metal client hypervisor and a client-hosted hypervisor. The client-hosted hypervisor is installed on the Windows, Mac OS X or Linux operating system as an application. The bare-metal client hypervisor is installed on top of the hardware, with the operating system installed on the hypervisor.
The main differences between the hypervisors are hardware support, performance, manageability and end-user experience.

Citrix XenClient, Neocleus and Virtual Computer are all bare-metal Client Virtualization Platform (CVP) or client-side VDI solutions.
Microsoft VirtualPC and MED-V, VMware ACE and Fusion, VMware View Client with Local Mode, Parallels Desktop, and Sun VirtualBox are client-side VDI solutions.

3.12 CLIENT MANAGEMENT

Any self-respecting professional IT organization is bound to use a Client Management solution, as it is needed to facilitate things such as OS deployment, patch management application and client deployment, asset management, service desk integration, and remote control.

Examples of client management systems are Microsoft System Center Configuration Manager (SCCM), RES Wisdom, Altiris Deployment Solution, LANdesk Client Management and Novell ZENworks Configuration Management.

4. DESKTOP VIRTUALIZATION

In the previous chapter an overview of all the 'Application and Desktop Delivery' solutions were explained. In this chapter Desktop Virtualization, server-hosted and client-side, is described.

4.1 INTRODUCTION

Making applications available to the end-user, regardless of the technology being used, is the ultimate strategic objective of an Advanced ICT infrastructure. The Virtual Desktop (vDesktop) is an essential component in the range of Application and Desktop delivery solutions and in essence, provides the following functions:

- **Flexibility:** Detach the vDesktop from the endpoint; Several vDesktops next to one another
- **Access:** vDesktop works independently of location, endpoint and network; Uniform workstation
- **Security:** Server Hosted – VDI; data in the computing center
- **Freedom:** Every user has their own desktop with administrator access when needed;
- **Management:** Hardware-independent 'image'
- **Legacy:** It is simple to offer legacy applications on a state-of-the-art platform
- **Sustainability:** Power Management, handling the necessary resources in an efficient manner

4.2 TYPES OF DESKTOP VIRTUALIZATION

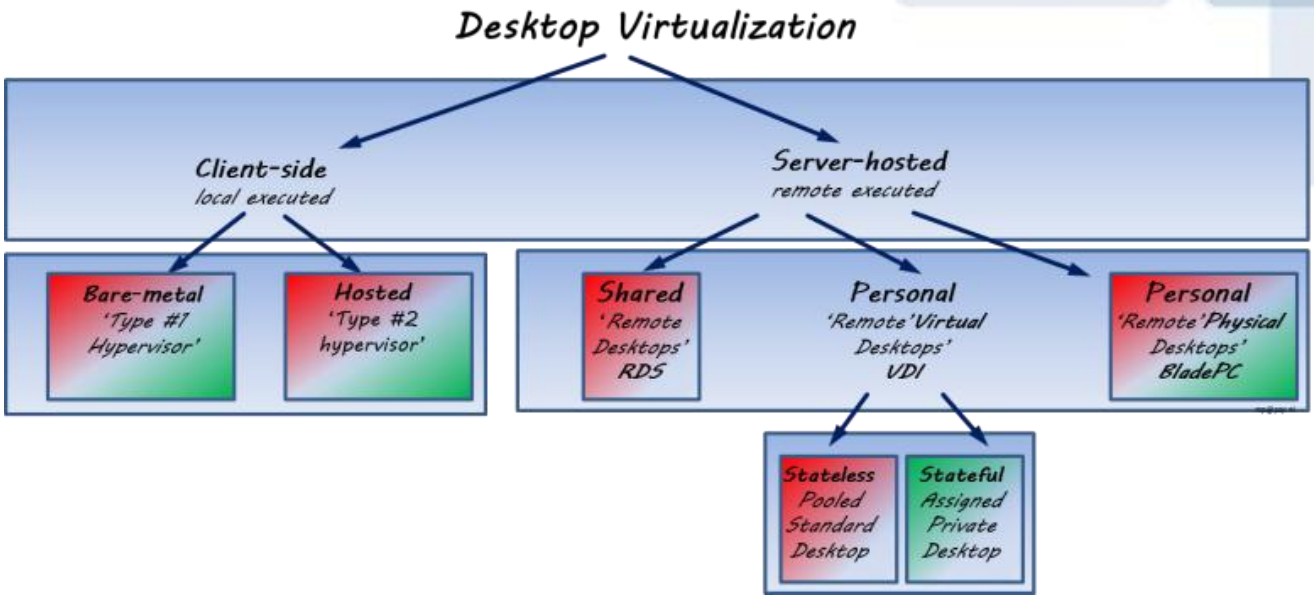
Desktop Virtualization is the detachment of the desktop, the operating system and the end-user applications from the underlying endpoint or device. This kind of virtualization can be subdivided into two types:

With the first type of virtualization, the end-user applications are executed remotely, *server hosted,* and presented at the endpoint via a Remote Display Protocol.

With the second type of Desktop Virtualization solution, the applications are executed at the endpoint, *client-side,* and presented locally on this workstation. If we study the two virtualization concepts in more detail, five different types of Desktop Virtualization can be identified, these include:

- Client-side (executed locally) bare-metal client hypervisor
- Client-side (executed locally) client-hosted hypervisor
- Server-hosted (executed remotely) shared desktop (RDS)
- Server-hosted (executed remotely) personal virtual desktop (VDI)
- Server-hosted (executed remotely) personal physical desktop (BladePC)

A graphic overview of the five different desktop virtualization solutions is shown here:



4.3 OVERVIEW OF THE DESKTOP VIRTUALIZATION SOLUTIONS

The five different Desktop Virtualization solutions are outlined in the following paragraphs.

4.3.1 Remote Desktop Services (RDS)

Desktop Virtualization, by means of 'Server hosted shared remote desktops', is a solution for gaining remote access to desktops and applications that are executed on a Remote Desktop Server (RDS) in the data center. Access to the desktop or application is not connected to a location or end-user equipment and the execution of the programme takes place centrally on the server. The information appears on the client's screen via a remote display protocol such as Microsoft RDP or Citrix ICA/HDX. Every user has his own desktop session but shares the computer platform with other users. Other frequently used terms for this type of desktop virtualization include the following: Terminal Services, Remote Desktop Servers (RDS) and Session or Presentation Virtualization. Suppliers of 'Server hosted shared remote desktops' solutions include, for example, Microsoft, Citrix (XenApp) and Quest (vWorkspace).

The Remote Display Protocol of Windows Server 2008R2 is comparable with that of Windows 7. It is, for example, possible to use Windows Media Player, SilverLight, Flash and DirectX with the Microsoft RDP7 protocol and experiences with this have been positive (especially in a LAN environment).

4.3.2 Server Hosted Virtual Desktop (VDI)

Server hosted Personal Remote Virtual Desktops is a solution for gaining remote access to Windows 7 or legacy Windows XP desktops that are executed on a virtual machine in the datacenter. The Virtual Infrastructure ensures availability and manageability. Other frequently used terms for this type of desktop virtualization include the following: Virtual Desktop Infrastructure (VDI) or Server Hosted Virtual Desktops (SH-VDI). The use of Server hosted VDI does not require the Windows XP/7 vDesktop to be connected to a location or item of end-user

equipment. Each user has his/her own unique, personal and completely isolated workstation. Program execution, data processing and data storage take place centrally on the personal desktop. The information is displayed on the client's screen via a remote display protocol such as Microsoft RDP, Citrix ICA/HDX or VMware 'PC-over-IP', to name but a few. Suppliers of overall solutions for 'Server Hosted Personal Virtual Remote Desktops' include, for example, Microsoft (RDS), VMware (View), Citrix (XenDesktop) and Quest (vWorkspace).

4.3.3 Stateless and statefull Desktops

Stateless and statefull are essential terms, especially in relation to server-hosted remote personal desktops. It is important to understand what these two terms mean.

Stateless Desktops: In practice, a number of different terms are used for stateless desktops; pooled, non-persistent or standard desktops are frequently-used terms. The essence is the same, the virtualized desktop is and will always remain clean and 'pristine'; therefore 'stateless'. All machine-related modifications, for example applications that are installed by a user, are removed when the user logs off. User-specific settings that are recorded in the user profile, however, can be stored and re-used. In addition to the aforementioned benefits of Desktop Virtualization, stateless desktops also offer the following specific properties:

- The simple roll-out and update of basic images
- A virtual desktop is guaranteed to be 100% identical
- The user always has the same (clean) workstation
- Less effort is required by the management team due to the standardization of images.

Statefull Desktops: In practice, a number of different terms are used for statefull desktops, including assigned, persistent or private desktops; are terms that are frequently used. The essence is the same; the user is and will always remain connected to a vDesktop on a 1:1 basis. When the user has the freedom to install software, the machine-related adjustments continue to be maintained within this desktop, which is where the term 'statefull' is derived from. In addition to the aforementioned benefits of Desktop Virtualization, a statefull desktop therefore has the following specific properties:

- Freedom to install software within the desktop
- Maintaining all changes to the operating system between reboots

An important aspect regarding statefull desktops is the fact that the roll-out phase, update, upgrade and security of the operating system and the applications is less simple to manage than with the stateless desktops. The impact on (central) storage is also greater than with stateless desktops. De-duplication on the storage array can reduce the storage capacity footprint.

Use stateless or statefull!?

So, which is better, stateless or statefull?! The answer to this question depends on the functionality that the end-users require and the impact of this functionality on the ICT department.

4.3.4 Server-Hosted (virtual) Desktop with GPU Acceleration, Blade-PC

An optimum experience has not yet been gained by the end-user with Remote Desktop Services and Server Hosted VDI when using graphic intensive 2D/3D, NextGen and Unified Communications applications. A significant reason for this is the fact that the presence of graphic processor power is lacking in the (current) virtual desktop. The server hosted personal remote physical desktop is the solution and offers users remote access to Windows 7 or legacy Windows XP desktops. These desktops are executed on a physical machine in the data center. Costly blade (professional) workstations, or blade-PCs, are frequently used for the physical machines.

The GPU in each blade ensures that every vDesktop is equipped with sufficient graphic processing power in order to be able to execute multimedia, 2D/3D, NextGen and Unified Communications applications. Monitor information is presented on the endpoint device via an optimized remote display protocol. In order to be able to present the information with the end-user gaining the best possible experience with this, additional requirements may be made with regard to bandwidth, latency or locally available (software) components. The expectation is that graphic performance in the physical desktop will become available in the Virtual Machines over time. The 'Server Hosted Personal Remote Physical Desktops' solution is supplied by HP, Citrix and Teradici, to name but a few.

4.3.5 Client-side vDesktop

Client-side, or Client-Hosted, desktop virtualization is a solution through which the Virtual Machine(s) is/are executed locally at the end point. The Hypervisor ensures that every virtual machine operates independently of hardware and renders it possible to utilize several Virtual Machines on the workstation at the same time. The hypervisor plays an essential role and can be subdivided into two categories, the 'bare-metal' category and a 'client-hosted' hypervisor.

The bare-metal client hypervisor is often referred to as Type 1, as this can be used directly from the hardware resources. The result of this is a 'near-native' performance.

The client-hosted hypervisor is installed as an application on the Windows, Mac or Linux operating system, and provides a broader level of hardware support. As this hypervisor is installed on the operating system, this is referred to as 'Type 2'. The performance of the vDesktop is acceptable for the average user, but is definitely not maximal.

Citrix XenClient, VMware Client Virtualization Platform (which isn't public available yet), Neocleus and Virtual Computer are bare-metal solutions.Microsoft VirtualPC, XP mode for Windows 7 (build-in feature), MED-V, VMware ACE and Fusion, VMware View Client with Local Mode, Parallels Desktop, Sun VirtualBox are client-hosted desktop virtualization solutions.

4.4 VDI STRATEGY

The growing reality of the transition to a dynamic datacenter is causing many IT organizations to reevaluate traditional IT operations, support, and management methods. Virtualizing the Desktop is a reasonable piece to support growing numbers of unmanaged desktops, external users, and other use-case scenarios. It's important to have a **Vision** and **Strategy** around Application and Desktop Delivery. Designing, building, managing and maintaining the vDesktop infrastructure using the right **Technologies**, corresponding vendors and products is an important last step.

We see a lot organizations primarily focusing on **products** and **vendors** and lacking a clear and profound vision and strategy. This approach isn't good or bad, it depends on what the goal of the organization is. When the organization needs a point solution, the various vendors and corresponding products can help to solve this issue and fill-in the demands.

When the organization is investigating possibilities, advantages, use cases and functionality of the vNext "Optimized desktop", a profound vision and strategy should be in place.

The following *themes* should be part of the vDesktop strategy:

- What are the **use-cases**? And does the use-case require Virtualization?
- **VD-why**, what do I want to achieve?, lowering TCO?, business enabler, overall cost of ownership and cost reducer?
- What is the **Business-case?**
- What's the **user experience** using Multimedia, NextGen, Video/Voice, 2D/3D applications?
- What **endpoints** do we support and facilitate and what is the role of these devices in the end-user experience?
- Do we need to **manage** the **endpoints**?
- How is the vDesktop managed? OS deployment, application distribution, patch management etc. etc. Is **client management** mandatory?
- What is the **impact** on **storage** (http://bit.ly/5HTajV) and how does it effect the business-case?
- Do we focus on **stateless** (pooled, shared) and/or **statefull** (assigned, private) **images**? What is, for example, the impact on storage, manageability, security, legal and business-case?
- **Windows 7** or Windows XP as core vDesktop **OS** platform?
- How does the solution scale? What do we need from a **scalability** point of view?
- How do we **size** the vDesktop and corresponding infrastructure and what are the best-practices for **optimizing** the vDesktop? http://www.virtualrealitycheck.net/
- What is the performance and bandwidth **impact** on the **network infrastructure**; LAN, WAN, wLAN
- How do we design and build the **user**'s **profile** and his '**workspace'**?
- **Licensing;** Operating System, Client Access Licenses and (Business) Applications
- Do we need to **backup** (and restore) the vDesktops?
- Is **Anti-Virus** needed? Inside the VM or as service module on the Hypervisor?
- Is the IT organization **mature** enough to support and maintain the complete **technology stack**? What is the knowledge and skill-set of the IT-department?
- Bottom Line: What's your current Desktop strategy?!

5. VENDORS AND THEIR VDI SOLUTION

5.1 INTRODUCTION

To get an overview of the major players in the Server hosted VDI space, a number of products are explained in this chapter (sorted alphabetically by vendor).

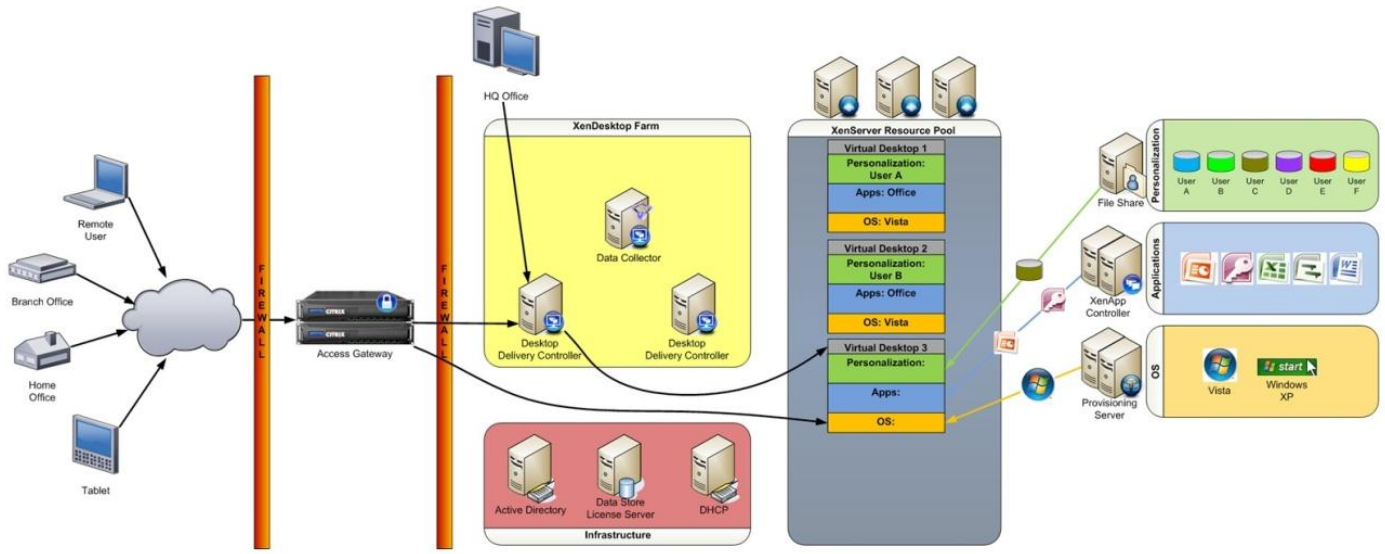
5.2 CITRIX XENDESKTOP

INTRODUCTION

Citrix has a long history in Server Based Computing with its XenApp product (formally known as MetaFrame Presentation Server). After the acquisition of XenSource, Citrix added two new product lines to its portfolio; Citrix XenServer for server virtualization and Citrix XenDesktop for desktop virtualization. Combined with the company's existing application virtualization product (as a part of XenApp), these two new additions give Citrix an end-to-end virtualization portfolio.

ARCHITECTURE

The architecture of XenDesktop consists of multiple components. This makes the initial setup of XenDesktop more complex than some other solutions.



The tasks of the connection broker or the "Delivery Controller" are:

- Authenticates users
- Manages assembling the user's desktop environment
- Brokers connections between the user and his virtual desktop

Other components of the XenDesktop infrastructure are: Licensing server, Datastore, Provisioning server (enables virtual desktops to be managed from a single golden image), Web Interface and Access Gateway for secure remote access. XenApp can also be included in the infrastructure for accessing remote or streamed applications.

A XenDesktop agent is required in the guest VM or Blade PC. The agent enables direct connections between the endpoint and the user's virtual desktop. On the endpoint the Citrix Receiver is required. The Receiver provides simple access from any device, anywhere, to virtual desktops and applications.

The protocol used for XenDesktop (and XenApp) is the ICA protocol and has some special features. The ICA protocol performs better on limited bandwidth and higher latency than the RDP protocol.

Together with Citrix XenDesktop 4 HDX was introduced. HDX consists of several elements that should improve the user experience, such as VoIP and webcam support, 3D support, enhanced audio and optimization for use over WAN.

LICENSING

XenDesktop is available in 4 types of licenses:

- Express
- VDI
- Enterprise
- Platinum

Each license type includes, next to the Desktop Delivery Controller (the broker) the right to use certain components of Citrix: XenApp, XenServer, Provisioning Server, Access Gateway, EdgeSight for desktops, etc. Express is the free version with the least components and allows up to 10 desktops and Platinum is the most advanced.

5.3 KAVIZA

(Not yet included in the version 1.0 of the Feature comparison matrix)

INTRODUCTION

Many customers have been priced out of traditional VDI solutions because of the complexity and the high upfront cost of deploying these solutions. Kaviza addresses this market with VDI-in-a-box - an all-in-one virtual appliance that provides high-availability without requiring shared storage. Kaviza eliminates complexity by bundling all the VDI functions including load balancing, connection brokering, dynamic desktop provisioning, and high-availability into a single turnkey virtual appliance. Kaviza runs on off-the-shelf commodity hardware with direct attached storage - this eliminates the high infrastructure requirements of traditional VDI. Kaviza's grid scales on-demand and additional servers can be added as desktop needs grow.

Kaviza has a strategic license with Citrix to resell HDX with its virtual desktops. Customers can buy Kaviza virtual desktops with HDX for $160 per concurrent user without needing any XenDesktop or XenApp licenses.

Kaviza is hypervisor agnostic and currently supports both VMware ESX and Citrix XenServer. Support for Hyper-V is on the roadmap.

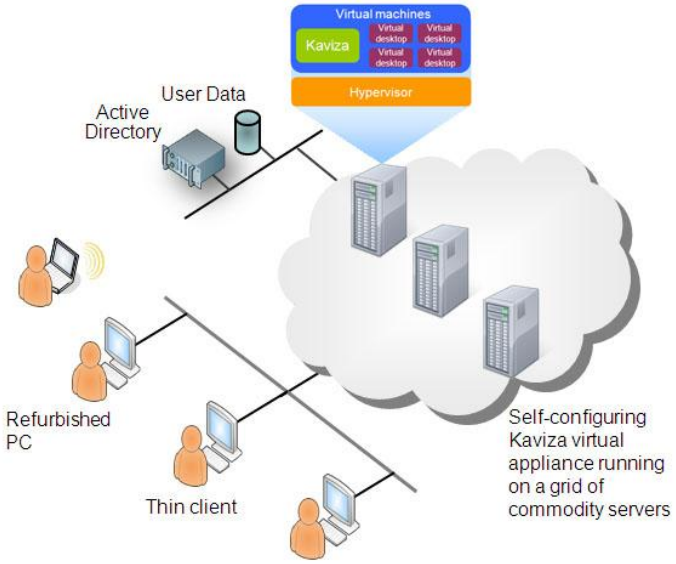


Figure 5, Kaviza solutions overview

ARCHITECTURE

As shown above, Kaviza uses a distributed grid architecture that consists of one or more servers each running a hypervisor and the Kaviza kMGR virtual appliance. The kMGR appliances on each server communicate and work together to:

- Run the desktops;
- Ensure there are redundant copies of key data so there's no single point of failure;
- Dynamically and automatically incorporate new servers;
- Detect and dynamically recover from server failures;
- Simplify management by allowing the administrator to manage the solution as if it were one logical server.

5.4 MICROSOFT REMOTE DESKTOP SERVICES

INTRODUCTION

Microsoft has had remote desktop capabilities built in their Operating Systems for years. This functionality was already available from Windows 4.0 NT Terminal Services Edition. With Terminal Services users shared a desktop with other users. With the launch of Windows Server 2008 R2 in October 2009, the name "Terminal Services" was replaced by "Remote Desktop Services". Windows Server 2008 R2 also introduced two new roles, namely the "Remote Desktop Connection Broker" and "Remote Desktop Virtualization Host". With the addition of these roles users can connect through a broker to a virtual desktop.

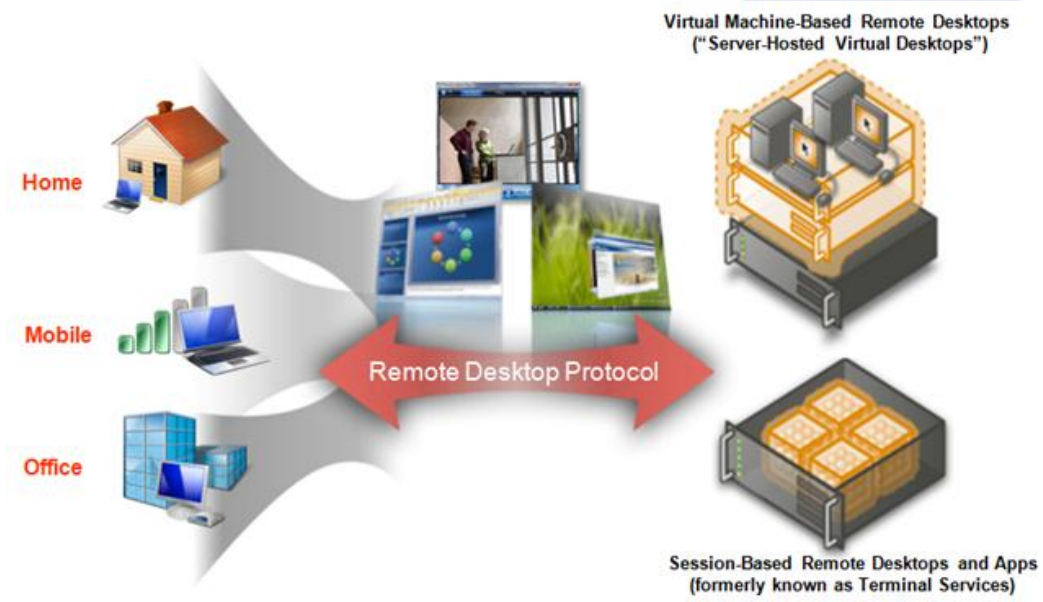


Figure 6, Microsoft VDI and RDS solution

ARCHITECTURE

All the components of the Microsoft RDS architecture are roles which can be installed as a part of Windows Server 2008 R2. The connection broker is called the Remote Desktop Connection Broker. This role orchestrates a virtual machine and returns connection information to the redirector. The redirector is actually a Remote Desktop Session Host (formally terminal server) in redirection mode. Hyper-V R2 is the only supported hypervisor for Microsoft RDS. A remote Desktop Virtualization Host role must be installed on the Hyper-V R2 host. Finally, a Remote Desktop Web Access server and, optionally, a Remote Desktop Gateway are roles that complete the Microsoft RDS infrastructure.

To get the best user experience, Windows 7 is required on the endpoint device and Windows 7 (or Windows Server 2008 R2) on the server hosted desktop.

LICENSING

To use the Desktop Connection broker in Windows Server 2008 R2, all you need is a Windows Server 2008 R2 license. But if you want more capabilities, Microsoft also offers VDI suites. The standard VDI Suite includes the basic infrastructure and management components required for a VDI deployment, and the VDI Premium Suite includes additional desktop and application deployment options. Both Volume Licenses are available as device based subscriptions on top of Software Assurance, thereby complementing the VDA license.

The Microsoft VDI Standard Suite includes licenses to the following technologies:

- Hypervisor platform (Hyper-V Server 2008 R2)
- An integrated management suite for VDI (System Center Virtual Machine Manager 2008 R2, System Center Operations Manager 2007 R2, and System Center Configuration Manager 2007 R2)
- Microsoft Application Virtualization through the Microsoft Desktop Optimization Pack (MDOP)
- Connection brokering capability through Windows Server 2008 R2 Remote Desktop Services.

The Microsoft VDI Premium Suite includes all the features of the Microsoft VDI Standard Suite, and also includes:

- Complete Remote Desktop Services capability, including the option to deploy session based desktops in addition to VDI desktops.
- Microsoft Application Virtualization for Remote Desktop Services

5.5 QUEST VWORKSPACE

INTRODUCTION

Quest vWorkspace is the result of an acquisition in 2007 by Quest of a company called Provision Networks. Founded in 2004, Provision Networks aimed to reduce the adoption barriers of virtual desktop deployment and application delivery, through cutting-edge technologies that address the end-to-end requirements of global deployments. Quest vWorkspace delivers virtual applications and desktops from multiple hypervisors, Remote Desktop Services and blade PCs through a single user access point and management center.

A key component of the vWorkspace offering is Quest EOP (Experience Optimized Protocol), a set of technologies that embrace and extend the Microsoft RDP protocol to provide a near local user experience over both LAN and WAN.

ARCHITECTURE

The connection broker is called the vWorkspace Connection Broker. Other components are a vWorkspace configuration database, vWorkspace web interface and vWorkspace SSL gateway server. The protocol that is used to connect to the desktop is the regular RDP protocol. For a better (graphics) performance over WAN the EOP protocol (Experience Optimized Protocol) can be used.

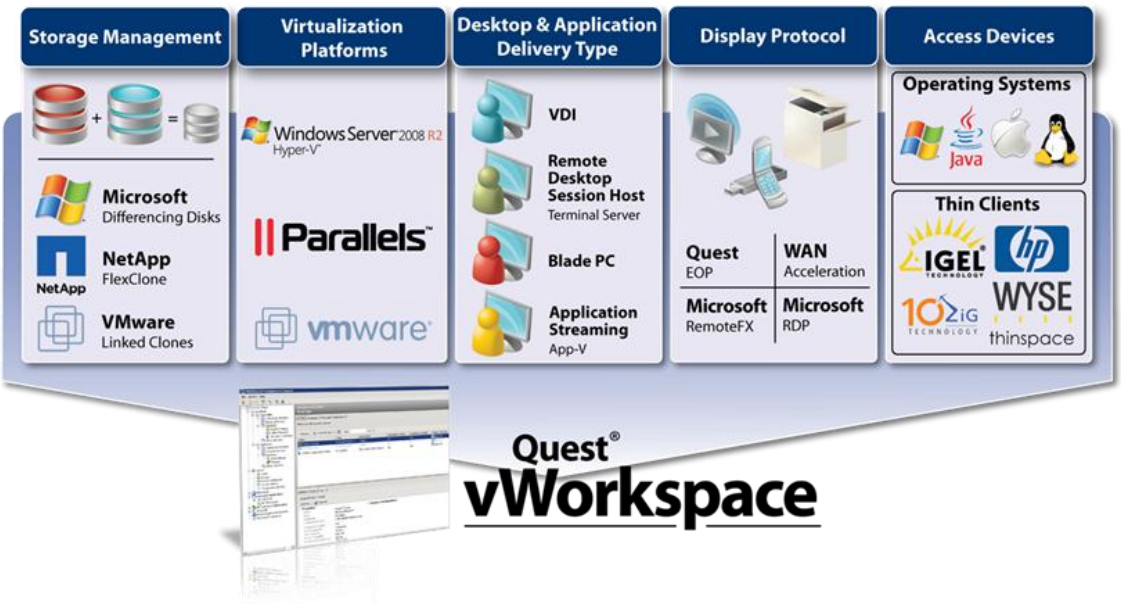


Figure 7; Quest vWorkspace solutions overview

LICENSING

Quest vWorkspace is available in 2 types of licenses: The Desktop Services Edition and Enterprise Edition. Both are per Concurrent User based licenses.

5.6 SUN VIRTUAL DESKTOP INFRASTRUCTURE

(Not yet included in the version 1.0 of the Feature comparison matrix)

INTRODUCTION

Sun offers a VDI solution that is made up of four main components: **virtualization platform**, **session management** (VDI Core), **desktop access clients and storage**. The central component is the SUN VDI core (broker). This component is responsible for the session management. IT architects can mix and match the different components to fit the needs of the customer. For example, when a customer wants to use Sun Ray thin clients but not the Sun VDI core as a broker, the customer can user VMware View as a broker with the Sun Ray software to use the Appliance Link Protocol (ALP), which is used by Sun Ray ultra-thin clients.

ARCHITECTURE

The architecture of Sun VDI is described below.

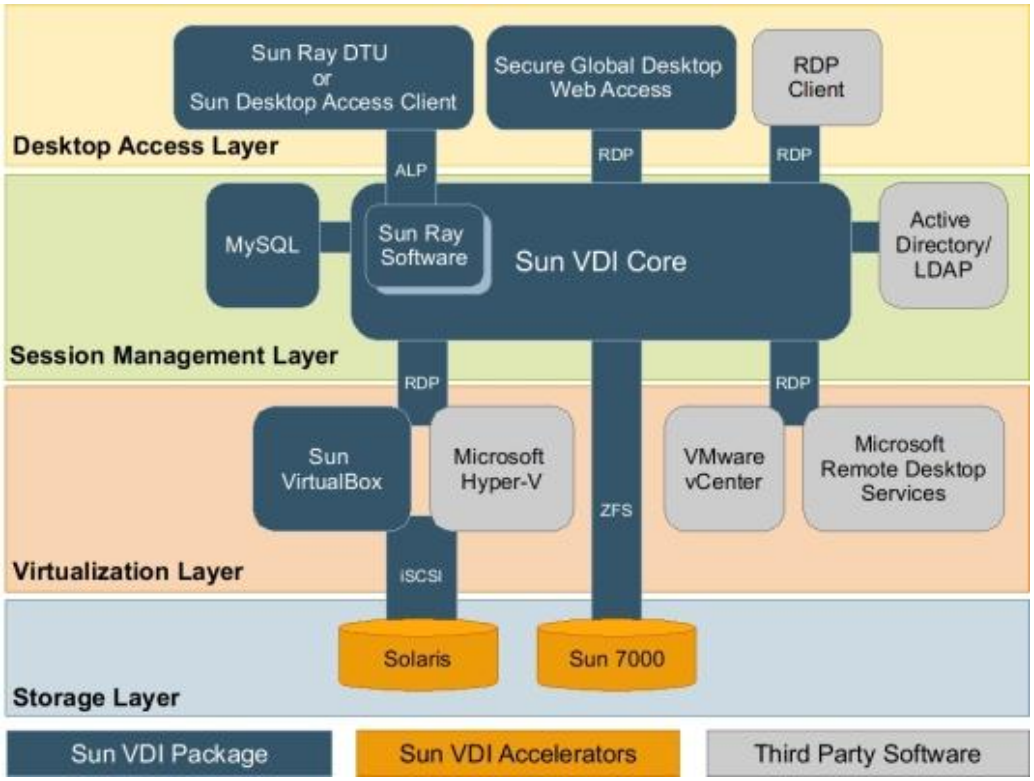


Figure 8, SUN's VDI stack

The basis for a VDI architecture is the virtualization platform. In addition to creating and storing virtual machines, the virtualization platform offers the core functionality needed for virtual desktop management such as starting, stopping, and snapshotting virtual machines. Sun VDI 3.1 supports the Sun VirtualBox, VMware vCenter, Microsoft Hyper-V, and Microsoft Remote Desktop Services virtualization platforms.

SESSION MANAGEMENT

The central component of the Sun VDI is the Sun VDI Core. The VDI Core provides all the functionality needed to build and manage large scale virtual machine deployments. In addition to its management capabilities, the VDI Core is also responsible for the brokering of virtual desktops on behalf of desktop access clients.

DESKTOP ACCESS

Three distinct mechanisms are supported for access to virtual desktops.

Sun Ray DTU or Sun Desktop Access Client - Users can access their virtual desktops through a Sun Ray Desktop Unit (DTU) or through Sun Desktop Access Client software by authenticating themselves with a user name and password, or a token card can be inserted in a Sun Ray DTU instead of providing a user name. Successful authentication initiates a custom Sun Ray Software Kiosk Session. The custom Kiosk Session uses the Sun VDI Core to request access to a virtual desktop on behalf of the user. Once a virtual desktop has been assigned to the user, a Remote Desktop Protocol (RDP) connection to the desktop is established for the session using the Sun Ray Windows Connector.

Secure Web Access with SGD - In this case, the browser is used to initiate a Sun Secure Global Desktop Software (SGD) session. SGD, in turn, uses the VDI Core's RDP redirection capability to establish a connection to an assigned virtual desktop.

RDP Client Access - (RDP redirection must be supported on the client side to use this mechanism). As with the previous case, the VDI Core's redirection capability is used to establish a connection to an assigned virtual desktop.

5.7 VMWARE VIEW

INTRODUCTION

VMware was founded in 1998 and in the early years focused on providing a platform to run Windows or Linux-based machine virtually. In 1999 this resulted in VMware Workstation. After the launch of ESX in 2001, VMware has made a name in server virtualization and quickly became the market leader in this segment.

In early 2008 VMware entered the VDI-market with the launch of VMware VDM 2.0. VMware VDM gave users a central hosted desktop. The name of VDM evolved in a new product suite: VMware View.

In 2009 VMware partnered with Teradici – they did this in order to make a change in the Remote Display capacity that resulted in a major enhacement to the user experience.Teradici has developed a hardware based remote presentation protocol called PCoIP. VMware, based on this protocol, developed a software version that comes with VMware View 4.

ARCHITECTURE

To implement VMware View a less complex architecture is required. Apart from the Virtual Infrastructure (VMware only!), you only need the View Manager to be up and running. To use the linked-clones technology, the VMware View composer has to be installed on the VMware vCenter server. With this feature it is possible to use one (snapshot of) a golden image to deploy virtual desktop VMs and save diskspace because the VMs uses the same golden image and an additional delta-file for changes.

The protocols used with VMware View 4 are RDP and PCoIP. Under certain conditions the protocols SUN ALP and HP RGS can also be used. PCoIP as now provided by VMware is not "proven technology" and still lacks a number of features that are available with RDP.

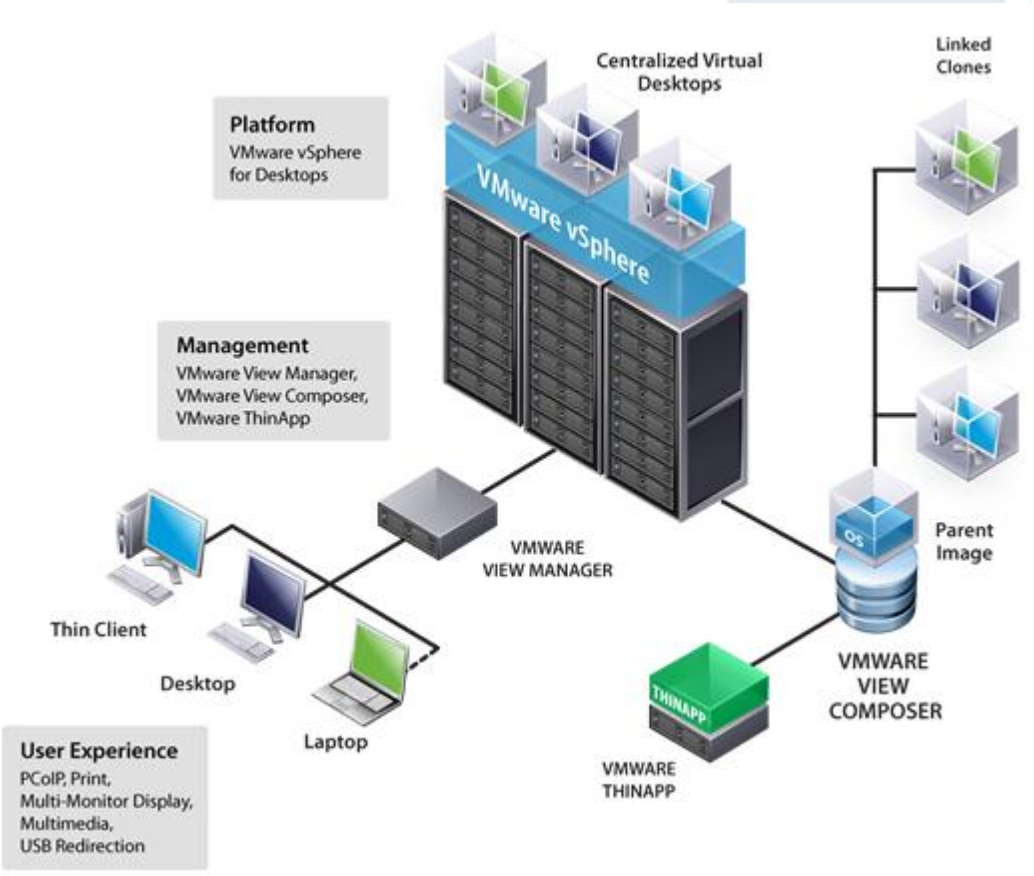


Figure 9, VMware VDI solution

LICENSING

VMware View comes in 2 flavors: View Enterprise and View Premier. The View Premier license includes View Composer (Linked-clones, single disk image provisioning) and ThinApp (application virtualization). You can also decide to purchase VMware View with licenses for vSphere and vCenter, but you are only allowed to run desktop VM's with those licenses.

5.8 ROADMAP

This document is 'just' a starting point in the VDI Smackdown space. Our aim is to add other server-hosted desktop virtualization solutions to the feature compare matrix when time is right. Extending the scope to client-side desktop virtualization solutions is part of the roadmap as well, so stay tuned!

6. VDI FEATURES COMPARISON

It's important to understand the comparing features are the last step in the decision tree. Vision, Strategy and Technology are the former steps. Each desktop virtualization product has its own functionality and feature-set. This chapter describes the features in a very detailed way. We did our best to be truthful and accurate in investigating and writing-down the different features. When you see improvements please let us know.

This matrix is developed with the following virtualization products and versions:

6.1 PRODUCT VERSION

Product	Version	Release date
Citrix XenDesktop	4.0 FP1	April 2010
Microsoft VDI/RDS	2008 R2	October 2009
Quest vWorkspace	7.1	April 2010
VMware View	4.0.1	February 2010

Legenda:

√ = Applicable; **X** = Not applicable; ~= It depends; # = Under investigation

RDP =Only supported with RDP;

PCoIP =Only supported with Software implementation of PCoverIP;

6.2 FEATURE COMPARISON MATRIX

Category	Citrix XenDesktop	Microsoft VDI	Quest vWorkspace	VMware View	Remarks
User Experience					
Connect Client Drives at logon	√	√	√	RDP	
Connect Client Printers at logon	√	√	√	√	
Connect Client COM ports at logon	√	√	√	√	
Microphone support	√	√	√	√	
Speaker support	√	√	√	√	
VoIP; Bi-directional audio LAN (11kbps each way)	√	~	~	X	~ Win7 or 2008 R2
VoIP; Bi-directional audio WAN; (11kbps each way) latency reduction and bandwidth compression	√	X	~	X	~ Win7 or 2008 R2
USB device support; USB hub – Full USB	√	X	√	X	
USB device support; USB 2.0 isochronous	√	X	√	X	
USB Camera (Mass Storage Device)	√	√	√	X	
Clipboard re-direction; text	√	√	√	√	
Clipboard re-direction; files-folders	√	√	√	X	
Twain (scanner) device support	√	X	X	√	
Client-to-server Folder redirection	√	X	√	X	
Client time zone redirection	√	X	√	X	
Regional settings redirection	√	X	X	√	
Webcam support (LAN)	√	X	√	X	
Webcam support (WAN); latency reduction and bandwidth compression	~	X	X	X	
Audio codec - System sounds (22Kbps)	√	√	√	√	
Audio codec - Optimized for Speech (34kbps)	√	√	√	√	
Audio codec - HQ audio (192Kbps)	√	√	√	√	
Adobe Flash support; server-side rendered	√	√	√	PCoIP	
Adobe Flash support; client-side rendering	√	X	√	RDP	RDP with Wyse TCX additions
Server-side content/flash fetching	√	√	√	√	
Client-side content/flash fetching	√	X	X	X	
Microsoft Silverlight; server-side rendered	√	√	√	PCoIP	
Microsoft Silverlight; client-side rendering	X	X	X	X	
Multimedia (A/V) redirection; server-side rendering	√	√	√	PCoIP	
Multimedia (A/V) redirection; client-side rendering	√	√	√	RDP	RDP with Wyse TCX additions
2D/3D Progressive Display	√	√	√	PCoIP	
Network latency masking / reduction. Local text echo	√	X	√	X	
Connect network printers with vDesktop policies	√	~	√	#	
ClearType fonts support	√	√	√	√	
Aero support (Win7)	~	√	√	X	~ (Blade) PC
3D OpenGL support	~	X	X	X	~ (Blade) PC
3D DirectX support	~	X	X	X	~ (Blade) PC
GPU compression for Remote Desktop protocol	~	X	X	X	~ (Blade) PC, nVidia CUDA (96+ cores)
16-bit color support	√	√	√	√	
24-bit color support	√	√	√	√	
32-bit color support	√	√	√	√	
Multi-monitor support - Spanning	√	√	√	√	
Multi-monitor support - Pivoting	√	X	√	RDP	
Multi-monitor support ≤2	√	√	√	PCoIP	

Category	Citrix XenDesktop	Microsoft VDI	Quest vWorkspace	VMware View	Remarks
Multi-monitor support ≤4	√	~	√	PCoIP	~ Win7 or 2008 R2
Multi-monitor support >4	√	~	√	X	~ Win7 or 2008 R2
Full-HD support (1920x1200) per monitor	√	√	√	√	
Maximum resolution ≤ 4096 x 2048	√	√	√	RDP	
2560*1600	√	√	√	√	
1920*1200	√	√	√	√	
1680*1050	√	√	√	√	
<1400*900	√	√	√	√	
Language bar docking	√	~	√	√	~ Win7 or 2008 R2
Auto-resize user desktop	√	X	√	PCoIP	
Dynamically adjust client printer configuration	√	X	√	X	
Dynamically adjust network printer configuration	√	X	√	X	
Dynamically adjusts client monitor configuration	√	X	√	X	
Session reconnection from new and current clients	√	√	√	√	
Unified Communications (Microsoft OCS) support A/V in LAN	√	X	X	X	
Unified Communications (Microsoft OCS) support A/V in WAN; latency reduction and bandwidth compression	√	X	X	X	
Unified Communication (Microsoft OCS) A/V rendered on end-point	~	X	X	X	
Toolbar; connect/disconnect client devices	√	√	√	√	
Toolbar; determine client-side file access	√	X	X	X	
Fast session connect and reconnect; session pre-launch	X	X	X	X	
Local applications integrated in vDesktop	X	X	X	X	
User Installed Applications integrated in VDI	X	X	X	X	
Optimized for bandwidth restricted environments (<256 Kbps) and - high latency connections (>150 ms)	√	X	√	X	
Single Sign-on from Windows endpoint to vDesktop	√	X	√	√	
Supported Remote Display Protocols					
Microsoft RDP 6.1	√	√	√	√	
Microsoft RDP 7.0	√	√	√	X	
Microsoft RDP 7.1 (RemoteFX)	X	X	X	X	Microsoft RemoteFX is announced but not released yet
Citrix ICA/HDX	√	X	X	X	
VMware / Teradici PCoIP	X	X	X	√	
HP RGS	X	X	√	√	
VNC	X	X	X	X	
SUN ALP	X	X	X	√	
RAdmin	X	X	X	X	
NX	X	X	X	X	
Quest EOP	X	X	√	X	
Management					
User Profile Management	√	X	√	X	not suitable or not included in suite
Bandwidth/resource management: printing	√	X	√	√	
Bandwidth/resource management: client drives	√	X	X	X	
Bandwidth/resource management: USB	√	X	√	X	

Category	Citrix XenDesktop	Microsoft VDI	Quest vWorkspace	VMware View	Remarks
Bandwidth/resource management: Audio	√	X	√	X	
Bandwidth/resource management: Video	X	X	X	X	
Bandwidth/resource management: Adobe Flash	X	X	X	X	
Universal print driver; client connected printers	√	~	√	√	
Universal print driver; server side / network printers	X	X	X	X	
Universal printer driver: EMF support	√	√	√	√	
Manage client drive redirection	√	√	√	√	
Manage client USB redirection	√	X	√	X	
Remote session control; session shadowing	X	X	√	X	No Windows Remote Assistant
Bandwidth Protocol Management	√	X	X	X	Limit bandwidth procotol per session/ channel
Adobe Flash Quality; configure through policy	X	X	X	√	
Support low bandwidth/high latency WAN connections	√	~	√	RDP	WAN = 50kbps/150ms
Supports WAN acceleration devices	√	√	√	RDP	
Additional instrumentation (end-to-end monitoring) for vDesktop	√	X	X	X	Not available or not in suite yet
Security and Networking					
Integrates (SSO) with Citrix Access Gateway Enterprise	√	X	X	X	SSO = Single Sign On
Integrates (SSO) with Cisco ASA	√	X	√	X	
Integrates (SSO) with Juniper SSL-VPN	√	X	√	√	
Integrates (SSO) with Microsoft IAG/UAG	√	√	#	X	
Two-factor authentication - RSA Secure ID	√	√	√	√	
Two-factor authentication - SMS passcode support	√	X	#	X	
Two-factor authentication - Full Radius / IAS support	√	√	√	X	
SSL Tunneling through Security Server	√	√	√	√	
Client device location awareness	√	X	√	√	
Smartcard pass-through support	√	X	√	~	
Smartcard logon support	√	√	√	RDP	Windows endpoints only
Local credentials pass-through	√	√	√	√	
Remoting Protocol network traffic shaping	√	√	√	RDP	
Remoting Protocol network QoS	√	√	√	RDP	
Dynamic traffic prioritization	√	X	X	X	
Client traffic is secured	√	√	√	√	
Management traffic is secured	√	√	~	√	
Auditing and security logging of admin actions	X	X	X	X	
VDI Desktop Assignment					
Integrated with AD	√	√	√	√	
Multi-AD support	X	X	X	√	
Multi-AD support; same forest and 2-way trust	√	√	√	√	
Based on AD group	√	√	√	√	
Based on AD user	√	√	√	√	
Based on AD OU	√	X	√	X	
Based on Device Name	X	X	√	X	
Based on Device Address	X	X	√	X	
Restrict access based on time/location/device	√	X	√	X	
Restrict functionality based on time/location/device	√	X	√	X	
OpenLDAP support	X	X	X	X	

Category	Citrix XenDesktop	Microsoft VDI	Quest vWorkspace	VMware View	Remarks
Novell eDirectory support	X	X	X	X	
Desktop Provisioning					
Support disconnected/offline virtual desktops	X	X	X	X	Offline support as core offering in VDI
Imaging delivery through LAN	√	X	X	X	
Imaging delivery through SAN	√	√	√	√	
Statefull; assigned/private images	√	√	√	√	
Stateless; pooled/standard images	√	√	√	√	
vDisk write cache can be stored on SMB share	√	X	X	X	
vDisk write cache can be stored in memory	√	X	X	X	
Automatic creation of desktops	√	X	√	√	
Manual creation of desktops	√	√	√	√	
Provision desktops across hypervisor multiple resource pools	√	X	√	√	
Provision Desktops across multiple data stores	√	X	√	√	
Single disk image build-in	√	X	√	√	
Single disk image 3rd party	√	X	√	√	
Physical desktops / Blade PCs	√	X	√	√	
Guest (VM) Operating System support					
Microsoft Windows 7 32-bit	√	√	√	X	
Microsoft Windows 7 64-bit	√	√	√	X	
Microsoft Windows Vista 32-bit	√	√	√	√	
Microsoft Windows Vista 64-bit	√	√	√	√	
Microsoft Windows XP Professional 32-bit	√	√	√	√	
MS Windows 95 / 98	X	X	X	X	
MAC OS X	X	X	X	X	
Linux	X	X	X	X	
Client (endpoint) Operating System					
Microsoft Windows 7 Professional	√	√	√	~	
Microsoft Windows Vista Professional	√	√	√	√	
Microsoft Windows XP Professional	√	√	√	√	
Microsoft Windows 2000 Professional	√	~	√	√	~ RDC Client v7 not available
Microsoft Windows Server 2003R2	√	√	√	X	
Microsoft Windows Server 2008	√	√	√	X	
Microsoft Windows Server 2008 R2	√	√	√	X	
Windows 9x	√	~	X	X	~ RDC Client v7 not available
Windows XPe	√	√	√	√	
Windows CE	√	~	√	√	~ RDC Client v7 not available
Windows Embedded Standard 7	√	√	√	√	
MAC OS X	√	~	√	RDP	RDC Client v7 not available
Any OS running Java*	√	X	√	X	*) limited Remote Protocol functionality
Unix flavors	√	X	X	X	
Linux flavors	√	X	√	RDP	RDC Client v7 not available
IBM OS/2	X	X	X	X	
EPOC / Symbian	√	X	X	X	
Wyse Thin OS (WTOS)	√	~	X	~	

Category	Citrix XenDesktop	Microsoft VDI	Quest vWorkspace	VMware View	Remarks
Wyse Zenith zero client	√	X	X	X	
Apple iPhone / iPad OS 3.X	√	X	X	~	~ 3rd party client; Wyse Pocket Cloud
Internet Browser support for web based access to vDesktop					
Internet Explorer 6.x	√	√	√	RDP	
Internet Explorer 7.x	√	√	√	RDP	
Internet Explorer 8.x	√	√	√	X	
Mozilla FireFox 2.x	√	X	√	X	
Mozilla FireFox 3.x	√	X	√	X	
Opera v9	√	X	√	X	
Safari v4	√	X	√	X	
Safari v5	√	X	√	X	
Google Chrome	√	X	√	X	
Java client	√	X	√	√	
Supported Protocols for all VDI related components					
TCP/IP v4	√	√	√	√	
TCP/IP v6	X	√	X	√	
Virtual Infrastructure (Hypervisor) support					
Citrix XenServer 5.x	√	X	X	X	
VMware VI 3.5	√	X	√	X	
VMware vSphere 4.0	√	X	√	√	
Microsoft Hyper-V	√	X	√	X	
Microsoft Hyper-V R2	√	√	√	X	
Virtual Iron	X	X	X	X	
Parallels Virtuozzo	X	X	√	X	
Oracle VM	X	X	X	X	
Integration with 3rd party storage Provisioning features	#	#	#	#	
Integration with server virtualization storage-provisioning features	#	#	#	#	
vDesktop Cluster is limited to <amount>of hosts	--	--	8	--	
Virtual Infrastructure Integrated (snapshot, create, delete) Management					
Citrix XenCenter	√	X	X	X	
Microsoft SCVMM 2008	√	X	√	X	
VMware Virtual Center	√	X	√	√	
Virtual Iron	X	X	X	X	
Parallels Virtuozzo	X	X	√	X	
Oracle VM	X	X	X	X	
Connection Broker / Service					
Integrated Load balancing	√	X	√	X	
High Availability by design	√	√	√	X	
Centralized management console	√	√	√	√	
Web-based management interface	X	X	X	√	
Microsoft Management Console Interface	√	√	√	X	
Delegation of control	√	X	√	X	
Console supports multiple concurrent administrators	√	√	√	√	

Category	Citrix XenDesktop	Microsoft VDI	Quest vWorkspace	VMware View	Remarks
Single management console supports 5K vDesktops	X	X	X	X	
VM pool management	√	√	√	√	
VM power management	√	~	√	X	
Virtual machine power policy	√	X	√	√	Power Policy when VM are not in use
User session management	√	X	√	√	
User session disconnect policy; Do nothing/logoff/shutdown	√	X	√	√	
Allow users to reset their desktop	√	X	X	√	
Multiple active sessions per user	√	~	√	√	
Server instance support 1.000 concurrent connections	√	√	√	√	
Server instance support 2.000 concurrent connections	√	√	√	√	
Server instance support 5.000 concurrent connections	X	X	X	X	
Provides a Web-based connection interface	√	√	√	√	
Scripting support and command-line interface	√	√	~	X	
Provides a Windows based connection interface	√	√	√	√	
Provides an Apple Mac OS X supported connection interface	√	X	√	X	
Single interface for accessing VDI, RDS/TS	√	√	√	√	
Single interface for accessing VDI, RDS/TS and PC	√	X	√	√	
Web interface is customizable through GUI	√	X	X	X	
Terminal Server 2003 integration	√	√	√	√	
Remote Desktop Services Host 2008 integration	√	√	√	X	
Remote Desktop Services Host 2008 R2 integration	√	√	√	X	
Citrix XenApp 5/6 integration	√	X	X	X	
No single point of failure by design without additions	√	√	√	X	
Integration with Systems management solutions	#	#	#	#	
Integration with Client/Device management solutions	#	#	#	#	
Includes client endpoint search capabilities	~	X	X	X	
Support for (wildcard) searching across management console	X	X	X	X	
Scales performance horizontally via complementary application delivery platform	√	√	√	X	
Customizable Management Console ; change/add/move columns, change view layout	#	#	#	#	
Connection Broker / Service OS support					
Microsoft Windows Server 2000	X	X	X	X	
Microsoft Windows Server 2003 R2	√	X	√	√	
Microsoft Windows Server 2003 R2-64-bit	√	X	√	X	
Microsoft Windows Server 2008	X	X	√	X	
Microsoft Windows Server 2008 64-bit	X	X	√	X	
Microsoft Windows Server 2008 R2 64-bit	X	√	√	X	
Virtual (Linux) appliance	X	X	X	X	
Datastore / database OS support					
Microsoft SQL Server 2005 Express Edition	√	√	√	√	
Microsoft SQL Server 2005	√	√	√	√	
Microsoft SQL Server 2008	√	√	√	√	

Category	Citrix XenDesktop	Microsoft VDI	Quest vWorkspace	VMware View	Remarks
Microsoft Access	√	X	X	X	
Oracle Enterprise 10.2	√	X	#	#	
Support and Community					
Certification prog. for 3rd-party VDI software vendors	√	√	X	√	
Certification prog. for thin-client vendors; "Ready"	√	X	X	√	
Public community forum	√	√	√	√	
Official training classes available	√	√	√	√	
Official Certification program, VUE or Prometric	√	√	X	X	
VDI technology stack is proven, the solution is being used for 1+ year in enterprise production environments. 10K+ endpoint, various deployment scenarios	X	X	X	X	
10+ of public available enterprise (10K CCU) references in Europe using VDI technology stack	X	X	X	X	
10+ of public available enterprise (10K CCU) references in US using VDI technology stack	X	X	X	X	
Licenses					
No external license server required	X	√	√	√	
First year support and maintenance included in license	√	#	#	#	
Concurrent user/desktop licenses	~	X	√	√	~ only the VDI version
Per device licenses	√	√	X	X	
Per named user licenses	√	X	√	X	
Grace period	√	√	X	X	
Offline mode	X	X	X	X	
Free for personal usage (FFPU)	~	X	X	X	10 users Express Edition

7. CONCLUSION

Which Virtual Desktop Infrastructure (VDI) Solution is THE best?!; Without a better understanding of the requirements in general it's impossible to give an accurate and profound answer in THE question. In essence it depends on various areas as mentioned in paragraph 4.4 'VDI Strategy'. It's important to have a **Vision** and **Strategy** around Application and Desktop Delivery. Designing, building, managing and maintaining the vDesktop infrastructure using the right **Technologies**, corresponding vendors and products is an important step. "This whitepaper is a useful resource in this journey!"

Keep in mind: *"VDI fits for every customer but not for every desktop"*

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