Application Virtualization Smackdown



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REVIEWERS

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1. INTRODUCTION

Are you looking for an independent overview of the Application Streaming and Virtualization solutions and curious about the different features- and functions each Application 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 Application Virtualization solutions. This white paper is focused on solutions that are anticipated to have an important role in Application Virtualization 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 to share information about:

- Application- and Desktop Delivery Solutions overview;
- Explain the pros and cons of Application Virtualization;
- Describe the different Application Virtualization vendors and solutions;

1.2 INTENDED AUDIENCE

This document is intended for IT Managers, Architects, Analysts, System Administrators and IT-Pros in general who are responsible for and/or interested in designing, implementing and maintaining Application Virtualization Infrastructures.

1.3 VENDOR INVOLVEMENT

All major vendors whose products are covered in the feature comparison, such as Citrix, InstallFree, Microsoft, Symantec 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 an e-mail to Ruben Spruijt (rsp@pqr.nl). Include the product name and version number, and the title of the document in your message.

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2. ABOUT

2.1 ABOUT PQR

PQR is THE specialist for professional ICT infrastructures with a focus on server & storage, virtualization and application & desktop delivery.

PQR stands for simplicity, freedom and professionalism. We provide our clients with innovative ICT solutions that ensure that application availability and manageability are optimal. We have demonstrable references and a wide range of expertise in the field, as witnessed by our many high partner statuses and certifications.

As a Trusted Advisor we inform our clients about new technologies that keep their ICT environments running even easier, creating optimal performance and information accessibility from any location or device. This not only applies to system administrators but also to users. By using application and desktop virtualization, for example, users experience the ease and speed of accessing applications and the associated data that they need. We therefore offer our clients an ICT environment that is manageable and well-organized and, above all, entails significant cost decreases, not only in management but also in energy consumption. In addition, these solutions contribute to a remarkable reduction of CO2 emissions. In this way PQR provides medium and enterprise companies and institutions with an ICT infrastructure that is stable, flexible and ready for the future.

PQR also has extensive experience in designing and implementing storage environments. Large storage environments have been our specialty for quite some time, and this ensures that we work efficiently. Our approach is clear for all processes. We begin with an inventory of needs and a preliminary examination. We carefully map out what is required in terms of functionality - naturally, taking future plans into consideration - and we give advice regarding necessary and feasible changes. During the entire project, from design to implementation, PQR takes responsibility for on-time delivery of (sub-)projects and for the end result. We usually do this fixed price with the associated guarantees. We call this 'simplicity in ICT'. And that is the PQR approach that delivers success - and has been doing so since the company's founding in 1990.

PQR is headquartered in De Meern, The Netherlands, and counts over 100 employees. In fiscal year 2008/2009 the company posted sales of € 84.6 million and a net after tax profit of € 4.2 million. PQR's clients can be found in all sectors of society. A significant part of our sales is realized in non-profit organizations, the health care industry, education and local and federal government. www.pqr.com

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:

A-Team, only through the effort and persistence of the 'Application Virtualization Smackdown' team we achieved the goals, a big thanks to them!

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Special thanks

With a solid base as an infrastructure consultant in the Netherlands, **Jurjen van Leeuwen** moved to Norway and started as a freelance consultant. With his company Leodesk.com, Jurjen continues to practice his enthusiasm for products in the application and desktop delivery area with a strong focus on Application Virtualization solutions from multiple vendors. Besides his work on the Application Virtualization Feature Overview and Compare Matrix, Jurjen also is active in the community as a moderator on AppVirtGuru.com. Contact Jurjen by email at Jurjen@leodesk.no

Personal note from Ruben: I would give a special thanks to **Jurjen van Leeuwen** and **Sven Huisman** who simply did an incredible job in investigating and reviewing various solutions. The amount of effort and private time spend is extraordinary… Thanks!

Community effort

A **BIG** thanks to the Application Virtualization community members, especially:
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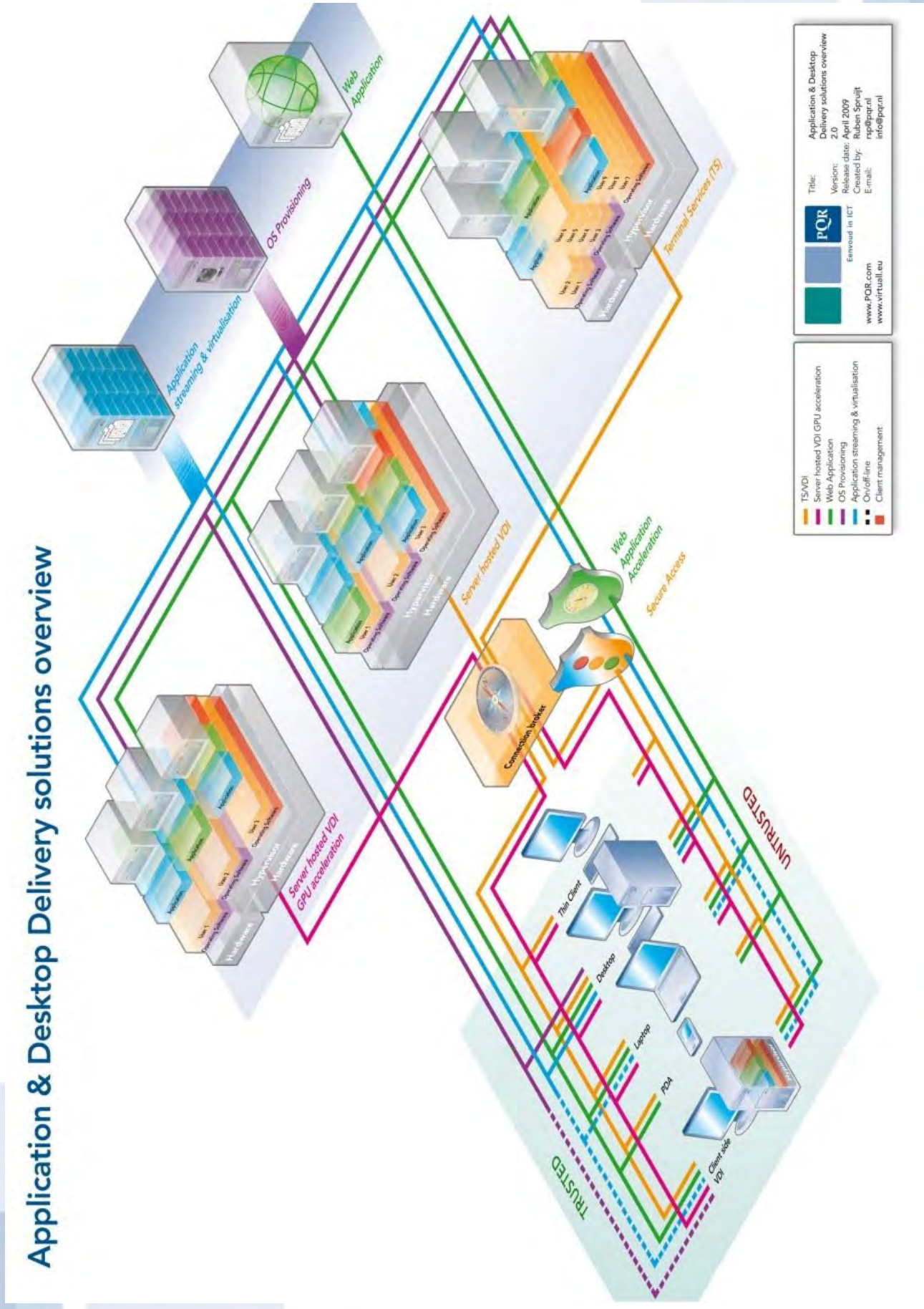
Suggestions and improvements

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 Application Virtualization 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.


Application & Desktop Delivery solutions overview
Web Application
OS Provisioning
Application streaming & virtualisation
Terminal Services (TS)
Server hosted VDI
Server hosted VDI GPU acceleration
Web Application Acceleration
Secure Access
Connection broker
Thin Client
Desktop
Laptop
PDA
Client side VDI
TRUSTED
UNTRUSTED
Title: Application & Desktop Delivery solutions overview 2.0
Version:
Release date: April 2009
Created by: Ruben Spruijt
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Eenvoud in ICT
www.PQR.com
www.virtuall.eu
TS/VDI
Server hosted VDI GPU acceleration
Web Application
OS Provisioning
Application streaming & virtualisation
On/off-line
Client management

3.2 Trusted and untrusted Work Place Scenarios

Trusted work places are devices that are connected to the existing IT backend infrastructure via a secure 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 Forefront Unified Access (UAG), 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, Facebook and eBay all use them. Web application acceleration solutions are not just useful for large organizations; You could also use them for your own web applications.
Solutions that facilitate web application acceleration and security include products such as Citrix Netscaler and F5 Networks Big IP.

3.5 Connection Broker

The connection broker determines which server-hosted remote desktop will be made available to the user. 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 or RDS (former Terminal Services - TS). Depending on the rules, it is possible to execute applications centrally on a server-hosted Virtual Desktop Infrastructure (VDI) or on a Remote Desktop 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 locally 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 alter the platform. In the occasion where a client component, as part of the Application Virtualization Solution, needs to be installed this is the only altering to the Operating System.
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 and an optimized Desktop.

Application Virtualization solutions include: Altiris/Symantec Workspace Virtualization, Endeavors Application Jukebox, Citrix Application Streaming, InstallFree Bridge, Microsoft App-V, VMware ThinApp and Spoon.

3.7 OS PROVISIONING

OS Provisioning allows workstations to boot up and run from a central image located on a shared resource. 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 provisioning, (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, DoubleTake Flex, 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 systems hardware- and endpoint 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 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, Oracle/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, Microsoft RemoteFX, Teradici and HP RGS 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 known 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 top 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. Depending on the desktop and application delivery infrastructure implementation that is chosen, not all features of these Client Management solution are always necessary.

Examples of client management systems are: Altiris Deployment Solution, BMC Bladelogic, HP Configuration Manager, IBM/BigFix, LANdesk Client Management, Microsoft System Center Configuration Manager (SCCM), Novell ZENworks Configuration Management and RES Wisdom.

4. APPLICATION VIRTUALIZATION

4.1 APPLICATION AND DESKTOP DELIVERY

The dynamic delivery of applications is an essential functionality and part of a broader strategy of an optimized Desktop. Making applications available to the end user, so-called Application- and Desktop Delivery, is probably the most important functionality of an ICT infrastructure.

Application and Desktop Delivery is a process which has the goal of offering applications independent of location and workstation, so that the user can work onsite, online, offsite and offline anywhere and at any time. When studying and determining which solution best suits the users and your organization, it is essential that you ask yourself two questions:

1. What is the **execution** platform for the applications?

   Within the execution platform, system resources such as the CPU, memory, disc and network are used in order to execute the Windows and web-architected applications. The most frequently used execution platforms include the following: Desktop, Laptop, Mobile Smartphone, Virtual Desktop Infrastructure and Remote Desktop Services. The choice of execution platform is the most fundamental decision made! The applications are executed locally on the device or centrally in a datacenter. Every implementing platform has its own characteristics. In practice, every organization actually possesses a mixture of workstation access scenarios. The theories: "Less is more" and "Cut out the exceptions" and "Manage Diversity" should always be in mind!

2. In what way are **applications** delivered and **available** on the execution platform?

   An execution platform is great, especially with Windows 7, but if there are no applications available on this platform, this platform is of no real value to the end-user. The second question is this: How do the applications (which are critical for the company) get onto the implementation platform?! A number of solutions exist for making Windows applications available on the implementation platform. The forms that are most frequently used include installation or virtualization.

   With installation, applications are automatically installed on the workstation and, where possible, installed in an unattended manner. The execution platform is altered after the installation process is finished. Installing the application as core component in the base image is also one of the possibilities available.

   When applications are made available by means of Application Virtualization, they are available 'on demand' on the execution platform. No adjustments are made to the platform within the scope of this.

4.2 VIRTUALIZATION

vir·tu·al·i·za·tion is the act of isolating or unbinding one computing resource from others. Or otherwise virtualization is the process of decoupling layers of IT functions so that configurations of the layers become more independent of each other. As a result, virtualization masks the specific nature of IT resources from their users. A user sees the function not the resource that delivers the function. Application Virtualization is an essential and critical component for all desktop delivery solutions. The name 'Application Streaming and Virtualization' is often used by customers and IT-Pros, although it's rarely understood fully in it details. To get a perception on its true meaning, it's best to break down the term.. *Application, Streaming and Virtualization*.

Application is the end-user focused **Windows**- and **web** programs executed on a Windows Operating System Platform;

Streaming is the process of **transporting** the application specific data/content as quickly as possible to the end-point. The application is Quick-up-and-running where ultimately the required resources to run and use the application is being delivered to the user.

Virtualization is a software layer that improves portability, manageability and compatibility of applications by **encapsulating** them from the underlying operating system on which they are executed. A virtualized application is not installed in the traditional sense, although it is still executed and behaves as if it were. Virtualization isn't Emulation.

4.3 WHY APPLICATION VIRTUALIZATION?

In conversations with customers and during workshop sessions we regularly receive the question, "What is the difference between application deployment and delivery and why virtualization". With application deployment, the applications are installed on the execution platform. The execution platform could be a local desktop or laptop, a central virtual desktop, a bladed Workstation or a Remote Desktop Server. When speaking of application delivery in the context of application virtualization, the applications are no longer installed, but they are made almost instantly available and executed on the execution platform. The execution platform does not undertake any alterations. So Application Virtualization enables fast application delivery in a central and local environment whereby mutual application conflicts are eliminated. This considerably reduces the amount of time for application packaging and delivery compared to the traditional deployment methods. What are the primary reasons for implementing application virtualization?

- There is no need to install applications anymore;
- Therefore, in essence, no application conflicts will occur;
- This will reduce regression testing time;
- Multiple versions of same application can be used simultaneously on multiple versions of Windows Operating System, greatly reducing the number of packages.
- It allows non-multiuser versions to run simultaneously;
- There is no need for Application Load Managed Groups, or so called 'silos'. Consolidate Remote Desktop Services;
- Applications are Quick and easy delivered;
- It is simple and easy to deliver application upgrades;
- The rollback to prior application versions is simple;
- It reduces packaging complexity;
- It stabilizes Windows user profiles;
- Application Virtualization is an essential part in 'layering the cake ' OS / Applications / User Configuration;
- It's a key component is the complete Application- and Desktop Delivery stack
- Application Virtualization creates dynamic user environments in a static Server Hosted VDI and RDS environment.

- Improves end-user mobility – access personalized applications from any machine.

4.4 STRATEGY

The growing reality of the transition to a dynamic and optimized desktop is causing many IT organizations to reevaluate traditional IT operations, deployment, delivery, packaging, support, and management methods. Application Virtualization is a key component in the Optimized Desktop. It's important to have a **Vision** and **Strategy** around Application and Desktop Delivery. Designing, building, managing and maintaining the Application Virtualization 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.

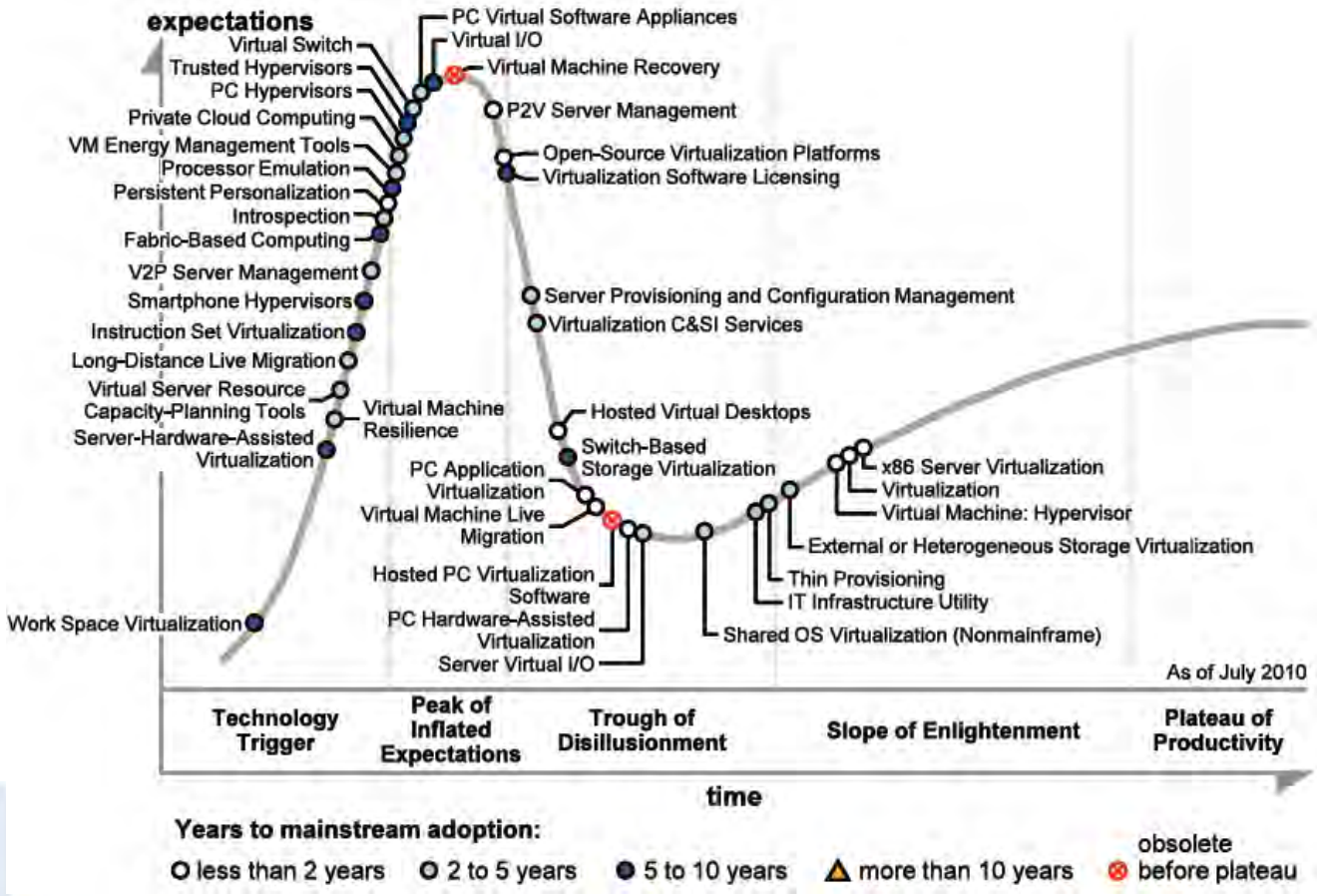
The following *discussions* and corresponding *topics* should be part of the Application Virtualization and Optimized Desktop strategy:

- What do you want to **achieve,** A **business enabler**, overall cost of ownership (**TCO**) and **cost reducer**?
- What are the **use-cases**? And does the use-case require Application Virtualization?
- What is the **business-case?**
- Are you investigating a **tactical** (point)-or **strategic solution**? What do you want to solve?
- What's your Desktop delivery and **migration** strategy for **Windows 7**?
- What **endpoints** do you support- and facilitate and what is the role of these devices in the optimized desktop?
- Are the **endpoints managed**?
- What is the strategy around **Client Management**, PC life Cycle Management, solution and how does Application Virtualization fit?
- Is a Bring Your Own Computer (**BYOC**) concept one of the key **Access Scenarios**?
- What is your application delivery model? Is delivery of applications focused on **SaaS**, **Enterprise**, **SMB** or the **Consumer** space?
- Are **billing**, license-management, reporting and/or **charge-back** of the delivered applications needed?
- Is a client- or **agentless** Application Virtualization solution required?
- Do you need to **integrate** and/or **isolate** your **applications** from each other or from the OS? Do you need both functionalities and how do you **manage** the application integration?
- What is the expected **packaging success ratio** of Virtualizing applications? How do you handle the 'exception' applications which can't be virtualized?
- Is the strategy '**Package once runs everywhere'** important? What are your expectations?
- How do you design and build the **user**'s **profile** and his '**workspace'**? Does Application Virtualization fit into this strategy?
- **Licensing** of the Application Virtualization solution. Stand-alone, part of a license stack? Is Microsoft Software Assurance or other subscription form needed?
- What is the (business) applications **vendor support** policy for virtualized applications?
- How do you handle **Application Compatibility** issues such as **IE6** and Java components while migrating to Windows 7?

- What is your Application **Readiness Assessment** strategy? Are Windows 7, VDI, Application Virtualization and x64 included?
- Is an **open, standardized** and **extendable** application package **format** key?
- Does the Application Virtualization solution need to be **proven** and **mature**? What is your definition of proven?
- Do you need to **convert** current **application packages** to the new virtual application package?
- What's your **overall Desktop Delivery strategy** model with solutions such as Laptop (Offline), Desktop (Online), VDI and Remote Desktop Services? How can Application Virtualization enhance these solutions?
- Does the Application Virtualization solution offer **shared-cache** or **cache-less** functionality? What is the use-case?
- **Bottom Line: What's your current Desktop strategy?!**

4.5 FROM NICHE TO MATURE

Over the past years Application Virtualization has out-grown the niche market and has become a mature solution for application delivery. Over the past years customers, from small to large enterprises see the benefits of Application Virtualization and has become an accepted form of application delivery, particularly when traditional methods fail to achieve their expected benefits.



Source: Gartner Hype Cycle for Virtualization 2010: http://bit.ly/dnEfJN

4.6 WHAT'S IN A NAME?

It seems that almost every vendor has a different name for the same technology. Is the technology really the same, is the functionality different?

In the haze of messaging and marketing around Application Virtualization, different names can blur the Application Virtualization arena; therefore it's good to have definitions of **streaming**, **virtualization**, **isolation**, **integration** and **re-direction**. The name '**client'** or '**end-point'** can be a Desktop, Laptop, Virtual Desktop, Terminal Server or Remote Desktop Server.

Managing expectations is always hard; a good starting point is to make sure everyone speaks the same (IT) language. It is important to note that not all vendor implementations support all aspects of the definitions provided below. For specific capabilities offered by specific vendors please refer to section 8.

4.6.1 Streaming

The delivery process of **transporting** the **application** specific data/resources to the end-point at the time the application is executed is called **streaming**. The application is quick-up-and-running and only the minimum amount of data (commonly between 10-30% of the total application) is delivered to a client before the application is launched. Not only does this result in a quicker first time launch for the user, it also results in significantly reduced load on the network (compared with full application distribution pre-caching) and makes it possible to keep end-user images "stateless". Additional features of an application are delivered on demand, or 'in the background' without user intervention. Application packages are stored on a (centralized) server, which can be a dedicated or shared infrastructure component. The **streaming protocol** transports the data over the **network** in an optimized, efficient and secure way.

Streaming can operate at a file-level (whole files are copied when they are needed) or block-level (file chunks are copied when they are needed) and cache resources locally on the endpoint for offline execution or faster subsequent startups. Streaming is particularly effective in well-connected environments where applications should be executed on-demand from a network resource and end-user images should be kept stateless – e.g. VDI and RDS/TS.

4.6.2 Virtualization

The process where applications are **encapsulated** or **isolated** from other applications and the underlying Windows Operating System on which they are executed is called Virtualization. This improves portability, manageability and compatibility and reduce conflicts of Windows 'end-user' applications. Virtualized applications run in their own discrete, or **virtual**, **environments**.

Application Virtualization requires a virtualization **layer** that replaces part of the runtime environment normally provided by the operating system. The layer intercepts all function calls to the Windows Operating System such as File, Registry and objects such as COM and DCOM. The application is executed inside the Virtual Environment, (sometimes called **bubble** or **sandbox**) and behaves as if it is running alone in the Operating System. So the underlying Operating System is protected, since the Application Virtualization prevents changes to System Components. Applications can use the hardware- and software components that are installed and available inside the Operating System. While most application virtualization technologies today provide an adequate level of isolation between applications, thus preventing app-to-app conflicts, very few provide full OS isolation and are able to prevent app-to-OS conflicts.

A quick summary of what application virtualization must provide:

1. All resources required by the virtual application are included in the package;
2. The virtual application is completely seperated (virtualized/isolated) from the operating system and other applications;
3. The virtual application cannot write to the OS file system or registry, or modify the native OS in any way;
4. The virtual application must operate the same way as a natively installed application and provide full OS shell integration, interprocess communications, etc.

4.6.3 Integrated

Application installation is the process where Windows Applications are **installed** on the Windows Operating System. Installed applications are fully **integrated** with the system and are able to communicate with other installed applications and the Operating System itself.

The Windows Installer (MSI) is the defacto standard used for the installation, maintenance, and removal of application. The installation information, and often the files themselves, are packaged in installation packages known as "MSI files". Applications that are installed and integrated don't run in a sandbox environment.

4.6.4 Agent-less

Client-less, or **agent-less**, application virtualization involves the use of an embedded virtual OS that is deployed as part of the virtualized application. While creating the Virtual Application package the application and client components are compiled and stored in one single container, mostly a single executable. These virtualized applications are fully encapsulated and able to run as a standalone executable from multiple locations such as a network drive, local drive, or USB drive. Every virtualized application contains a 'built-in' agent. So no agent, or client-component, is installed in the Operating System but every application has an agent.

4.6.5 Agent-based

Client-based, or **agent-based**, application virtualization involves the use of a locally installed agent or client on the endpoint. This agent contains functionality to setup and maintain the Virtual Environment for each application. The agent takes care of management tasks such as Shortcut creation, File Type Associates (FTA) registration and is a key component in the streaming behavior. This behavior is a key functionality for agent-based Application Virtualization solutions.

4.6.6 Kernel- and User Mode

Windows runs all code, application and services, in one of two modes, user-mode and **kernel-mode**. The two modes reflect two different security models. Code running in kernel-mode has full Operating System access. Kernel-mode code typically comes from device drivers and the windows kernel itself. A kernel-mode driver or service is part of a locally installed agent on the endpoint. Code running in **User-mode** does not have full Operating System access and there is no direct interaction with the kernel of the endpoint's Operating System. Problems when executing code in kernel mode can quickly lead to complete system halts (Blue Screen Of Death). Kernel mode drivers require admin privileges to be initially installed. User-mode agents don't. Kernel mode drivers require admin privileges to be initially installed. User-mode agents don't.

4.6.7 Portable Apps

Portable applications are software programs that are able to run independently without the need to install files to the system they are run upon and irrespective of the version of Windows

installed on the system. They are commonly used on a removable storage device such as a CD, USB flash drive, flash card, or floppy disk. Agent-less Application Virtualization may convert even complex application into portable apps.

4.6.8 U3

U3 is a proprietary method of launching windows applications from U3 compatible USB drives. Applications that comply with U3 specifications are allowed to write **files** or **registry** information to the host computer, but they must remove this information when the USB flash drive is ejected. Customizations and settings are **redirected** and stored with the application on the flash drive. This isn't a virtualization technology, but has its use-cases though.

4.7 FIND THE BALANCE

What is the best Application Virtualization solution? Is this solution, Agent-less running in User-mode, Agent-based running in Kernel-mode or a more integrated Virtualization solution?! Can the solution balance between the fully isolated- or virtualized world and more open 'integrated' world? Good questions! ☺

There isn't a single best answer about which solution is THE best solution. Use-cases, delivery mechanism, client-Management, Security, Application integration are just some important topics in this discussion. The Strategy written in paragraph 4.4 is the key to the question: ' What is the best Application Virtualization solution'!



5. APPLICATION COMPATIBILITY AND READINESS

5.1 MIGRATION

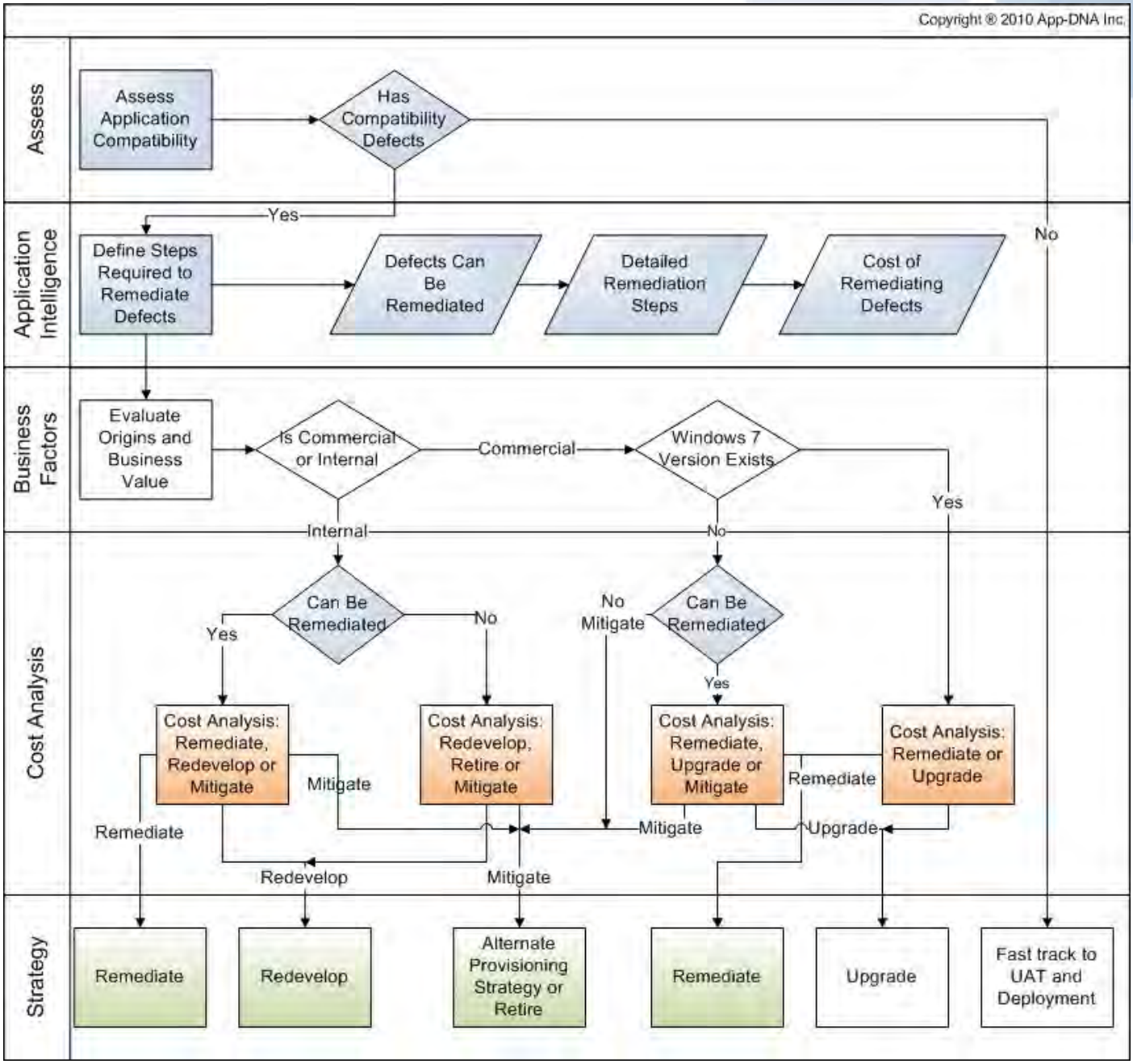
The use of Application Virtualization, Windows 7 and Virtual Desktop Infrastructure (VDI) brings much new functionality and drives upcoming use-cases such as Bring Your Own Computer (BYOC). Today, users expect greater flexibility, freedom and functionality on their end-point devices, whereas the IT organization is focused on cost reductions, manageability and compliancy. The migration of applications to a new Operating System platform, such as Windows 7, has a huge impact on the planning, design build and migration to the optimized desktop especially when x64 and Application Virtualization is involved. The main questions in such a migration are:

- Can I run my set of applications on Windows 7, if your new platform is Win7?
- Are the applications suitable to Virtualize, which are not and why not?
- Do I run into trouble using Internet Explorer 8 with my stack of web-architected applications?
- Can I move to 64-bits Windows?
- What are graphical intensive applications? Can I use these in VDI and RDS scenarios?

There are various solutions on the market who can address these questions. Some are free, and limited but in some cases useful; others are more expensive and valuable. Solutions like Microsoft Application Compatibility Tool Kit (ACT), Changebase AOK and App-DNA AppTitude play an important role in application compatibility, readiness and remediation. Solutions such as ChangeBase and App-DNA examines application compatibility and gives insights in remediation which results in a simpler, less risky and more controlled migration to a new or updated platform.

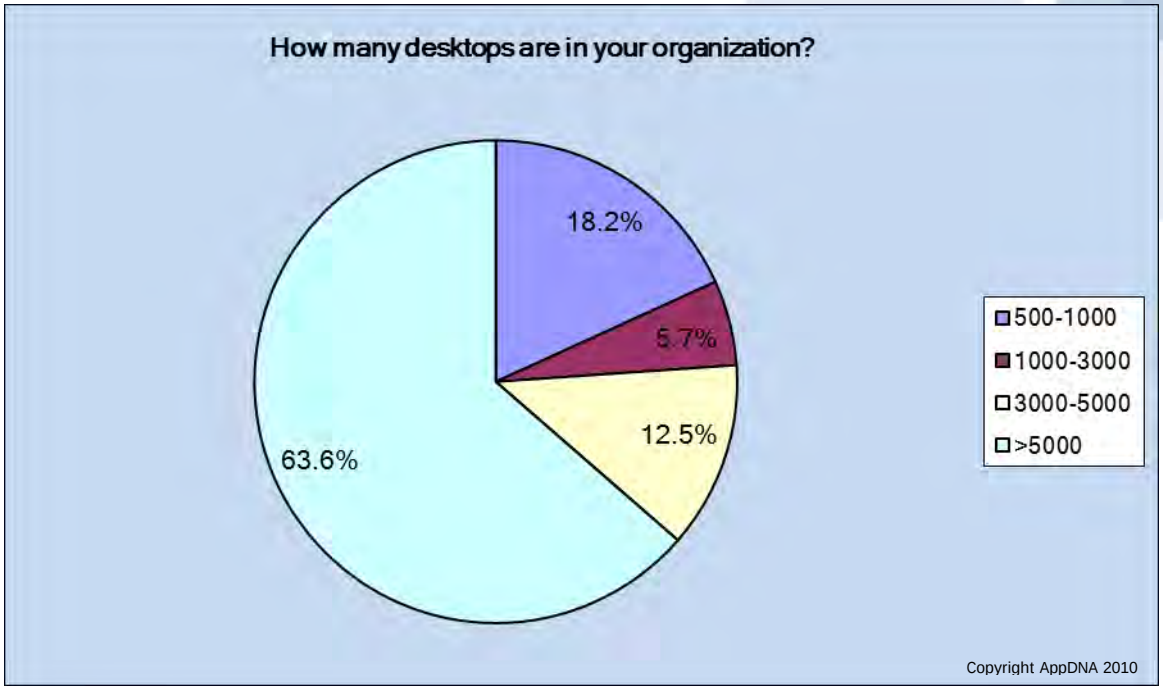
App-DNA executed a survey with 110 of their enterprise customers in the Financial, Engineering and Pharmacy space and shared their finding with PQR. The unique results are part of this whitepaper. The goal of these results is to give you insights in the enterprise world with Application Virtualization, OS and x64 adoption, IE and impact on migration in mind. These insights will help you with your migration to Application Virtualization, Windows 7 or an optimized desktop in general.

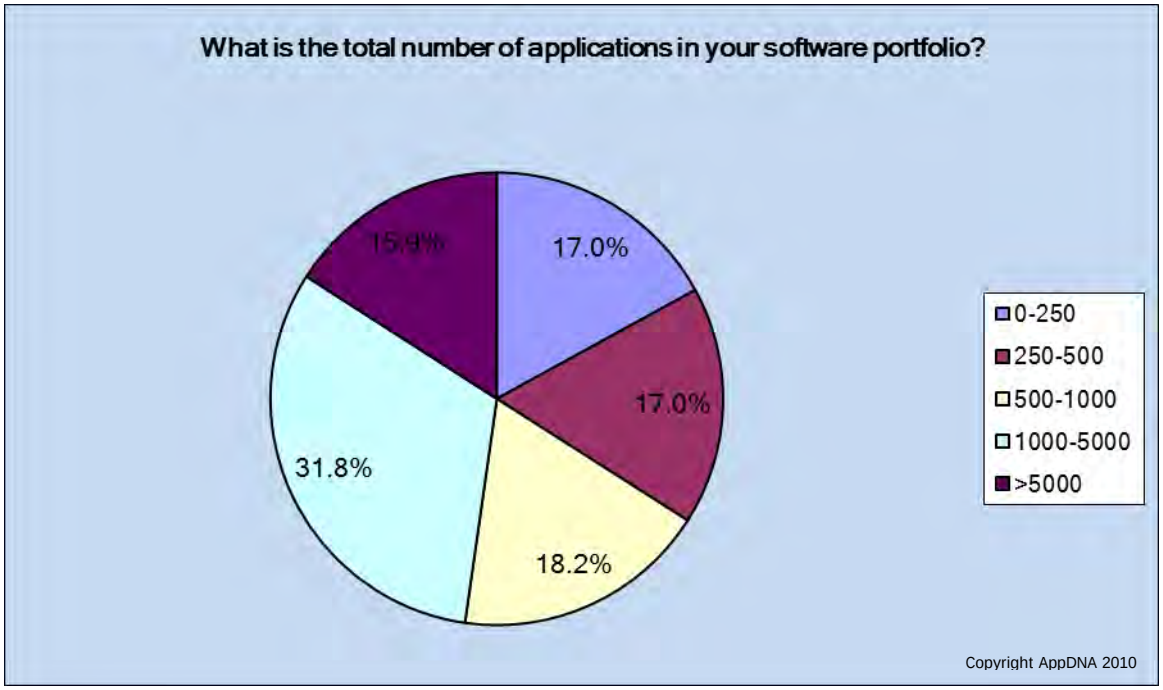
App-DNA believes they have a solution that can help in application compatibility, readiness and remediation. It's up to you to determine their value. **Please keep in mind this survey isn't executed by a Research and Business Insight organization. The results gives an idea what's going on with these 100 App-DNA customers, still valuable though;**

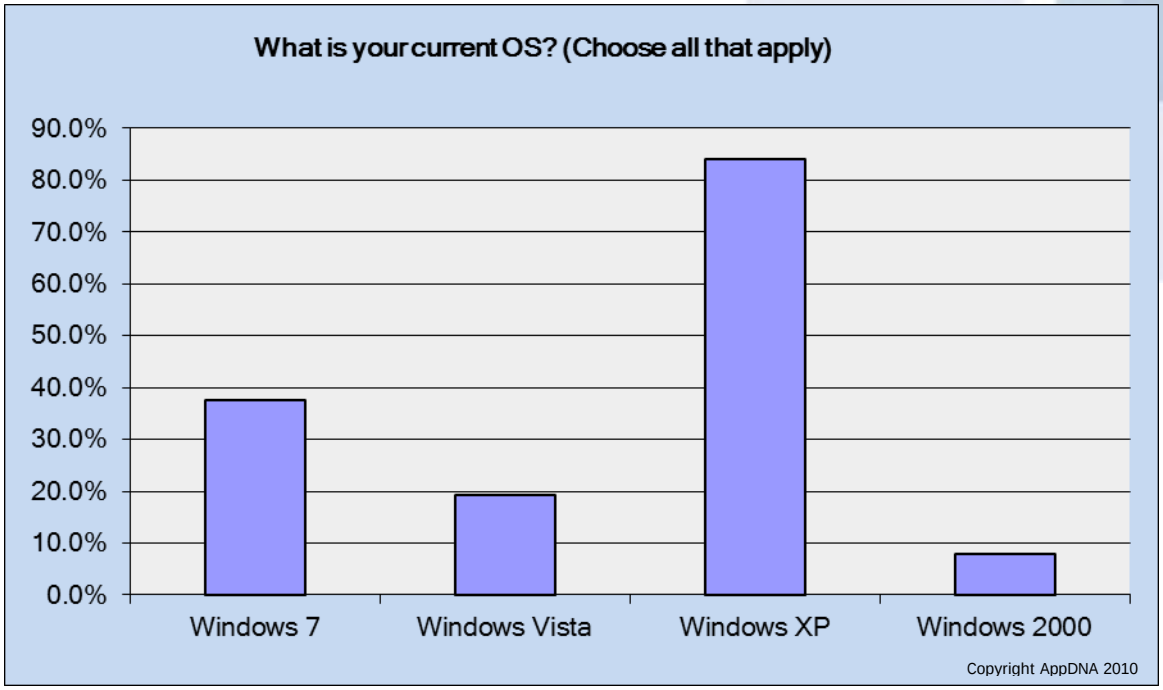


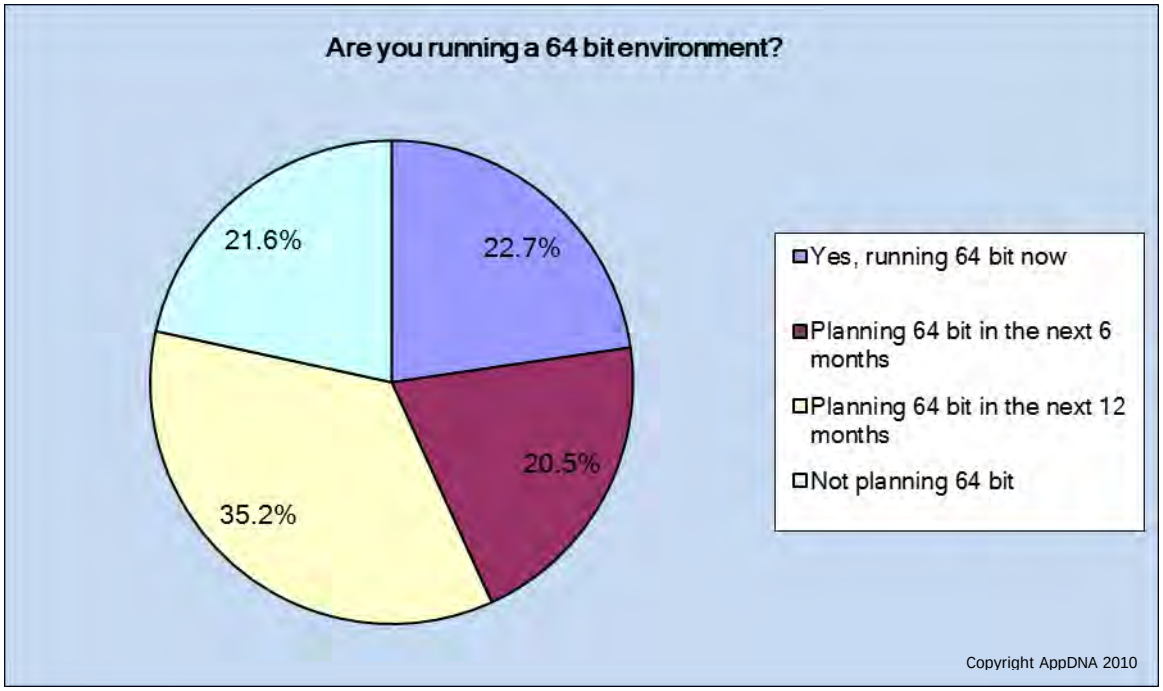
The **decision flow chart** for Application Compatibility projects is useful to determin the steps and solutions to solve application compatibility issues. Technology to "Alternate Provisioning Strategies" are VDI, Remote Desktop Servers, Terminal Services or client-side Desktop Virtualization.

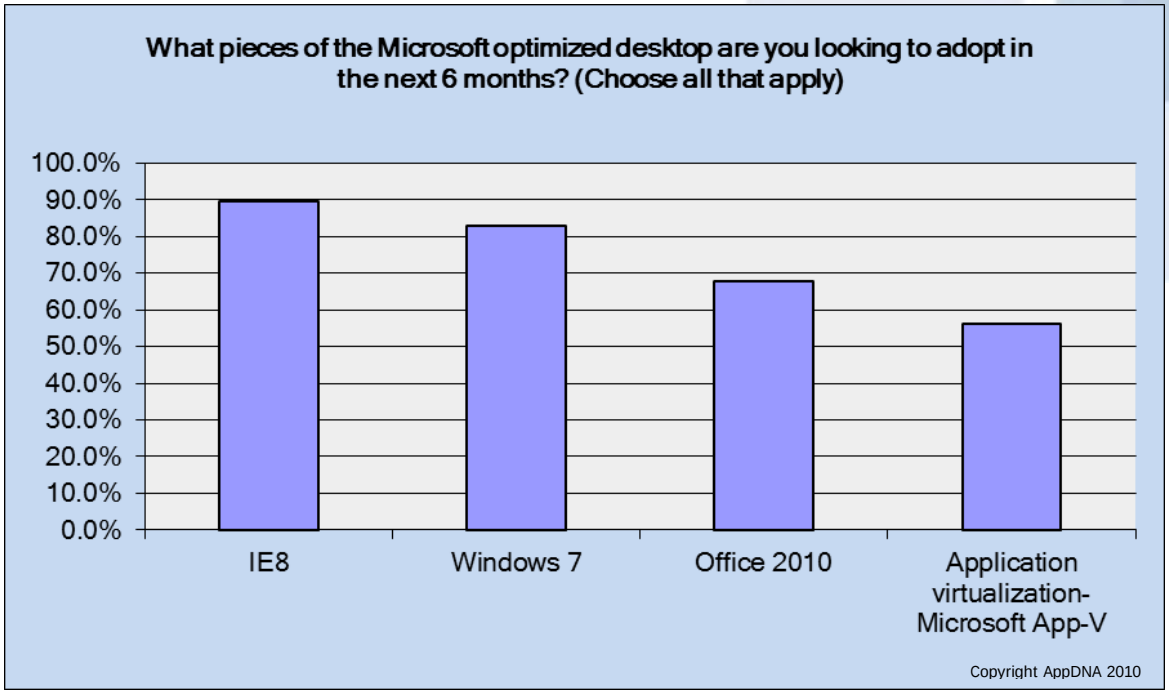
5.2 SURVEY RESULTS

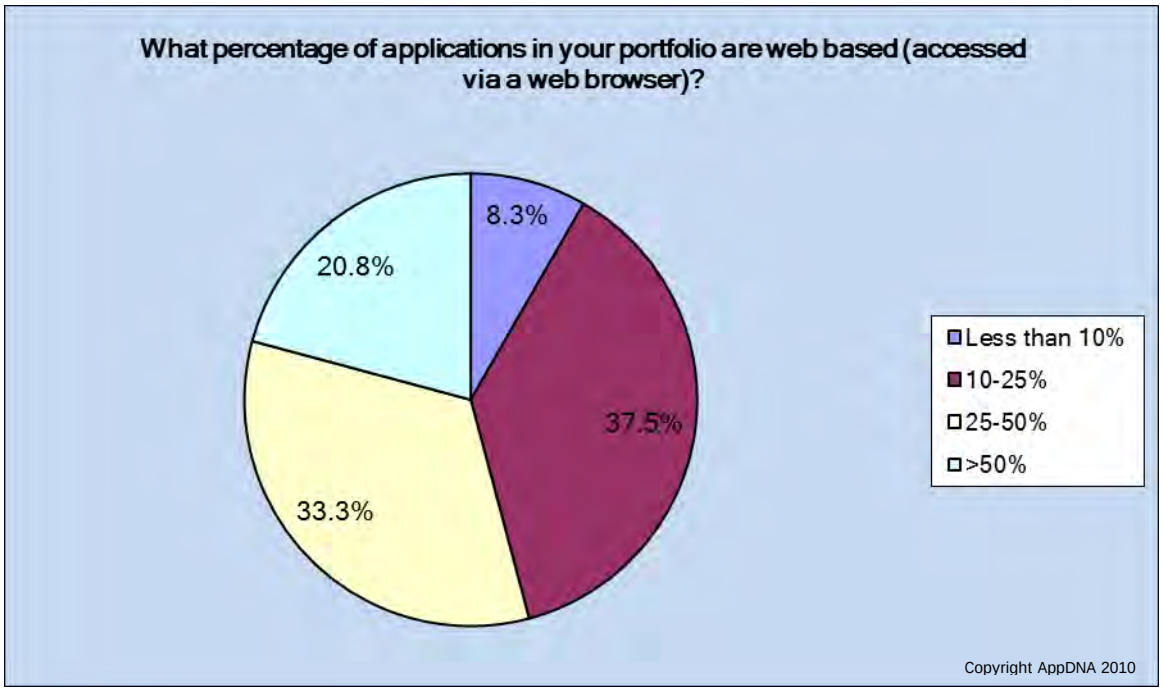


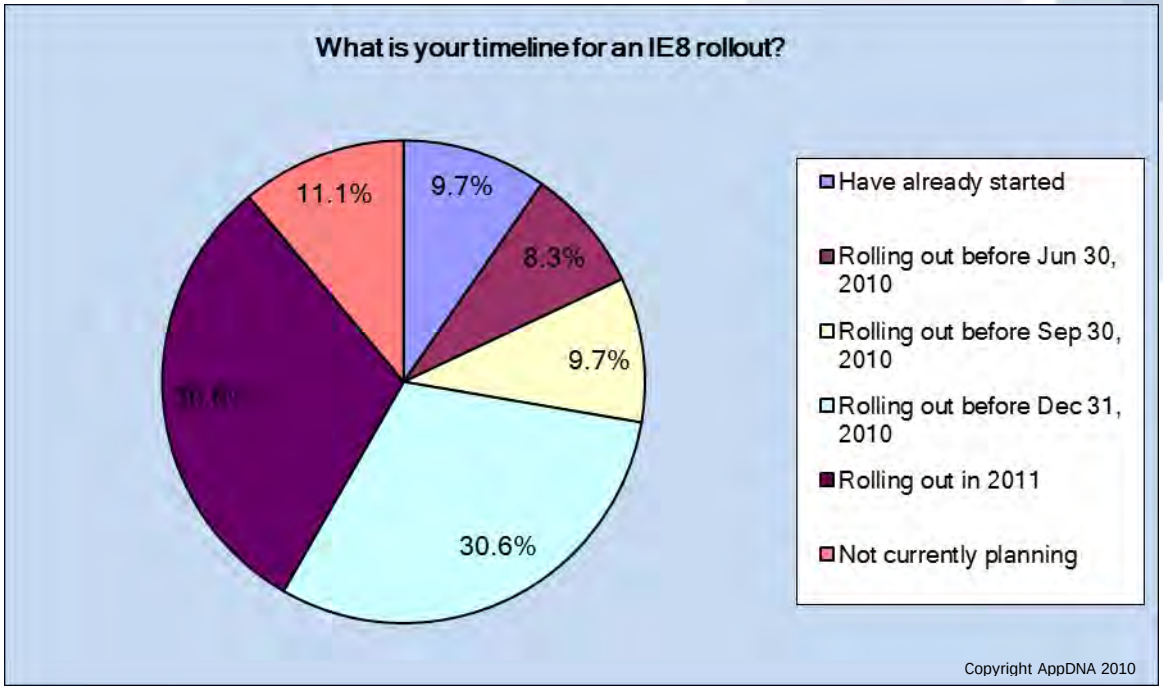


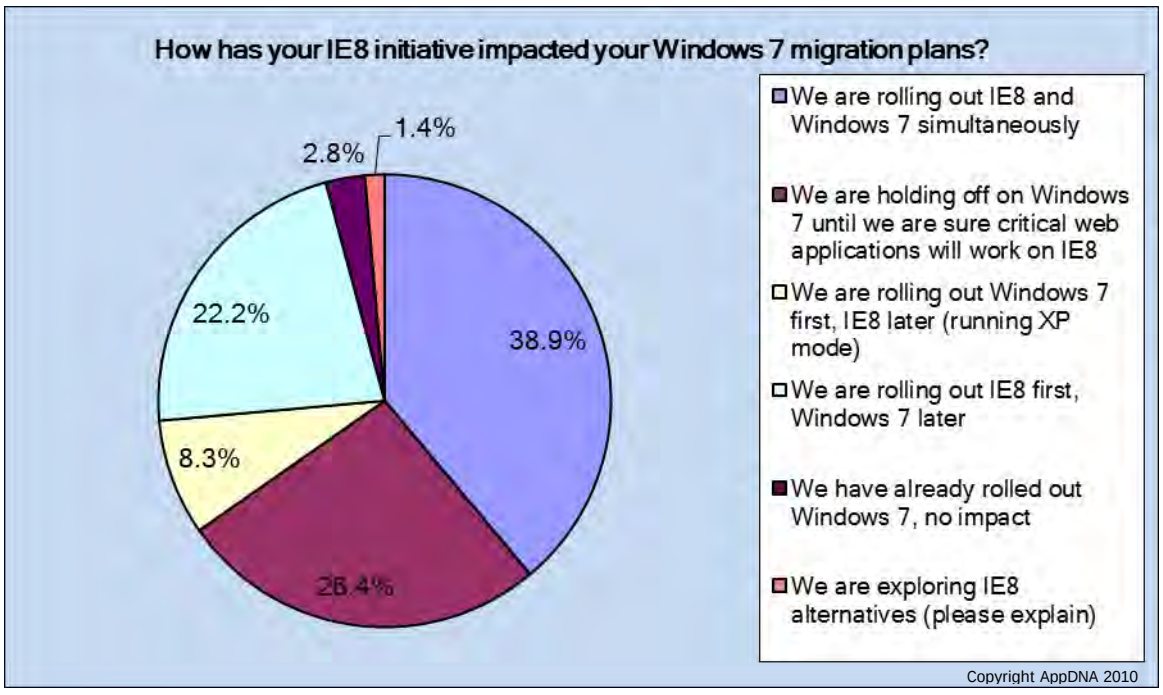

What is your current OS? (Choose all that apply)
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Windows 7
Windows Vista
Windows XP
Windows 2000
Copyright AppDNA 2010

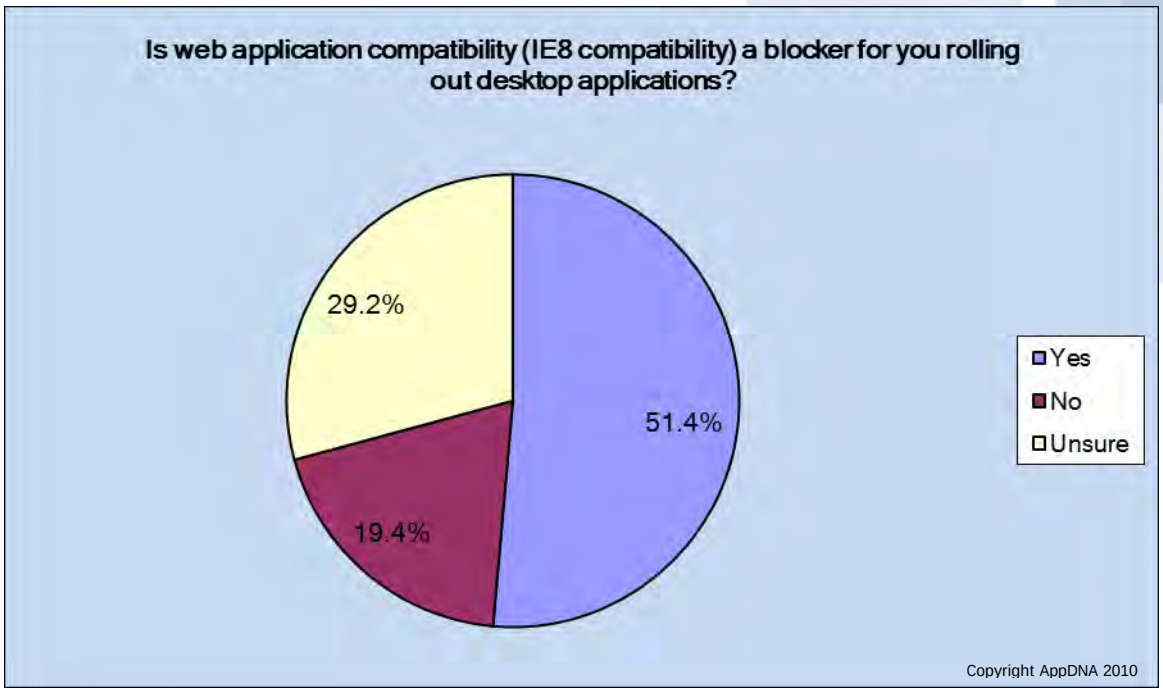

Are you running a 64 bit environment?
21.6%
22.7%
20.5%
35.2%
Yes, running 64 bit now
Planning 64 bit in the next 6 months
Planning 64 bit in the next 12 months
Not planning 64 bit
Copyright AppDNA 2010

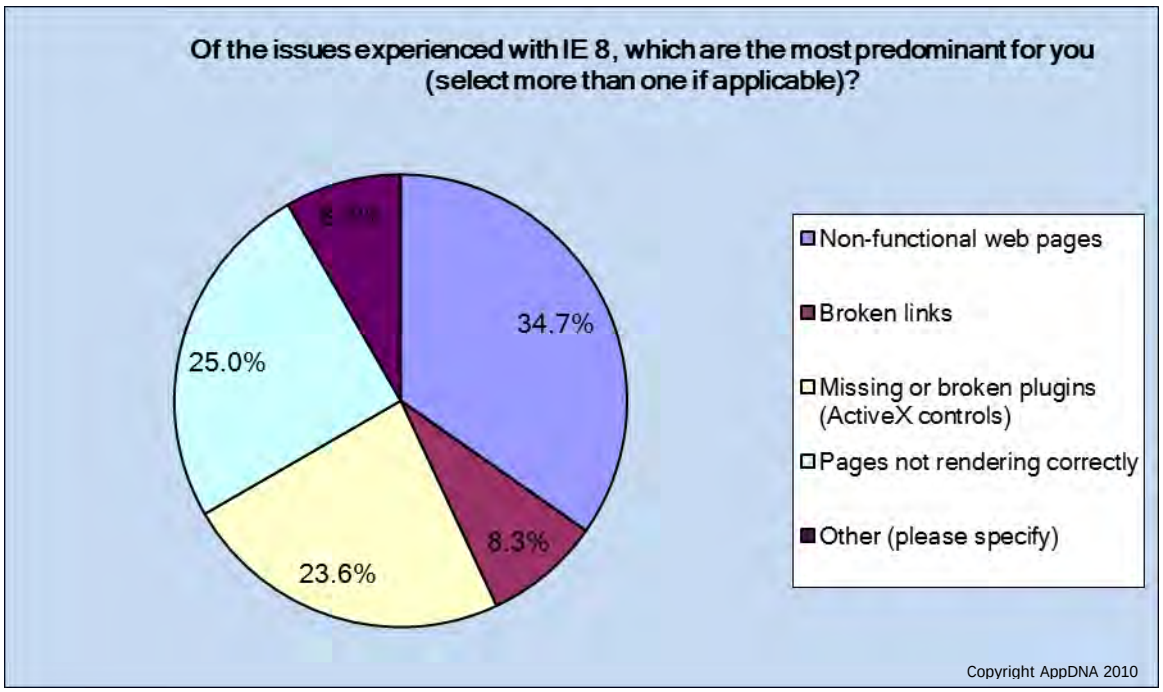

What pieces of the Microsoft optimized desktop are you looking to adopt in the next 6 months? (Choose all that apply)
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
IE8
Windows 7
Office 2010
Application virtualization- Microsoft App-V
Copyright AppDNA 2010

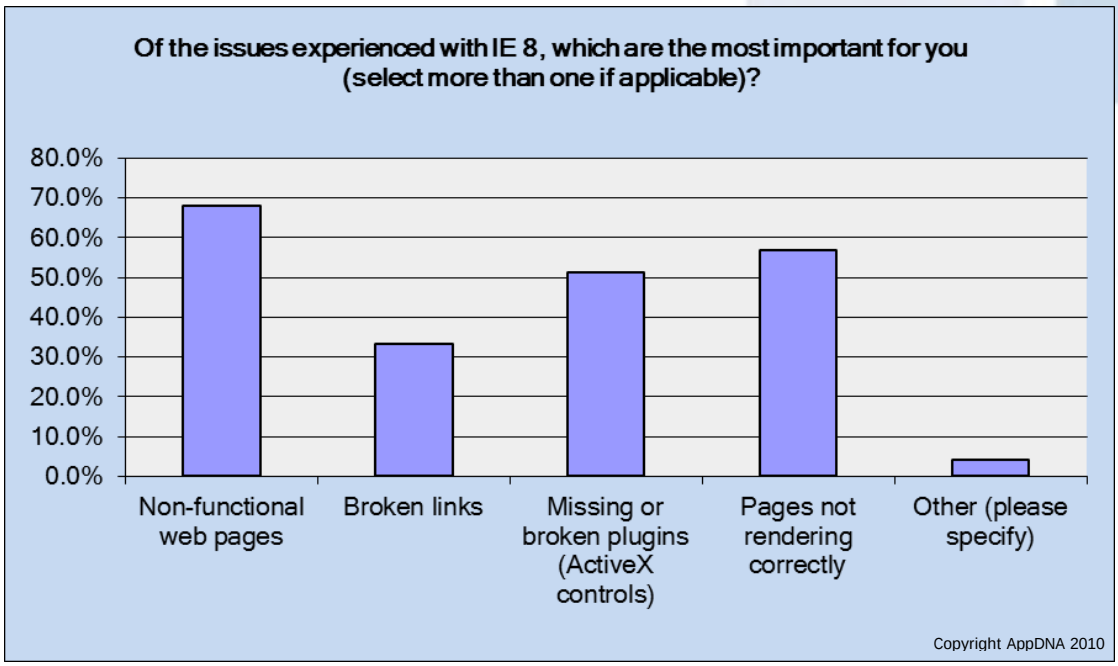

What percentage of applications in your portfolio are web based (accessed via a web browser)?
8.3%
20.8%
37.5%
33.3%
Less than 10%
10-25%
25-50%
>50%
Copyright AppDNA 2010


What is your timeline for an IE8 rollout?
9.7%
8.3%
9.7%
30.6%
11.1%
Have already started
Rolling out before Jun 30, 2010
Rolling out before Sep 30, 2010
Rolling out before Dec 31, 2010
Rolling out in 2011
Not currently planning
Copyright AppDNA 2010


How has your IE8 initiative impacted your Windows 7 migration plans?
1.4%
2.8%
22.2%
38.9%
8.3%
26.4%
We are rolling out IE8 and Windows 7 simultaneously
We are holding off on Windows 7 until we are sure critical web applications will work on IE8
We are rolling out Windows 7 first, IE8 later (running XP mode)
We are rolling out IE8 first, Windows 7 later
We have already rolled out Windows 7, no impact
We are exploring IE8 alternatives (please explain)
Copyright AppDNA 2010


Is web application compatibility (IE8 compatibility) a blocker for you rolling out desktop applications?
29.2%
51.4%
19.4%
Yes
No
Unsure
Copyright AppDNA 2010


Of the issues experienced with IE 8, which are the most predominant for you (select more than one if applicable)?
34.7%
25.0%
23.6%
8.3%
Non-functional web pages
Broken links
Missing or broken plugins (ActiveX controls)
Pages not rendering correctly
Other (please specify)
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5.3 BOTTOM LINE

- Application Virtualization is mature and widely adopted; Still room for growth;
- Windows XP is still the main OS platform; (2010), Windows 7 is ramping up;
- Customers are using x64 or planning to use 64-bits Windows;
- Enterprises use really a lot of different applications; 500-1000 are normal numbers;
- Big portion of applications are web-architected based;
- IE8 rollout is on the roadmap for 90% of the customers;
- IE8 initiative is impacting Windows 7 migration plans;
- Adoption of IE8 and the assessment of web-architected applications should just be a natural part of the application testing cycle;

6. WEB APPS: THE NEW P@IN IN THE @$$

For the last 10 years, web applications grew in popularity because of the easy implementation. They promised to be accessible from any device and from any browser, therefore no need to deploy client software, update the software, test client software (for conflicts with other software) or the need for an application virtualization solution. If only it was THAT simple…

6.1 'THE NEED FOR… IE6'

While Web app-development was a growing business, Internet Explorer 6 was dominating the browser market. As a result, a lot of (legacy) Web apps were developed and tested for IE6 only. Many of the Web apps use ActiveX-controls and/or a plugin, like Java, often depending on a specific version of a plugin and a specific version of a browser. The HTML standards have also changed over the years. While using Web apps promised to be accessible from any device and from any browser, in the end this promise didn't hold up. There are still 'some' web apps still dependent of IE6 and or a specific browser plugin version. This makes Web apps the new "DLL hell".

6.2 IE 6 AND WINDOWS 7

Migrating to Windows 7 is on the agenda of almost every company. It's not a question of if but "when". Application virtualization is useful for a lot of applications and strategic in the migration to Windows 7. But Web apps are a different story. How can you run your "IE6 only" compatible web applications on Windows 7 which uses IE8?. There are different options to accomplish this. One option is to use a Server Hosted VDI or Remote Desktop Service to host IE6 and then seamlessly presented this to the end-user. Another option is to use Microsoft Enterprise Desktop Virtualization (MED-V), part of Microsoft Desktop Optimized Pack (MDOP), or use XP-mode in Windows 7. In both cases a Virtual Machine running Windows XP is installed on the end-point. Microsoft Internet Explorer 6 runs inside the VM and is presented on the local client. The different options from Microsoft's point of view is described here: http://www.microsoft.com/downloads/en/details.aspx?displaylang=en&FamilyID=495934c8-5684-451c-a16e-5ceb50706a42

6.3 VIRTUALIZE IE6?!

A third scenario to deliver IE6 to Windows 7 is to virtualize Internet Explorer 6 with Application Virtualization. The big and main advantage is web applications which need IE6, and IE6 only, can run on Windows 7. Even the plugins can be virtualized so that different versions of Plugins can run simultaneously side-by-side. Various Application Virtualization vendors provide tools to virtualize IE6 and IE7 and run these on Windows 7. There are, however, a number of things to keep in mind:

- Support: Running Multiple Versions of Internet Explorer On Single Operating System is not supported by Microsoft: http://support.microsoft.com/kb/2020599
- Support: IE6 running on Windows 7 isn't supported by Microsoft. For various enterprises this is an important reason to find a different solution to run IE6 on Windows7. On the other hand some Application Virtualization vendors will give full support on running Virtualized IE on Windows 7.
- Legal: Ask Microsoft if running IE6 in your scenario meets EULA;
- User Experience: Users may need to start a different browser for each web app. It would be nice (or a must with a lot of web apps) that the web application is automatically and seamless redirected to the appropriate (virtualized) browser.

Ideally, web apps should work on any device with any browser, without the need for plugins. In the real world companies will face (legacy) web apps and they will need to find a way to solve the compatibility issues described above. Part of the strategy around Application Virtualization is the question; Is it important to have an Application Virtualization solution that can Virtualize and deliver IE6 to Windows 7 machines and ultimately without any downsides to the end-user experience?!

7. APPLICATION VIRTUALIZATION AND VDI: A PERFECT MATCH?

In general, there are two types of virtual desktops in a server-hosted VDI environment: Stateless and stateful. In this chapter both types are explained and why it is key and almost mandatory to use application virtualization to deliver applications to users in a server-hosted VDI environment.

7.1 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.

7.2 STATEFUL DESKTOP

In practice, a number of different terms are used for stateful desktops, including assigned, persistent or private desktops; 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 'stateful' is derived from. In addition to the aforementioned benefits of Desktop Virtualization, a stateful desktop has a specific property, namely:

- Freedom to install software within the desktop.

An important point of special interest with regard to stateful 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.Because of the ease of management and the flexibility of stateless desktops; this type is mostly used in a VDI scenario. One of the challenges with stateless desktops is to figure out how to get the right applications to each user on the stateless desktop. Since a user is not dedicated to a virtual desktop and the desktop can be reverted to a clean state, it is not an option to install on a per user or per desktop base. It is also not an option to install all the applications that are used within the company in the golden image, because you would have to update the golden image and redeploy the entire image each time an application needs an update. That's not practical and flexible when you have to maintain 200 applications.

The best option is to use application virtualization to stream or publish applications to the stateless desktops on a per user base.

7.3 OVERHEAD AND STORAGE IMPACT

In an infrastructure where users have a dedicated physical desktop to work on, the overhead (CPU/memory/disk) of application virtualization isn't a big concern. But in a shared environment like hosted VDI or SBC, the overhead of application virtualization is something to take in to account. Application virtualization might have effect on:

- **CPU/Memory**

The virtualized applications might use more CPU cycles and/or memory than locally installed applications. This might affect other users on the same server in a Remote Desktop Services, or Terminal Services, environment or users on the same host in a hosted VDI environment.

- **Network**

Virtualized applications are often streamed to the user's desktop or session. Depending on the size of the virtualized application and the distribution method the application virtualization solution is using, this might have an impact on the network.

- **Disk/Storage**

First of all, the size of the virtualized applications can be important for the disk sizing of the physical desktop or laptops or Virtual Machines. The application virtualization solution can use a caching method where the virtualized application is cached on disk. When hosting a large number of virtual desktops, the caching of the virtualized applications takes place in these entirely virtualized desktops. Cumulative this can take up a lot of disk space. Whenever possible, a shared caching method should be considered.

Secondly, impact on IO's on the storage cannot be taken lightly. On a physical desktop the number of IOPS is the last thing to worry about, but with shared storage this is one of the biggest challenges in a VDI project.

A useful tool to inventory and analyze the behavior of applications is Liquidwarelabs Stratusphere. With this tool, data and usage metrics for existing installed applications are gathered in order to determine their fitness and complexity for application virtualization.

8. VENDORS AND THEIR VIRTUALIZATION SOLUTIONS

8.1 INTRODUCTION

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

Some of these product descriptions are provided by the vendors, most of the marketing stuff is removed. The goal of this chapter is to receive a better understanding of the Application Virtualization market-space from a vendor perspective.

8.2 CITRIX APPLICATION STREAMING

Client-side application virtualization technology in Citrix XenApp is comprised of two main functionalities: *application streaming* and *application isolation*. The application streaming feature enables applications to be delivered to client devices and run in a protected, virtual environment. Applications are managed in a centralized Application Hub, but are streamed to the client device and run in an isolation environment. Applications become an on-demand service that is always available and up-to-date.

THE CHALLENGE

The reality today is that many companies are hitting a wall of complexity when it comes to managing their ever-growing number of desktop applications and diverse access scenarios. This complexity translates into a huge amount of time and money spent providing what amounts to a patchwork solution.

APPLICATION STREAMING OVERVIEW

Client-side application virtualization reduces the cost of testing, installing and supporting applications. Using isolation and application streaming technologies, client-side application virtualization enables local virtualized applications. Rather than installing applications on each user's PC, applications are streamed to a protected isolation environment on their client device. The isolation environment controls how applications interact on the user device, which prevents application conflicts.

Streaming applications into the isolation environment greatly accelerates their delivery by reducing regression testing and simplifies management with streamlined maintenance, upgrades and de-provisioning. In fact, using streaming for de-provisioning an application is the most efficient method of removing all traces of an application. Caching technology makes applications available even when users are not connected to the network.

With server-side application virtualization, the server acts as the client. Applications are streamed to a protected isolation environment on the server as opposed to the local device. This has many of the same benefits of client-side application virtualization and also helps reduce application silos and greatly improves management of XenApp farms.

KEY BENEFITS

As a key component of both client-side and server-side application virtualization, Application streaming enables IT to:

- Eliminate application conflicts and OS instability resulting from desktop application installation
- Reduce the costs associated with regression testing, deployment, maintenance, updates, and de-provisioning for applications running locally on users' machines

- Offer applications as an on-demand service
- Lower support costs by automatically updating and repairing applications every time they are used
- Speed regulatory compliance by eliminating the need for extensive testing to certify applications
- Enhance security by giving IT administrators complete control over applications delivered to desktops, even those of unmanaged partners and users

8.3 ENDEAVORS APPLICATION JUKEBOX

Application Jukebox - Enterprise Edition is a application virtualization solution designed to deliver any Windows application to any PC, anytime, from anywhere, without the need for downloads or installs. Application Jukebox is an out of the box technology solution for instantly delivering existing Windows software across the enterprise. Application Jukebox Studio creates stream able and virtualized application sets from an original installer. Application Jukebox Server controls and delivers those application sets to the clients. Application Jukebox Player runs on the client machine creating a virtual environment to run the application. Instead of using traditional push technology such as Microsoft Systems Management (SMS), or client-server based solutions to install or run entire applications, Application Jukebox responds to user requests for applications and immediately pulls the application to a user's desktop.

The new features of Application Jukebox are:

CONFIGURABLE VIRTUALIZATION

Applications held in Application Jukebox can be fully integrated with the end user client environment, fully isolated or any combination in between. This unique functionality gives the administrator complete control on how applications are delivered and interact with client devices. A simple example being, an application that is shipped with fonts only licensed for use with that application. The application could be streamed as a fully integrated application, interacting with local system resources and other locally installed software. The fonts, however, could be streamed in an isolated virtual environment, hidden from the resident OS and installed applications, and therefore only available by the licensed application. The four layers of virtualization are

- Layer 1 – Installed Permanent – this copies the file to the specified location on the users system when the application is first virtualized and the file is left behind even once the application is removed. We generally use this for the data files that might come with an application, like an .mdb file or personalization registry settings. It is also used for things that you would want to be persistent should the application be virtualized again in future as the files are not overwritten if already present.
- Layer 2 – Installed Temporary – this copies the file to specified location on the users system when the application is first virtualized but the file is then deleted when the application is removed from the player. This might be used for files that you want to have on the machine but put outside of the control of Jukebox, but then remove them when the app is removed in order to leave a clean state.
- Layer 3 – Virtual Integrated – this is a virtualized file or key that can be seen by the rest of the system and is visible in the file system and registry, as if locally installed but its use is restricted by Application Jukebox
- Layer 4 – Virtual Isolated – this is a virtualized file or key that is isolated (sandboxed) and is only visible from within the virtualized application

An important thing to understand is that applications do not have to be either all isolated or all integrated; the level of virtualization can be set for each file and registry key. For example alternatively you might have a fully isolated application but have the files and registry keys for a

PDF printer plug-in as integrated. Or you can have all of the application integrated or isolated as a whole if you want to.

MIXED MEDIA STREAMING

Application Jukebox makes it possible to stream applications from different media sources; CD, USB stick or network delivery. This gives the Enterprise increased flexibility in deploying applications. For instance, if a user is in a remote location with limited network access, they can receive a preloaded application on a CD containing only the necessary data to launch the application and then stream any additional data blocks as needed, on-demand from the network.

MULTISTAGE PROGRESSIVE STREAMING

Applications can have additional blocks of data streamed using macros once the activation and prefetch have taken place. An Enterprise can publish an application with a small prefetch allowing users to start working more quickly, while in the background additional data is being streamed.

INCREMENTAL PATCHING

When bug fixes and minor point versions of applications are released, Enterprises need to get the updates to their users in a timely manner; Application Jukebox makes it possible to quickly and easily patch the application and stream only the differential, not the whole application saving time and effort.

ANYTIME – ANYWHERE

Application streaming and virtualization gives users on-demand access to desktop applications anytime, from anywhere. Application Jukebox dramatically reduces the cost and complexity of delivering applications to desktop and laptop computers across the enterprise.

REDUCED TOTAL COST OF OWNERSHIP

Most organizations deploy and manage their business applications using methodologies that were introduced over a decade ago prior to the 'digital age' and the internet phenomenon as we know it today. The exponential growth of our dependence on the PC, and the increase in remote workers, has led to a spiraling application and hardware Total Cost of Ownership (TCO).

Application Jukebox allows organizations to rapidly deliver desktop applications, upgrades and patches. It gives users access to software as they need it, when they need it and where they need it on a "pull-based" application delivery model. Maximizing existing infrastructure organizations can serve many more users per server, dramatically reducing TCO.

AVOID COMPATIBILITY AND STABILITY ISSUES

Application Jukebox avoids application compatibility issues by isolating the streamed application from other application's configuration/run-time environment and dramatically reduces the cost and complexity of delivering applications. Software delivery becomes an on-demand service – one where the latest release of the application is always accessible, where application maintenance releases are automatically detected and instantly made available. Central administration eliminates the need to recall or visit the client computer. By isolating the streamed applications, the enterprise can guarantee software stability with an immediate roll out of new builds to their users. This reduces the need for complex and lengthy regression testing procedures and the need for an intricate testing infrastructure.

8.4 INSTALLFREE

InstallFree provides application compatibility, portability and virtualization solutions to help customers accelerate the adoption of new operating systems and applications solve conflicts

and reduce cost and complexity. InstallFree Bridge Enterprise is a Desktop Application Virtualization and Management solution that enables organizations to centrally manage and deliver virtual applications, updates and add-ons to end-users, while using their existing IT infrastructure. InstallFree Virtual Applications (IFV Applications) provide end-users with a natural desktop experience that is identical to physically installed applications, including local processing, offline availability, application interconnectivity and complete shell integration with the host environment. The InstallFree Bridge itself is a virtual application, enabling end-users to access their complete set of IFV Applications from virtually any Windows environment, without the need to install any management agents or otherwise alter the host PC configuration in any way. The InstallFree Bridge provides full end-user autonomy and productivity on locked-down computers, thereby enabling IT to realize significant cost savings from locking down end-user desktops and improving overall manageability.

InstallFree Key Benefits

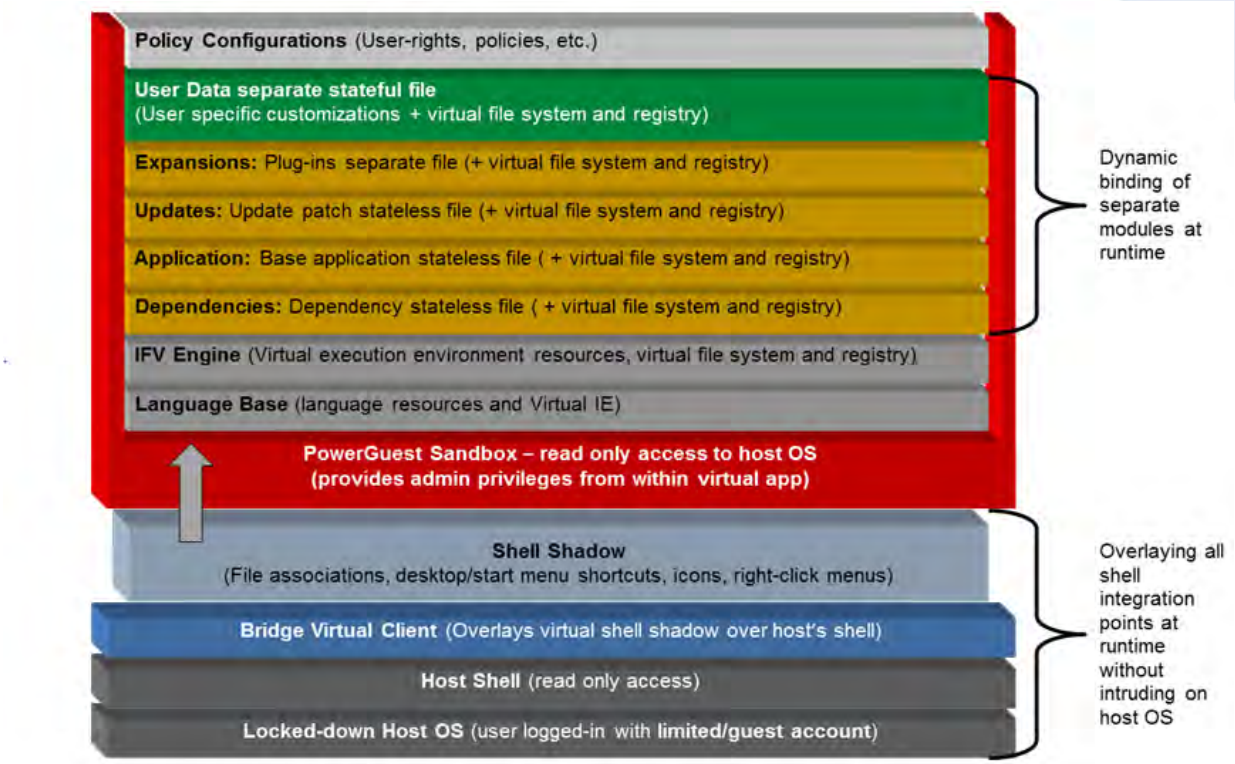
- Application compatibility and portability – InstallFree Virtual Applications are completely self-contained and isolated from their environment. Even applications that are not compatible with the target OS (e.g. IE6 and IE7 on Windows 7) can still run as Virtual Applications as InstallFree ensures they get access to all the resources they need. InstallFree can be used as an application compatibility solution when migrating to new operating systems like Windows 7.
- Package Once and For All – InstallFree separately encapsulates applications, updates and add-ons into stateless, sandboxed, modular and portable desktop elements. IT departments need only package an application once, and can then easily deliver it, update it and extend it on any Windows environment without ever repackaging it. The technology supports both standard Windows applications and web-architected applications using Internet Explorer. This reduces package and image sprawl, greatly reduces integration testing and accelerates application release, delivery and migration.
- Run Anywhere - with the InstallFree Bridge, end-users can access their entire set of virtual applications, updates and add-ons -- as well as their personalized settings -- from any computer and without limitations. The solution does not require any client system software to be physically installed on the host PC, thereby enabling full functionality and complete end-user autonomy across any environment, including shared, public, locked-down and virtual PCs. This approach provides unprecedented flexibility and mobility across the organization and beyond.
- Desktop Security with End-User Autonomy – InstallFree Virtual Applications operate in a fully secure, sandboxed environment with read-only access to the host OS, even when the logged-on user has full administrator privileges. As a result, the physical environment is kept in a pristine state and protected from application contamination. In addition, end-users can be granted administrator-like privileges from within their virtual applications, enabling them to download and install add-ons and plug-ins even when working on locked-down PCs.
- Rapid Implementation - all the components of the InstallFree solution are virtual applications, including the client, console and packaging utility. This makes for an easy and rapid implementation with no need for permanent software installations on the server or clients and no need for a clean PC for application packaging.

InstallFree Products

- InstallFree Bridge Enterprise – a complete application virtualization and management solution enabling customers to centrally package, manage and deliver virtual applications to end-users across the enterprise and beyond. InstallFree virtual applications are fully portable between different versions of the Windows operating system and can run on physical PCs, virtual PCs, Citrix/terminal services sessions or from removable media.

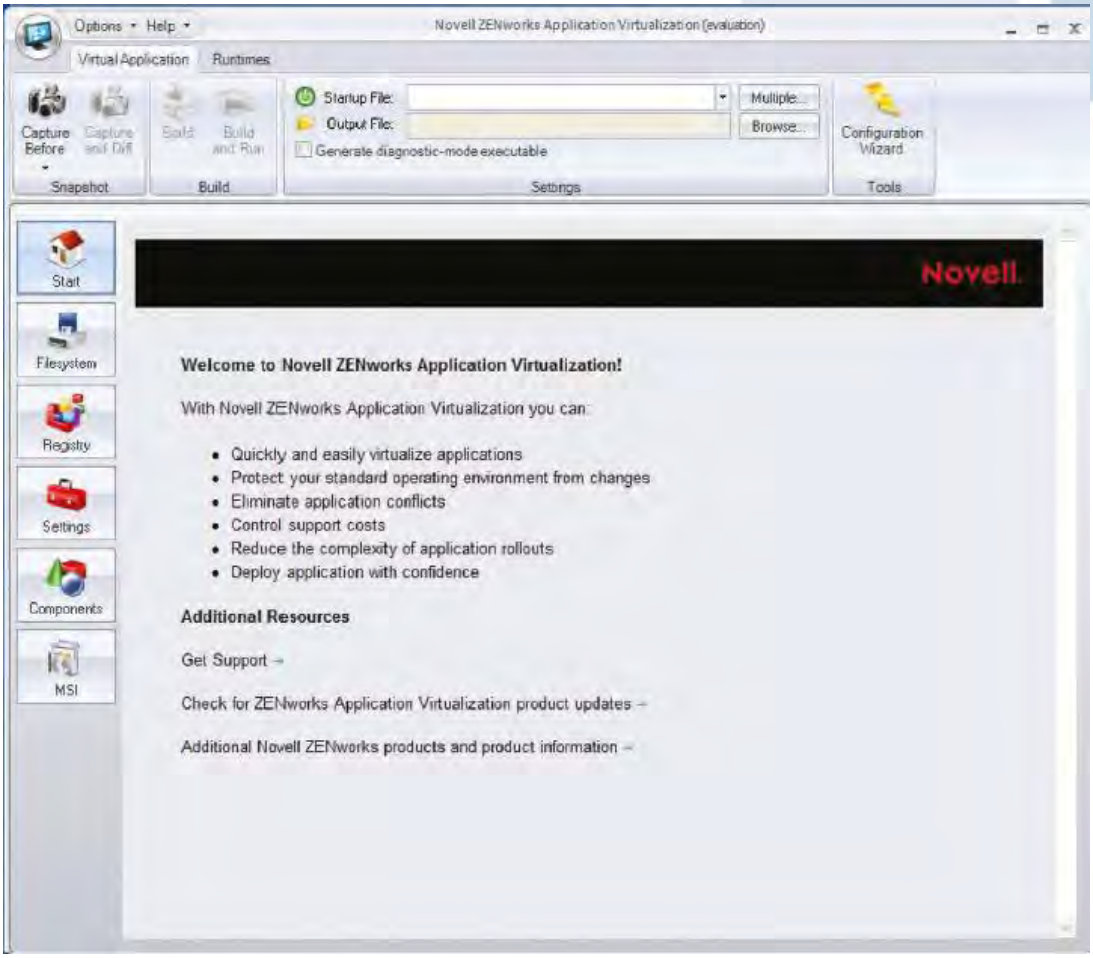
- InstallFree 7bridge – an application compatibility and migration solution designed to help customers migrate incompatible applications to Windows 7.

InstallFree Virtual Application Architecture



8.5 NOVELL ZENWORKS APPLICATION VIRTUALIZATION

Novell ZENworks Application Virtualization is an easy-to-use solution for deploying your Windows*, .NET and Java-based applications in compact, preconfigured virtual executable that run in your existing IT environment. Distribute the executable via the Web, USB keys or from your existing desktop management infrastructure. There are no additional agents or device drivers to support, and no virtual machines to set up or manage. ZENworks Application Virtualization also offers application compression and the ability to distribute patches for a virtual application independently of the application itself. Of course, if you prefer to build MSIs and deploy them using MSI distribution tools; ZENworks Application Virtualization is capable of doing that, too. Using this approach to application deployment, you can dramatically reduce deployment and maintenance costs associated with traditional application setup and distribution while ensuring a high-quality end-user experience.



Novell ZENworks Application Virtualization offers three ways to create and configure virtualized applications. The best method in a given situation depends on the nature of the application.

Novell ZENworks Application Virtualization includes a number of auto-configuration wizards for popular applications, which can be built and customized using a guided, step-by-step process. This simple method is recommended for first-time users.

- Snapshot an application installation. The snapshot captures a system's state before and after an application is installed and automatically configures virtual application settings based on observed system changes. This method is ideal for virtualizing off-the-shelf applications.
- Manually configure an application. This method is most often used by developers who are virtualizing internally developed applications. While manual configuration requires a high degree of technical knowledge about the application's inner workings, this does allow extremely fine-grained control over virtual application settings. Because of the tremendous number of variables involved, users should refer to product documentation for additional help and insight.
- Convert ZENworks AXT-based applications. Novell ZENworks Application Virtualization makes it easy to convert your legacy ZENworks applications to virtual applications and make them a fully integrated component of your virtual application environment.

Each of these configuration methods allows additional configuration and customization to be performed once the initial virtual application configuration has been constructed.

Once you have built a virtualized application, you can distribute it with all the control and automation of Novell ZENworks, or from the Internet or intranets. You can even choose to

optimize the virtual applications to run directly from DVDs, USB thumb drives or other portable media—all of which can still be controlled by ZENworks policies to insure efficiency and security. This integration with ZENworks Configuration Management makes it possible to create a single unified lifecycle management solution for managing all your physical and virtual applications.

Bottom-line: Novell is OEM-ing the Application Virtualization engine from Xenocode/Spoon and has added specific functionality to have deep integration with ZENwork Configuration Manager.

8.6 MICROSOFT APP-V

Microsoft Application Virtualization (App-V) transforms applications into centrally-managed virtual services that are never installed and don't conflict with other applications. App-V streams applications on-demand to desktops, servers and laptops. It changes application management from a series of tedious, manual tasks into an automated, streamlined process. App-V dramatically accelerates application deployment, upgrades, patching and terminations by eliminating time-consuming processes and simplifying the application management lifecycle.

With App-V, applications run reliably without failure—no matter what other software is running on that computer. All applications are instantly available on any licensed device. App-V even allows controlled application use when users are completely disconnected. Because App-V centralizes management of applications, users can only get the applications they have the rights to; application usage and license metering are managed centrally so that administrators can ensure compliance. Centralized control also enables IT to patch or upgrade once to the server and the next time the users access the network, their applications are updated without impacting their productivity. App-V provides various delivery mechanisms including http and file streaming, terminal services integration, and standalone mode which provide application caching on the local client for offline usage.

Microsoft Application Virtualization fully integrates with Microsoft System Center Management products, providing both users and administrators a seamless experience for running and managing applications in the enterprise.

Application virtualization is at the heart of Microsoft Application Virtualization (App-V). It decouples applications from the operating system and enables them to run as network services. Application virtualization can be layered on top of other virtualization technologies—network, storage, machine—to create a fully virtual IT environment where computing resources can be dynamically allocated in real-time based on real-time needs. App-V's patented application virtualization, dynamic streaming delivery, and centralized management technologies make everything from deployments and upgrades to migrations and business continuity initiatives easier and faster with better agility:

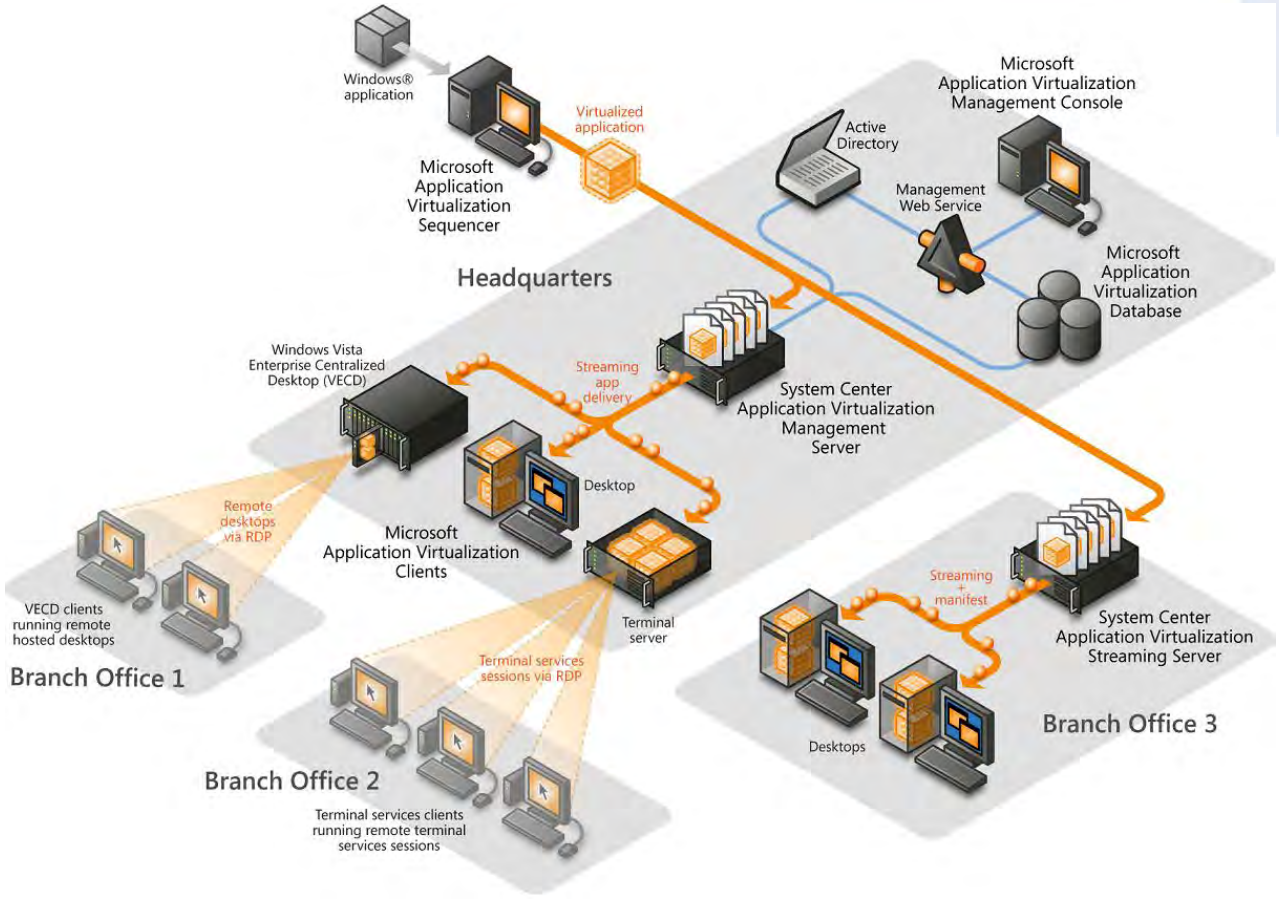
Application virtualization: Enable applications to run without the need to visit a desktop, laptop, or terminal server. Applications are no longer installed on the client—and there is minimal impact on the host operating system or other applications. The most extensive virtualization technology on the market, App-V virtualizes per user, per application instance, as well as key application components. As a result, application conflicts and the need for regression testing are dramatically reduced.

Dynamic streaming delivery: Applications are rapidly delivered, when needed, to laptops, desktops, and terminal servers. In most cases only a small percentage of the application is needed to launch the application. Additional components are delivered when transparently requested by the application. This results in faster delivery of the application when needed.

Centralized, policy-based management: Virtual Application deployments, patches, updates, and terminations are more easily managed via policies, and administered through the App-V console or via your ESD system. Use Microsoft App-V Application Virtualization to help reduce the complexities inherent in enterprise application management. With App-V you can

reduce challenges and transform your computing environment into a dynamic, services-oriented infrastructure.

The diagram illustrates the key components of Microsoft App-V Application Virtualization.



8.7 SPOON (FORMERLY KNOWN AS XENOCODE)

About Spoon

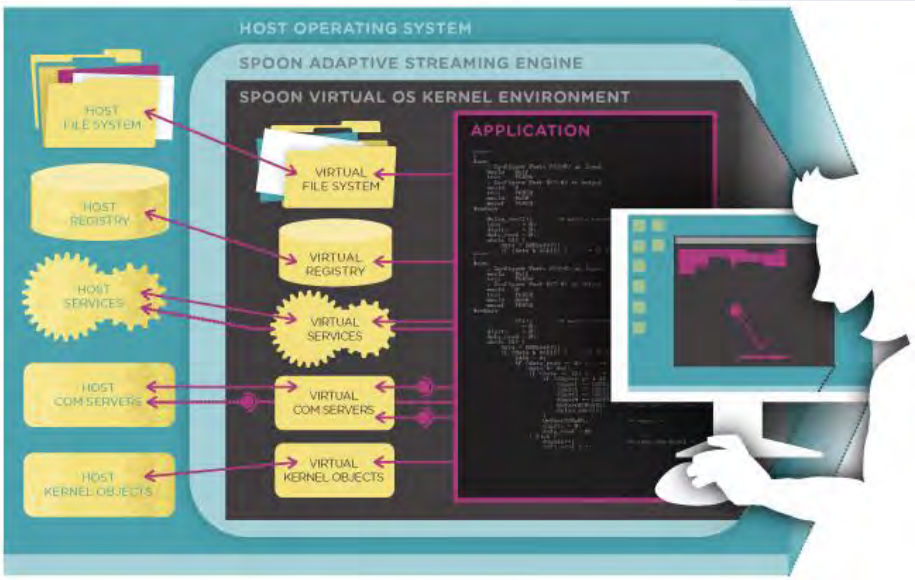
The company started in 2003 as Xenocode, but changed its name in May 2010 to Spoon. Spoon offers the technology to virtualize and stream applications across the web to deploy them efficiently to any Windows desktop.

With the change of the company name now also comes a strong focus on delivering any Windows application over the web directly to the end-user. Spoon's technology enables one-click access to applications via internal and external websites and the desktop. This makes the Spoon technology ideal for software publishers to distribute their products directly to end-users without intervention of the normal distribution channels. A good example is Autodesk deploying its Inventor Fusion Technology Preview software using the Spoon technology.

Application virtualization and adaptive streaming

The core of the company's virtualization technology is the Spoon virtual machine (VM) kernel. The Spoon VM Kernel is a user-mode virtualization solution able to run applications without client installations or administrative privileges requirements for the user. The kernel is a

compact implementation of Windows operating system APIs, including the file system, registry, process, and threading subsystems, completely implemented within the user mode space.



Based on the behavior of the user, Spoon's streaming technology transfers application components in the background. Spoon streaming works over HTTP and works with web-servers, Content Distribution Networks (CDNs) and desktop management solutions. More information about the streaming technology can be found here: http://spoon.net/Server/Spoon-Streaming-White-Paper.pdf

Spoon Studio

Spoon Studio is the software used to enable virtualization of Windows applications. Spoon Studio comes in three editions which basically differ in the usage focused on deployment of virtual applications by means of the Spoon Server or standalone executables.

Spoon Server

Spoon application streaming is powered by the Spoon Server which streams the virtual application to the end user via HTTP. The Spoon Server offers its own application portal or can be used in combination with existing web portals like Microsoft SharePoint, IBM WebSphere or just by adding HTML code a custom webpage. Besides, managing applications, users, groups and their rights, Spoon Server allows for detailed analytics, all from a single web interface.

Spoon Browser Plugin

Spoon web delivery uses a small browser plugin that integrates Spoon streaming and virtualization functionality directly into the user's web browser. The plugin takes only a few seconds to configure, does not require any browser restart, and can be installed without administrative privileges on the desktop.

Novell ZENworks Application Virtualization

Spoon has licensed their virtualization technology to Novell which uses it in its ZENworks Application Virtualization software.

8.8 SYMANTEC ENDPOINT VIRTUALIZATION SUITE

Symantec Endpoint Virtualization Suite (EVS) contains both a streaming product, Workspace Streaming, and a virtualization product, Workspace Virtualization. They may be used together or independently, providing great flexibility for customers. If only the virtualization is desired, any delivery mechanism may be used, from a USB stick to a full blown system management suite from ANY vendor. The streaming product may be used to stream virtualized applications (from Symantec and others), or even existing MSI packages.

The Kernel Driver Advantage

One of the greatest strengths of Symantec's solutions is that the technology uses kernel level drivers, allowing applications to behave completely normally and as designed, regardless of their complexity or dependence on other applications. In fact, the operating system, as well as all management and security tools, will interact with Symantec virtualized and streamed applications exactly as if they were normally installed. Services and device drivers are also fully supported with this approach. Unless otherwise specified, applications will behave and interact with the operating system and other applications as designed, with no effort required to "link" or "un-bubble" them (even for different versions of the same application). For the occasional situation where applications must be isolated, or hidden from the OS or other apps, in order to work properly, or not cause problems, like running multiple versions of Java, various levels of isolation may be set or changed at any time; there is no need to re-package to change the application behavior. And packaging is usually as simple as installing the application, and may even be done on production machines that are not "clean", allowing almost anyone to start creating packages with little or no training.

Full License Management

Symantec Workspace Streaming includes full enterprise-ready and real-time license management. With each streamed application, the license agreement may be captured in all its detail, including type (user/host/concurrent), quantity, and expiration, to insure license compliance for all circumstances. Also included are a host of additional controls to improve user flexibility and license cost optimization, like online/offline streaming, offline only if streaming to a laptop, automatic re-harvesting after a specified idle time, and full directory integration for provisioning at the user and group level. There are three options when provisioning applications to optimize access and utilization: 1) automatically stream the application in the background as soon as the individual has identified himself on a device, 2) present the icon only to preserve licenses until required for productive use, 3) list the application in the web portal only, preferred for less common applications to minimize desktop or Start Menu clutter.

Application Lifecycle Management

Applications may be rolled out, updated, version-controlled, and retired from a central web-based console. Different versions of the same applications may be delivered to specific individuals or groups as necessary, and updates may be done in the background by delivering only the delta that has changed. It is as simple to upgrade, downgrade, or even skip multiple updates by simply selecting the desired version for the individual, or by setting the default version. Applications may be provisioned with a timeout for non-use, especially useful for occasional use applications like MS Project or Visio. When these expire, the application license is returned to the pool, but the icon remains for the user if it should be needed in the future. Users may also be assigned a hard expiration date, as with temporary employees or contractors. In this case, the client-side agent forces a removal of the application AND the icon, whether the user is connected to the company network or not.

Application Streaming

Symantec Workspace Streaming (SWS) is an on-demand application distribution platform, similar to other streaming technologies in that the delivery of the application may be delayed until the user requires the application, then a small portion of the application is delivered very quickly so the user may begin using the application without waiting for a full installation. Additionally, this technology is developed to integrate or work alongside most infrastructure technologies, allowing SWS to be the application system of record across ALL compute models across the enterprise. Most companies have a mix of laptops, desktops, VDI, terminal servers, blades, etc., requiring packaging and management redundancy across these silos. This makes it difficult to optimize license costs and maintain efficient central control of applications. SWS allows applications to follow the users, regardless of their device, location, or current infrastructure.

SWS was developed for maximum scalability from the ground up, using HTTP for streaming, maximizing flexibility for users and simplifying management across the largest and most geographically distributed organizations. A simple backend/frontend server structure can be installed on a single server for small installations, or may be set up with many frontend servers distributed around the world, and all configurations support load balancing and primary/secondary failover. Proxy caching servers (hardware or software) are also supported for inexpensive scaling to branch offices on thin connections.

Since the SWS agent may be installed either as an administrative push install, or an Active-X user install, applications may be delivered and controlled on both managed systems inside an organization, and on unmanaged systems owned by employees, business partners, or even web customers. This makes it possible to provide applications on a controlled subscription basis, or even employ a departmental chargeback arrangement on a per-usage basis.

Application Virtualization

Although Symantec Workspace Virtualization (SWV) is included when you buy Workspace Streaming, it is deliberately maintained and available as an independent product for maximum flexibility. Not everyone uses Symantec's management console, and streaming is not always desirable to every device. Along with the benefits of a kernel driver, SWV packages (often referred to as layers) use two sub-layers, a read-only layer that maintains the known good base installation, and a re-writable layer that contains the changes and user customizations for that application. This makes it very simple to reset the layer instantly and at any time if there is ever a problem or a need to start over. It also makes it easy to separate and manage the user-specific portion independently if desired. Note also that the read-only layer may be mapped to many desktop instances without the need to copy it into every session, if configured to do so. Although SWV applications are completely transparent and appear to be installed normally, several levels of isolation are available at any time, if required. This is especially valuable for middleware like JVMs where a specific version is required for only a few or a single application.

Virtualizing IE6 for use on Windows 7 is rapidly becoming one of the most popular use cases for this technology because it provides the simplest and most natural way to run multiple browser versions without deploying and managing a separate XP kernel or forcing the IE6-dependent apps to run isolated in a terminal server. This technology allows complete sharing of plug-ins, both previously and subsequently installed, without any re-packaging. Of course specific versions of certain plugins may be designated if necessary. Also available is a simple whitelist plug-in that causes automatic switching of browsers only when necessary. For example, on Windows 7, most browser usage will be through the more secure and native IE8. Only when a designated application or URL is specified, a separate IE6 window will appear to run that application. If a link, app, or other website is selected from the less secure IE6 session, it automatically reverts to IE8, maintaining maximum functionality and security, without confusing the user or requiring special training.

8.9 VMware ThinApp

Run any version of virtually any application on a single operating system without conflicts. You can even run multiple versions of the same application. Plug VMware ThinApp, formerly known as Thinstall, into your existing management infrastructure and accelerate your software development and desktop deployment. Deliver and deploy applications more efficiently, more securely, and more cost-effectively with agentless application virtualization.

Eliminate Installation Conflicts with Application Virtualization

Application virtualization encapsulates the applications from the OS and each other; eliminating costly regression testing and conflicts from badly behaving applications. Just plug in an .MSI or .EXE file to deploy a virtual system environment, including registry keys, DLLs, third-party libraries, and frameworks without requiring any installation of agents or applications on the underlying operating system.

Package Once, Deploy Everywhere (Network, USB, Physical or Virtual Desktops)

Deploy virtualized applications in user mode, without administrative rights. No device drivers are installed and no registry changes are made because the entire application and its virtual OS are delivered as a single EXE file. Transparently stream large applications from a shared network drive with no server or client software to install. Upgrade or roll-back applications while they're running. The new version will execute the next time the user starts the application.

Cater to Your Mobile Workforce

Let your users run applications on virtually any computer they have access to, including kiosk and hotel PCs. They won't need to install software or device drivers and won't need admin rights. Applications run directly from portable storage devices, including Flash drives.

Improve Your Software Distribution Process

Deliver software that protects the local OS from modifications that might cause instability or breach security using your existing configuration management tools. Even restricted user accounts can safely run virtualized applications without requiring a local installation, making it much more appetizing for IT staff concerned about security.

Ease OS and Application Migrations

ThinApp agentless application virtualization eases OS migrations by enabling applications to run side by side on the same operating system. Users can continue with business as usual without disruption from problematic applications. Furthermore, if an application needs to be removed from the endpoint—it is a simple file-remove with no mess left to clean up in the system registry.

LANDesk is OEM-ing the Application Virtualization engine from VMware and has added specific functionality, such as deep integration with LANDesk Client Management Suite, to the solution.

9. APPLICATION VIRTUALIZATION 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 Application 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:

9.1 PRODUCT VERSION

Product	Version
Citrix Application Streaming, XenApp	6.0; Streaming Profiler 6.0
Endeavor Application Jukebox	8.2, Enterprise Edition in virtual isolated mode
InstallFree Bridge Suite	2.1.5.3; Bridge: 1.0.0.120
Microsoft App-V	4.6
Spoon (Former Xenocode Virtual Application Studio)	2011, Spoon Server Standard Edition
Symantec Endpoint Virtualization Suite	6.1 SP6
VMware ThinApp	4.6

9.2 FEATURE COMPARE MATRIX

	Application Virtualization solutions and features
Goal:	Detailed description of virtualization features
Requirements:	Hands-on-experience, vendor involvement
Result:	Whitepaper
Method of Execution:	Hands-on experience, read articles, communicate with vendors and discuss with colleagues

Legenda:

√ = Applicable; X = Not applicable; ~= It depends; # = under development;

A green √ or red X has nothing to do with advantage or disadvantage of a solution. It just present the availability of the functionality.

Note: It's out of scope for this whitepaper to explain the 'It depends' remarks'.

9.3 FUTURE ADDITIONS

TBD; 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)

- Conversion MSI -> Virtual Package format

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
Virtualization Characteristics									
	The Solution is capable to fully virtualize/Isolate Applications	√	√	√	√	√	√	√	
	The Solution is capable to fully Integrate Applications with local Operating System	√	X	~	X	~	~	X	
	Configurable virtualization and integration	√	X	X	X	X	√	X	
	Solution allows multiple layers of integration(Isolated/virtualized or non-isolated	X	X	X	X	X	√	X	
	Applications will operate without any chance of conflicts	~	~	√	√	√	√	√	Isolation mode = √
	Applications integrates and communicates seamless with the OS	√	X	X	X	√	X	X	App-V only Office 2010
Manageability									
	Central management platform for application delivery	√	√	√	X	√	√	√	
	The solution is usable in SaaS scenario. SPLA licensing is available; applications are on-demand streamed and delivered as a service, pay per-use.	√	√	√	X	X	√	√	
	Application is delivered in a very efficient way, quick up-and running. Stream only data which is needed to start application.	√	√	√	√	√	√	√	
	Application specific license metering, track application usage	√	X	√	X	√	√	√	
	Application Virtualization Solution license usage tracking	√	√	~	X	√	√	√	
	Role based administration	√	√	X	X	√	X	X	
	Application 'rollback'	√	√	√	√	√	√	√	
	Application 'rapid' upgrade; Application has to be shut down for upgrade	√	√	√	√	√	√	√	
	Application upgrade, centrally managed	√	√	√	√	√	√	√	
	Application upgrade while in use	√	√	√	√	√	√	√	
	Application upgrade using deltas	√	√	√	√	√	√	√	
	The Communication between server and client can be secured without additional solutions	√	√	√	~	√	√	X	
	Native integration with 2+ Client Management solutions; No difference in man-ageability, support, deployment scenario's and inventory between installed and virtualized applications.	√	X	√	√	X	X	√	

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
	Native integration with Access Gateway A/E edition and Citrix Web Interface	X	√	X	X	X	X	X	
	Pre-launch and post-exit scripting	√	√	√	√	X	√	√	
	Pre-launch and post-exit scripting, centrally managed via GUI	√	√	X	X	X	√	X	
	Determine virtual application pre-requirements	√	√	√	√	√	√	√	
	Determine virtual application pre-requirements, centrally managed	√	√	√	X	√	√	X	
	Determine virtual application pre-requirements, centrally managed via GUI	√	√	X	X	√	√	X	
	Limit application usage based on AD security groups	√	√	√	√	√	√	X	
	Limit application usage based on AD computer objects	X	X	X	√	√	√	X	
	Limit application usage based on AD OU's	X	X	X	X	√	√	X	
	Machine targeting, centrally managed	X	√	~	X	√	√	X	SCCM
	Machine targeting, application runs dependent of target OS, centrally managed	√	√	√	~	X	√	X	
	Machine targeting, application runs dependent of target OS/language/service pack, centrally managed	X	√	X	~	X	X	X	
	Application streaming source can be based on client IP-subnet	√	√	~	X	√	X	X	Group Policy Preferences + ASR
	Application streaming source can be centrally managed	X	√	√	X	√	√	√	
	Offline application usage can be time limited	√	√	√	√	√	√	√	
	File Type Association (FTA) centrally and standalone managed	√	√	√	X	√	√	X	
	File Type Association (FTA) locally managed	√	~	√	√	√	X	√	Only with Dazzle
	Support for the protocol handler MAILTO://	√	X	X	√	√	X	√	
	Support for the protocol handlers MAILTO://, FTP://, FILE://	√	X	X	√	√	X	X	
	Manageable by scripting; command-line	√	√	√	√	√	√	√	
	Manageable by API	√	√	X	√	√	√	√	
	Integration with Add or Remove programs	√	X	√	√	√	X	√	
	Group policies can never, from a security point of view, be omitted	√	√	X	√	√	X	√	
	Interoperate with roaming user profiles;	√	√	√	√	√	√	√	
	Event logging on client	#	#	√	#	√	√	#	

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
	Event logging on server	#	#	√	#	√	√	#	
Usability									
	Desktop and/or Laptop Online	√	√	√	√	√	√	√	
	Desktop and/or Laptop Offline	√	√	√	√	√	√	√	
	Microsoft Terminal Services (Remote Desktop Services) supported	√	√	√	√	√	√	√	
	Applications can run anonymous, without authentication with a directory service	√	√	√	√	X	√	√	
	No Microsoft Active Directory or NT4.0 domain required for management platform (management is key)	√	√	√	√	X	X	√	
	Usable in a Novell NDS environment	√	√	√	√	X	X	√	
	Usable in a Novell eDirectory environment	√	√	√	√	X	X	√	
	Application can run from removable storage without installing a client/agent component	X	X	X	√	√	X	√	
	Application and user preferences can run from removable storage without installing a client/agent component	X	X	X	√	√	X	X	
	Application package is portable and can be stored on and imported from removable storage	√	~	√	√	√	√	√	
	Official Support for EN localized Windows client operating systems	√	√	√	√	√	√	√	
	Official Support for EN/DE/FR/ES localized Windows client operating systems	√	√	√	√	X	X	√	
	Official Support for JP/Simple Chinese localized Windows client operating systems	√	√	√	√	X	X	√	
	URL redirection to Virtualized Internet Explorer(s); locally configured	√	X	X	√	X	X	X	
	URL redirection to Virtualized Internet Explorer(s); centrally managed	√	X	X	√	√	X	X	
Application Characteristics									
	Compression of virtual application package	√	√	√	√	√	√	√	
	Dynamic path relocation	√	√	√	√	√	√	√	
	Possible to package and deliver application with build-in kernel mode drivers	√	X	X	X	X	X	X	
	Virtualization of applications with user mode services	√	√	√	√	√	X	√	

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
	Virtualization of applications with boot time services	√	√	X	√	X	X	X	
	Virtualization of services that require privilege	√	√	√	X	X	X	X	
	Application package can be digitally signed with a certificate	X	√	X	~	X	X	~	
	Files and Registry virtualization	√	√	√	√	√	√	√	
	COM virtualization	√	√	√	√	√	√	√	
	COM+ virtualization	X	X	X	X	X	X	X	
	DCOM virtualization	X	√	√	√	√	√	√	
	Named Pipes isolation	X	√	√	√	√	√	√	
	Virtualization of fonts on desktops	√	√	√	√	√	√	√	
	Virtualization of fonts on terminal server	√	√	√	√	√	√	√	
	Communication between different application virtualization environments	√	√	√	√	√	X	√	
	Performance impact when virtualized applications communicate with each other	#	#	#	#	#	#	#	
	Side by Side(SxS) support for virtualized applications	~	X	√	√	√	√	√	
	Run application with elevated privileges(RunAs)	√	√	√	√	√	√	√	
	Compatible with Windows Vista User Account Control	√	√	√	√	√	√	√	
	Windows long filename support	√	√	√	√	√	√	√	
	Microsoft .NET framework virtualization	~	X	~	√	√	√	√	
	(Virtual) reboot during packaging supported	√	√	√	√	√	√	√	
	Terminal Server drive remapping supported	X	~	√	√	√	√	√	
	Windows Dynamic disks support	√	√	√	√	√	√	√	
	Software development kit(SDK) available	√	√	X	√	√	√	√	
	No maximum application package file size limitation	√	√	X	√	√	√	√	App-V: 4GB;
	Win16 application support on x32 platform	X	X	√	√	√	√	X	
	Win16 application support on x64 platform (Windows limitation)	X	X	X	X	X	X	X	
	Win32 application support on x64 platform	√	√	√	√	√	X	√	
	Win64 application support on x64 platform	√	X	√	X	X	X	√	

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
	MSI to virtual application package conversion with Flexera and/or Wise	√	√	√	√	X	X	X	
	MSI to virtual application package conversion build-in	X	X	X	X	X	X	~	Simple MSI apps
	Support for virtual drive letters	X	X	X	√	√	X	X	
	Support for virtualized internationalization and code pages	X	X	X	√	√	X	√	
	Support for virtual drive serial numbers	X	X	X	√	√	X	X	
	Different versions of Internet Explorer can run simultaneous on the same client	√	X	X	√	√	X	√	
	Internet Explorer 6, 7 and 9 can be virtualized and run on Win7	√	X	X	√	√	X	√	Not supported by Microsoft
	Run application in Windows compatibility mode. (eg. can use various shims in VE)	X	X	√	X	√	√	X	
	Apps are packaged and virtualized by user, User Installed Applications	X	X	X	X	X	X	X	
Architecture									
	Management platform is included	√	√	√	X	√	√	√	
	Application delivery using (streaming) HTTP/S protocol	√	√	√	X	√	√	√	
	Application updates delivered using (streaming) HTTP/S protocol	√	√	√	√	√	√	√	
	Application delivery using proprietary protocol (RTSP/s)	X	X	√	X	X	X	X	
	Application delivery using SMB	√	√	√	√	√	√	√	
	No need for client/agent installation	X	X	X	√	√	X	√	
	Virtualization with client-code in user-mode	X	X	X	√	√	X	√	
	Virtualization with client code in kernel-mode	√	√	√	X	X	√	X	
	Original Microsoft Windows APIs are used by application	√	√	√	~	~	√	~	
	Multiple concurrent client or agent versions on the same platform	X	X	X	√	√	X	√	
	Memory sharing in multi-user environment	#	#	#	√	#	#	#	
	No need for a license service	√	X	√	√	√	X	√	
	No need for a file share	√	√	√	√	~	√	√	Only needed for console
	No need for dedicated server	~	√	~	√	√	X	√	
	MSI wrapper to deploy virtualized applications with ESD	√	X	√	√	X	X	~	Virtual Apps only; not streaming
	No need for ESD infrastructure for enterprise wide deployment	√	√	√	~	√	√	√	

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
	Data store can be on: Microsoft SQL Express Edition	X	√	√	X	X	√	√	
	Data store can be on: Microsoft SQL	√	√	√	X	X	√	√	
	Data store can be on: Oracle	√	#	X	X	X	X	X	
	Data store can be on: IBM DB2	X	#	X	X	X	X	X	
	Data store can be on: MySQL	√	X	X	X	X	X	X	
	Data store is XML based	X	X	X	X	√	X	X	
	The Application package format is open and documented	√	√	√	X	X	X	X	
	The Application package format can be encrypted; native tools available	X	X	X	X	X	√	X	
	Client-side persistent cache	√	√	√	X	√	√	√	
	Support for journaling	#	#	#	√	#	#	#	
	Support for application white listing (Applocker windows7)	X	X	√	√	X	X	X	
	Block Caching by network WAN acceleration devices	√	√	√	√	#	#	#	
	Solution can integrated with Content Delivery Networks such as Akamai	√	#	#	#	#	#	#	
End user experience									
	Full Windows Explorer context menu integration	√	X	X	X	√	X	X	
	User driven application repair	√	X	√	X	√	X	X	
	Application behaves in essence the same as an installed application, apps are integrated with other applications and local OS	√	X	X	X	~	X	X	
	Performance impact	#	#	#	#	#	#	#	virtualrealitycheck.net H1-2011
	User settings are preserved between application launches	√	√	√	√	√	√	√	
	User settings can be redirected and stored on the network	√	√	√	√	√	√	√	
	User settings can be streamed between user and server	X	X	X	X	√	X	X	
	Localized client interface available, 4+ languages (EN/DE/FR/ES)	√	√	√	√	X	X	X	
	User Self Provisioning web portal	√	X	X	X	√	X	X	
	Allow EULA/Message to be displayed at virtual application startup	X	X	X	X	X	√	√	
	Allow user to easily terminate virtual environment (incl. running child processes)	X	X	X	X	X	√	X	

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
Supported Client Platforms									
	Windows NT 4 – Workstation	X	X	X	√	X	X	X	
	Windows NT 4 - Terminal Server Edition	X	X	X	√	X	X	X	
	Windows 2000 - Pro	√	X	X	√	X	X	√	
	Windows XP - Pro (SP2 and up)	√	√	√	√	√	√	√	
	Windows XP - Embedded	√	X	X	√	√	√	√	
	Windows 2000 - Server	√	X	X	√	X	X	√	
	Windows 2000 - Terminal Services	√	X	X	√	X	X	√	
	Windows 2003 - Server	√	√	√	√	√	√	√	
	Windows 2003 - Terminal Services	√	√	√	√	√	√	√	
	Windows Vista	√	√	√	√	√	√	√	
	Windows Server 2008 - Server	√	√	√	√	√	√	√	
	Windows Server 2008 - Terminal Services / Remote Desktop Services	√	√	√	√	√	√	√	
	Windows Server 2008R2 – Terminal Services / Remote Desktop Services	√	√	√	√	√	X	√	
	Windows 7	√	√	√	√	√	X	√	
	Windows 7 x64	√	√	√	√	√	X	√	
	MacOS, running Win32 applications on MacOS	X	X	X	~	X	X	X	Wine (limited)
	Linux, running Win32 applications on Linux	X	X	X	~	X	X	X	CrossOver (limited)
Licensing Model of Solution									
	Concurrent	√	√	X	√	√	√	X	
	Device	√	√	√	√	√	√	X	
	Unlimited	√	X	√	√	√	√	√	
	Per named user	~	√	√	√	√	√	√	
	Free for personal usage (FFPU)	√	X	X	X	X	√	X	
Solution in general									

Category	Functionality	Symantec EVS	Citrix XenApp	Microsoft App-V	VMware ThinApp	InstallFree Bridge	Endeavors	Spoon	Remarks
	Proven technology, the solution is being used for 2+ years in enterprise production environments. Packaged 1000+ different apps, various deployment scenarios	√	√	√	√	~	X	~	
	Varity (10+) of public available enterprise references in Europe	√	√	√	√	~	#	~	Not public available
	Varity (10+) of public available enterprise references in US	√	√	√	√	~	#	~	Not public available
	Doesn't require a clean OS during packaging process	~	X	X	~	√	X	X	
	Packager can capture only installer process	X	X	X	X	X	√	X	
	Packager can capture all processes	√	√	√	√	√	√	√	
	Possibility of creating a High Available platform; additional services needed	√	√	√	√	√	√	√	
	Load Balancing is part of the solution	X	X	X	X	X	√	X	
	Official application virtualization training classes available	√	√	√	√	√	√	√	
	Official Certification program, VUE or Prometric	X	√	√	X	X	X	X	
	Company website for delivering (demo) 50+ applications to community	X	X	X	X	X	X	√	
	Large community resource, share recipes, FAQ, discussion	√	√	√	√	X	X	X	

10. CONCLUSION

Which Application Virtualization Solution is THE best?!; Without a better understanding of the requirements in general it is impossible to give an accurate and profound answer on THE question. In essence it depends on various areas as mentioned in detail in paragraph 4.3 'Strategy'. Key areas for your Application Virtualization strategy are:

- What do you want to **achieve**?, lowering **TCO**?, **business enabler**, overall cost of ownership and **cost reducer**?
- What are the **use-cases**? And does the use-case require Application Virtualization?
- Are you investigating a **tactical** (point)-or **strategic solution**? What do you want to solve?
- What is the strategy around **Client Management**, PC life Cycle Management, solution and how does Application Virtualization fit?
- Is a Bring Your Own Computer (**BYOC**) concept one of the key **Access Scenarios**?
- What is your application delivery model? Is delivery of applications focused on **SaaS**, **Enterprise**, **SMB** or the **Consumer** space?
- Is a client- or **agentless** Application Virtualization solution required?
- Do you need to **integrate** and/or **isolate** your **applications** from each other? Do you need both functionality and how do you **manage** the application integration?
- What's your **overall Desktop Delivery strategy** model with solutions such as Laptop (Offline), Desktop (Online), VDI and Remote Desktop Services? How can Application Virtualization enhance these solutions?
- Does the Application Virtualization solution offer **shared-cache** or **cache-less** functionality? What is the use-case?
- **Bottom Line: What's your current Desktop strategy?!**

It's important to have a **Vision** and **Strategy** around Application and Desktop Delivery. Designing, building, managing and maintaining the Optimized Desktop 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:

"Application Virtualization is a solution, Application and Desktop Delivery is THE goal"



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