

# Guidelines

F o r I T M a n a g e m e n t



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## Virtual Desktop Infrastructure



Since 1966, the National Computing Centre (NCC) has been helping organisations to manage IT processes and systems development and equip people with the skills to ensure business effectiveness. We do this through a unique membership service that brings together professionals and experts to identify, create and disseminate knowledge and experience across the spectrum of IT issues.



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**One Planet Computing**

One Planet Computing is a Green IT company that helps organisations to reduce the environmental impact of IT equipment, by extending the working life of existing computers, laptops and legacy thin clients through the use of modern Virtual Desktop technologies from Microsoft, Citrix and VMware.

One Planet Computing have a range of products that can be used to reduce energy usage, reduce carbon and as a direct benefit, help you reduce day-to-day running costs.

***The Dynamo Virtual Desktop Accelerator Kit***

The Dynamo Virtual Desktop Accelerator Kit can be used to perform a quick 30 minute proof-of-concept to establish if any of the legacy equipment you own could be redeployed as a new Virtual Desktop for use with the latest technologies from Microsoft, Citrix and VMWare.

***One Planet Desktop***

One Planet Desktop is the commercially supported, enterprise version of Dynamo. It is designed to be used with Terminal Services, Remote Desktop Services, Citrix Presentation Server, XenApp, XenDesktop and VMware View.

***One Planet Computing***

If you are ready to go to a completely hosted desktop solution, the full One Planet Computing suite can be used to run a virtual office in the cloud.

These three core products can also be used as part of an organisations strategy for improving data security, reducing desktop management and patching, or as part of a larger host-desk or disaster recovery solution.

When these products are combined with a renewable energy source such as solar panels, or wind turbines One Planet Computing can help organisations deliver a low-cost, zero carbon computing environment that “self-funds” itself with the energy savings it generates.

## 1. Virtual Desktop Infrastructure

In these NCC Guidelines, we will provide an insight into the real issues and explore technical challenges and business considerations that are preventing organisations from taking that leap of faith into VDI. They will provide you with a better understanding of where you are currently and what you can do in your organisation if you are evaluating or planning adoption of VDI or desktop virtualisation.

### 1.1 Existing issues

Organisations everywhere are struggling to balance ever increasing complexity against ever decreasing budgets. Employees expect, and often need to work from anywhere, from any device.

In our 'always on' society it is very common now for employees to use personal devices such as smart-phones, net-books and home computers as part of their work arsenal.

Many consumer devices are now sold with enterprise features such as the built-in support for Exchange and Remote Desktop sessions in consumer orientated netbook devices and smart-phones such as the new generation of Android and Apple smart-phones and tablet/iPad devices.

So how do you provide a consistent, standardised desktop experience for employees who need to work with multiple devices, with multiple different form factors, connectivity options, processors and operating systems?

#### *The answer:*

**Virtualisation...** and the abstraction of the desktop from any one physical device. Logically, as everything becomes Internet-enabled, the cloud comes into play and becomes a more convenient place to host these services (once the inevitable security concerns have been highlighted and addressed).

### 1.2 Opportunity

VDI is on the wish list of most CIOs and IT Directors and has to be one of the hottest topics around at the moment. However, most of the evidence including the pulse point of the room at the NCC's recent conference – *Maintaining Service Levels with reduced budgets, November 2010...* the reality is that less than 10% of corporate enterprises have virtualised their desktop environment. So if the economic climate is tough and cost savings paramount, the technology mature enough, just what are the issues inhibiting VDI adoption?

### 1.3 New challenges

The large proportion of businesses are wrestling with this issue...

Too many customers have tried VMware and Citrix for VDI and have become disillusioned due to levels of investment required and the complexity, or because the solutions thus far are not delivered the range of functionality required by businesses for VDI to be deemed a success. While their approach may work for storage and server virtualisation the desktop presents very different challenges and must be addressed a different way.

Desktop virtualisation is not about building the 'highest spec desktops', capable of working with every USB, serial or parallel device known to man, it is about finding the lowest common denominator or 'base-build' and applying it where appropriate in the organisation, then making incremental improvements in frequently repeating 'ITIL-like' iterations.

### 1.4 The Reality

Starting out with a 100% coverage 'mother of all desktops' project is not only going to cost you your sanity, but it could also cost you £1,500 per PC if you build each virtual desktop out of high-end server components, high-end storage arrays and high-end networking components and the premium versions of vendors virtualisation products.

Why would an organisation spend £1,500 on a 1:1 high-end VDI solution (one user per OS install) that supports plug-and-play USB headsets, when a headset with a traditional headphone socket could use a standard 'Terminal Services' solution that could support a user ratio of 150:1 or more (one hundred and fifty users per OS install). Or why not just stick with a conventional £500 PC?

*'So if the economic climate is tough and cost savings paramount, the technology mature enough, just what are the issues inhibiting VDI adoption?'*

The reality is that leading edge technology implementations look better on CVs than they do on the balance sheet. The irony is that the organisations and IT Directors' who have the best chance of surviving the downturn, are likely to be the ones who take a more pragmatic approach to the virtual desktop, instead of trying to spend their way through it.

## 2. Players, products, devices and technologies

### 2.1 Types of virtualisation

#### **Server Virtualisation**

Server virtualisation encompasses all products that allow you to run one or more virtual machines on one physical 'host' server. Although these products can host desktop operating systems as guests, as well as server operating systems as guests, they do not contain any special features relating to the desktop. Many of the newer desktop virtualisation products are based on these server based hypervisors, but with additional features and components for managing multiple images and improving multimedia performance for desktop users.

Products that fall into this category are:

- Microsoft Hyper-V
- VMware ESX and vSphere
- Citrix XenServer
- Red Hat Virtualisation (based on KVM)

#### **Server Based Computing (many to one)**

Server Based Computing encompasses all products that allow one or more virtual desktop sessions from a single operating system image. Each user will 'generally' receive a standardised desktop, technically much the same as every other user on the system.

This solution offers only basic customisation and support for plug-and-play devices, but costs significantly less and has much higher user densities per server, and lower storage costs than VDI (Virtual Desktop Infrastructure).

Products that fall into this category are:

- Microsoft Terminal Services 2000/2003/2003-R2
- Microsoft Remote Desktop Services 2008-2008-R2
- Citrix Presentation Server
- Citrix XenApp

#### **Virtualisation Desktop Infrastructure (one to one)**

Desktop virtualisation encompasses all products that allow multiple, individual desktops to be delivered from a single host. Generally this will be a single virtualisation server hosting multiple guests running a desktop OS such as Windows XP, Vista or 7. Each guest can be customised and configured independently of each other guest.

This solution offers the most customisation, flexibility and support for plug-and-play devices but costs significantly more and has much lower user densities per server, and higher storage costs than SBC (Server Based Computing).

Products that fall into this category are:

- Microsoft VDI on Hyper-V
- Citrix XenDesktop on XenServer
- VMware View on vSphere
- Red Hat RHEVD on Red Hat KVM

*'The reality is that leading edge technology implementations look better on CVs than they do on the balance sheet'*

**Table of VDI categories and products**

The following table shows which products fall into each category:

Vendor	Hypervisor	SBC	VDI
Microsoft	Hyper-V	Terminal Services, Remote Desktop Services	Windows guest on Hyper-V
Citrix	Xen	Presentation Server, XenApp	XenDesktop
VMware	vSphere		VMware View
Red Hat	KVM		RH Enterprise VD

**2.2 Players****Microsoft**

Microsoft has been in the desktop business for 25 years, and first got into SBC (Server Based Computing) with Windows NT 4 Terminal Server. This was closely followed by Terminal Services 2000/2003/2003-R2, and the newer RDS (Remote Desktop Services) found in Server 2008 and 2008-R2. Microsoft also have a new range of 1:1 desktop virtualisation products based on the Hyper-V hypervisor platform.

**Citrix**

To many people the work 'Citrix' is synonymous with SBC (Server Based Computing) and remote access technologies. Citrix licenced its technology to Microsoft to help them build NT Terminal Services. To this day you must still buy a Terminal Services CAL (Client Access Licence) as well as a Citrix licence in order to use Citrix.

**VMware**

For many, VMware created the virtualisation market and pioneered the use of a hypervisor on the x86 and x64 PC platform (It had been around on mainframes for years but had never really taken off on the standard PC). VMware had products aimed at server virtualisation such as ESX and vSphere, but extended this offering with a specific desktop virtualisation product called VMware View, which some people still refer to as VDI or Virtual Desktop Infrastructure.

**Red Hat**

Red Hat have provided various virtualisation solutions in the past as part of RHEL (Red Hat Enterprise Linux), but now have a desktop specific product called 'Red Hat Enterprise Virtualisation for Desktops'. RHEVD incorporates the new multi-tiered SPICE protocol.

**2.3 Products**

Here is what the vendors have to say about their products: *Source: Vendors websites*

**Microsoft – Remote Desktop Services**

Accelerate and extend desktop and application deployments from the datacentre to any device with Remote Desktop Services (RDS), one of the core virtualisation technologies available in Windows Server 2008 R2. In addition to the traditional session virtualisation scenario (formerly known as 'Terminal Services'), Remote Desktop Services has expanded its role to provide an extensible platform for a Virtual Desktop Infrastructure (VDI).

New in Windows 7 and Windows Server 2008 R2 Service Pack 1 Release Candidate, Microsoft RemoteFX introduces a fresh set of remote user experience capabilities that enable a media-rich user environment for virtual desktops and applications accessed from a broad range of client devices, improving remote worker productivity.

**Citrix – XenApp**

Citrix XenApp 6 introduces new enhancements for advanced management and scalability, a rich multimedia experience over any network and self-service applications with universal device support from PC to Mac to smart-phone. With full support for Windows Server® 2008 R2 and seamless integration with Microsoft® App-V, XenApp 6 provides session and application virtualisation technologies that make it easy for customers to centrally manage applications

using any combination of local and hosted delivery to best fit their unique requirements.

#### ***Citrix – XenDesktop***

Windows desktops and applications of all kinds are delivered as a service which can be accessed from any location using any device. Citrix HDX technology ensures a high-quality experience in any network scenario, while Citrix XenClient enables offline desktop virtualisation. Citrix FlexCast delivery technology addresses the full range of user requirements through a single solution. An open, scalable architecture allows seamless integration with current and future investments.

#### ***VMware View***

VMware View™ gives you the ability to deliver desktops from the datacentre as a secure, managed service. Built on VMware vSphere™ for desktops.

#### ***Red Hat – Enterprise Virtualisation for Desktops***

With Red Hat Enterprise virtualisation for desktops, complete desktop environments are hosted as virtual desktops on servers located in a centralised datacentre. Users connect to these virtual desktops using either inexpensive thin clients or re-purposed PCs.

### **2.4 Devices**

#### ***Fat Client***

A 'Fat Client' in the virtualisation sense is a client with large amounts of processing power, memory, storage and network bandwidth. Users can run and install local applications and customise settings themselves. A traditional PC which can run local and remote applications concurrently.

Fat clients have a full desktop operating system installed locally such as Windows XP, Vista or 7. Applications are installed, patched and updated individually on each device.

Fat Clients use the most energy and have lots of moving parts such as hard-drives, CD/DVD drives and case fans which are prone to mechanical failure.

Fat Clients are often just standard desktop PCs with a Remote Desktop client, Citrix client or VMware View client installed on top of a standard copy of Windows.

#### ***Overweight Client***

An 'Overweight Client' in the virtualisation sense is a client with large amounts of processing power, memory, storage and network bandwidth. Users cannot run or install local applications or customise settings themselves and are 'locked-down' so they can only use preconfigured sessions to SBC or VDI servers.

Overweight clients have a full desktop operating system installed locally such as Windows XP, Vista or 7 which is heavily locked down through group policy or other management tools, or run an internally customised version of Windows Embedded.

These Windows images, or Windows Embedded images are all maintained and customised by the organisations internal IT department.

Overweight Clients still use a large amount of energy (when compared to thin clients and zero clients) and still have lots of moving parts such as hard-drives, CD/DVD drives and case fans which are prone to mechanical failure.

Overweight Clients are often just standard desktop PCs with a Remote Desktop client, Citrix client or VMware View client installed on top of a standard copy of Windows or Windows Embedded which has been heavily locked-down.

#### ***Thin Client***

A 'Thin Client' in the virtualisation sense is a client with a minimal amount of processing power, memory and storage. Users cannot run or install local applications or customise settings themselves and are 'locked-down' so they can only use preconfigured sessions to SBC or VDI servers.

Thin clients usually have a custom thin client operating system installed locally such as Windows CE, Windows XP Embedded or a custom Linux based OS. These

thin client images are all maintained and updated by the organisations internal IT department.

Thin Clients only use a small amount of energy and have little or no moving parts such as hard-drives, CD/DVD drives and case fans which are prone to mechanical failure.

Thin Clients are often purpose built, compact, low-power devices with a Remote Desktop client, Citrix client or VMware View client installed on top of a customised version of Windows CE, Windows XP Embedded or a custom Linux based OS, which has been heavily locked-down.

#### **Zero Client**

A 'Zero Client' in the virtualisation sense is a client with a minimal amount of processing power, memory and no local storage. Users cannot run or install local applications or customise settings themselves and are 'locked-down' so they can only use preconfigured sessions to SBC or VDI servers.

Zero clients usually have no operating system installed locally and boot up over the network via PXE network boot in a matter of seconds and from there on run completely stateless from a secure, read-only operating system in RAM.

These PXE zero client images are stored centrally on TFTP servers and updated by the organisations internal IT department.

Zero Clients only use a small amount of energy and have little or no moving parts such as hard-drives, CD/DVD drives and case fans which are prone to mechanical failure.

Zero Clients are often purpose built, compact, low-power devices with a Remote Desktop client, Citrix client or VMware View client, although it is possible to re-purpose desktop PCs, laptops and legacy Thin Client devices by removing or disabling local storage and changing the BIOS boot sequence to use PXE network boot.

Zero Client devices require the least management of any device and can pay for themselves quite quickly in energy savings alone.

## **2.5 Technologies**

To improve the multimedia performance and support for plug-and-play devices on virtual desktops, several protocols and multimedia enhancements have been developed by vendors.

#### ***RDP – Remote Desktop Protocol***

RDP is a propriety protocol developed by Microsoft that is supported by almost all vendors and technologies. It is the lowest common denominator that can be almost guaranteed to work on any implementation, by any vendor.

The reason for this is three-fold:

- 1 Most vendors support the RDP protocol.
- 2 Every version of Windows since Windows 2000 supports RDP just by enabling the 'Remote Desktop' service from within windows on the guest machine.
- 3 Citrix is built on top of Terminal Services, which uses RDP natively.

RDP may not have all of the enhanced features supported by other protocols, but it is still the most widespread protocol available for accessing desktops remotely.

#### ***ICA – Independent Client Architecture***

ICA is the protocol Citrix uses natively in Presentation Server and XenApp/ XenDesktop. It has several improvement over RDP including better performance and end-user feedback when working over slower network connections, and better support for USB plug and play devices than standard RDP.

#### ***Teradici – PC over IP***

The Teradici protocol is used natively in VMware View as a complete PC-over-IP solution. Teradici promises superior multimedia performance over multiple

monitors and full pass-through support to the server for peripherals and plug-and-play devices presented at the client device.

Other similar software solutions also exist such as RemoteFx, Citrix HDX and Wyse TCX offer similar functionality but it is a very fragmented market which can be product, platform or vendor specific, and quite often it can be a minefield of additional licencing costs, additional device costs and vendor lockin.

### **SPICE – Simple Protocol for Independent Computing Environments**

SPICE is an open source, adaptive remote rendering protocol used by Red Hat Enterprise Virtualisation for Desktops.

Unlike first-generation remote rendering protocols such as RDP and ICA, SPICE features a multi-tiered architecture that adapts to the bandwidth and processing power of each device dynamically.

Spice consists of three parts:

- 1 **SPICE Driver:** A software driver that is installed on each virtual desktop guest.
- 2 **SPICE Device:** A software component that resides within the Red Hat Enterprise Virtualisation Hypervisor server itself.
- 3 **SPICE Client:** A software client that resides on the endpoint device, either a thin client or a re-purposed PC.

### **3. Virtualising and centralising**

The reality for most organisations is a desktop and application transformation that simply lifts the computing environment away from the device. Virtualising and centralising needs to be at the heart of any IT strategy, allowing the organisation to deliver software and desktops as a service.

#### **3.1 Why would an organisation want to virtualise the desktop?**

There are many different reasons. The most common goals are:

- Improving the desktop experience
- Improving application compatibility
- Improving data security and governance
- Improving service scalability and reliability
- Managing software and hardware upgrades
- Managing ever decreasing budgets
- Reducing complexity
- Reducing Capital Expenditure
- Reducing Operational Expenditure
- Reducing the amount of time spent managing desktops
- Enabling an improved flexible working solution
- Enabling an improved disaster recovery solution
- Enabling Green IT and responsible low-carbon computing

We provide a short summary of each of these areas before beginning a more detailed breakdown of how VDI could be used in your own organisation.

#### **3.2 Improving the desktop experience**

Whilst some people may view a Virtual Desktop Infrastructure as a step backwards that will result in a lower performance desktop with sluggish screen updates and lots of complaints to the helpdesk, in all but a few very specific cases the opposite is true.

*‘Virtualising and centralising needs to be at the heart of any IT strategy, allowing the organisation to deliver software and desktops as a service’*

**Server-class hardware**

It should not come as a surprise to anyone that servers contain server-class hardware? Server processors contain massive amounts of Level 1 and Level 2 cache (when compared to standard desktop processors), and high speed interconnections between processors and cores.

Server disk arrays are usually built from multiple 15,000 RPM drives connected to RAID controllers with hundreds of megabytes, and sometimes gigabytes of cache RAM.

Server memory is often provisioned in 4Gb chunks these days, and it is not uncommon to see servers with 16Gb, 32Gb or even 64Gb of RAM being deployed in virtual environments (as they have usually replaced 8-10 older servers).

**Questions:**

- 1 How long do you think it will take a server with 16 64-bit processor cores to load winword.exe of a local storage array built from 15k drives or a fibre channel SAN?
- 2 More time or less time than the Pentium 4 with a 5400 RPM IDE drive that your users might be using now?
- 3 How often do you users actually launch winword.exe, or Outlook, or Excel, or PowerPoint each day? (Or do they launch it once and leave it open all day?)

**Shared Memory**

One server with 16Gb of RAM does not equal four virtual desktops each with 4Gb of RAM.

Almost all virtualisation solutions now include the concept of shared-memory or memory-ballooning, where multiple different virtual machines all share the same read-only copy of DLLs or application in memory. So although you might provision a machine with 4Gb of virtual memory, once the first operating system has loaded everything into memory each subsequent machine or session started might only actually be consuming another 128-256 Mb RAM.

So the more standardised your desktops and applications are, the higher the ratio of users you can achieve per server should be.

The chances are that the next time one of your users tries to load winword.exe the server will never actually get as far as making a disk read as the file will already be:

- Already loaded in processor cache
- Already loaded in system RAM
- Already in the RAID controller cache

That is not to say that a fast disk subsystem is not important, just that most people make assumptions and focus on the wrong issue, which often turns out to be a non-issue.

**HINT:** Try putting your swapfile on a dedicated disk, or on an internal SSD device (Solid State Disk) and see what happens to performance.

***We've already tried Citrix and we didn't like it***

This is a very common story, and probably the biggest misconception surrounding what VDI is and how it works.

A modern VDI infrastructure is nothing like using Terminal Service or Citrix session over a dial-up connection or the high-latency WAN/ISDN connections of old.

**HINT:** A modern VDI solution only streams video, and mouse and keyboard events for the majority of the time. Opening a 100Mb PowerPoint or 1Gb Access database does not drag 100Mb or 1Gb over the network every time a large file is opened. In this sense a VDI solution actually lowers network bandwidth usage, and could even provide a reason not to upgrade network infrastructure and cabling. With VDI solutions typically only needing anywhere between 30Kb/s and 150Kb/s of bandwidth per second (kilobits), a switched 100Mb/s (megabits) network connection is more than adequate for all but the most intensive environments.

#### ***I'll need hundreds of servers***

This is simply not true, and goes back to the days when people assumed that issues around the number of users a server could support were related to processing power alone, when in reality network latency would be the real culprit long before the server ran out of processing power.

**HINT:** Measure how much bandwidth your terminal server or Citrix server is using over a WAN, VPN or MPLS connection when fully loaded. If the bandwidth never reaches full capacity, then try copying a large file from one server to another over the connection. If the file copy is able to utilise all of the bandwidth, but your remote sessions cannot then your issue is with latency, not bandwidth or the server. Spending money on 'fatter pipes' will not fix your problem, but a WAN accelerator such as a WANScaler/Branch Repeater, Riverbed or PacketShaper might.

*'The Wikileaks exposure shows how easily a quarter of a million documents could be stolen and published without the Pentagon noticing until after the announcements were made'*

### **3.3 Improving application compatibility**

Most VDI solutions now also include an application virtualisation component. These solutions allow a complete application to be virtualised and delivered to a traditional PC, laptop or VDI device over the network or from a file share. When you combine VDI desktops with application streaming you have a very powerful set of capabilities at your disposal. Once you have a working VDI solution, application streaming is the next logical step (unless you are absolutely sure that you have the necessary skills and experience in house to manage both concurrently).

### **3.4 Improving data security and governance**

It seems that every day we hear something new about organisations losing personally identifiable information or financially sensitive information. Information Security is now a hot-topic for organisations wanting to avoid the PR nightmare of a security breach, or the large fines that can be imposed on organisations who do not take Information Security seriously.

#### ***Information security***

How do you get back information that has been stolen or published without your consent?

The Wikileaks exposure shows how easily a quarter of a million documents could be stolen and published without the Pentagon noticing until after the announcements were made.

Most criminals or disgruntled employees would not advertise the theft of sensitive information and the first thing you would know about it would be after a serious breach had already occurred, or the information had already been disclosed (or as is increasingly common, sold to a competitor).

#### ***Data Protection Act***

New powers under the Data Protection Act allow for fines of up to £500,000 for each breach where negligence can be shown on the part of the organisation.

'The Data Protection Act 1998 is a United Kingdom Act of Parliament which defines UK law on the processing of data on identifiable living people. It is the main piece of legislation that governs the protection of personal data in the UK'

Previously fines were limited to a few thousand pounds and most organisations did not take them seriously as the cost of complying was sometimes higher than the fine itself. Obviously the goal posts have moved and most organisations

cannot afford to 'wait and see' now that the fines have been increased to half a million pounds (per incident).

#### **PCI DSS**

The Payment Card Industry (PCI) also have strict legislation regarding the storage of financial information.

Failing to meet PCI DSS criteria means that the ability to store credit card information or take payments from credit cards and debit cards can be withdrawn.

Most modern businesses could not survive without being able to accept electronic payments.

**NOTE:** If you can employ 'thin client' or 'zero client' devices in your organisation there is nothing on the desktop to steal or lose. If you can employ a purely 'zero client' model in sensitive areas of your business you could potentially sidestep the whole 'local storage' issue altogether.

### **3.5 Improving service scalability and reliability...**

#### ***How do we make sure that the services is scalable?***

Most modern VDI solutions incorporate some form of load balancing technology, so although it is quite possible to run in the region of 150-200 desktops per SBC server, or 30-40 desktops per VDI server once these load-balancing and server-farm technologies are used the solution can easily scale into tens of thousands of users.

#### ***How does a hypervisor help?***

A hypervisor helps by consolidating processing power, memory, storage and network resources, but more importantly it abstracts the physical hardware away from the operating system installation meaning that virtual machines can easily be moved or upgraded across multiple different types of hardware, seamlessly.

#### ***What about reliability enhancements like HA, V-Motion and DRS?***

Although HA, V-Motion and DRS are names for VMware technology each vendor has equivalents but these original terms are used interchangeably with virtualisation professionals.

**HA – High Availability.** The ability to restart a virtual machine on a different server if the guest operating system stops responding. HA forces a hard-reboot and does not shut-down gracefully (but only does so when the guest has stopped responding altogether to 'heartbeats' and has effectively crashed anyway).

**V-Motion – Virtual Motion.** The ability to move a running guest from one host server to another host seamlessly, without a restart, or any noticeable interruption during the move. V-motion requires that the virtual machine images files are stored on a shared storage device such as SAN or iSCSI (in order for the old host and new host to transfer ownership of the guest). V-Motion is usually invoked manually.

**DRS – Distributed Resource Scheduling/Scheduler.** DRS automatically moves guests from one host to another based on server load. It does this dynamically and is normally invoked automatically based on pre-defined policies on the management server.

**NOTE:** DRS can be used to automate the movement of guests onto a few hosts during periods of low activity. This allows other under-utilised hosts to be shut-down to save energy in the form of power and air conditioning to support a 'green datacentre'. These hosts are automatically powered up again when load increases and DRS distributes the load evenly again.

#### ***How do you clone/replicate machines?***

Most VDI solutions include some form of cloning or templating of machines. VMware view and XenDesktop also include tools to generate new instances in real-time from a 'master' image.

*'Most modern businesses could not survive without being able to accept electronic payments'*

**How do you recover machines?**

Individual machines can be recovered or restarted with technologies such as HA and V-Motion. Whole sites can be migrated or recovered in a disaster recovery situation with add-on components such as VMware SRM (Site Recovery Manager)

**How does it work over WAN and LES connections?**

Almost all virtualisation product on the market today are designed to run in low-bandwidth environments. The more expensive products and hardware devices are also able to run in low-bandwidth and high-latency environments.

In very high latency environments a hybrid solution can be deployed where a dedicated server can be placed in a branch offices to which applications can be streamed from a central server at head office, delivering a combination of both local and remote processing.

**How does it work over broadband connections?**

Broadband connections have improved greatly over the past few years, and solutions designed to work on low-speed dial-up and ISDN connections work perfectly well on ADSL and cable internet connections.

Where a connection with low bandwidth and high latency is encountered it makes sense to lower the overall experience using one or more of the following options:

- Lowering the colour depth to 16-bit or 15-bit colour (or even 8-bit colour with a private colour map)
- Disabling redirection of local storage devices and USB storage devices
- Disabling or lowering the quality of redirected sound
- Disabling desktop effects, backgrounds and window decorations
- Lowering screen resolution to 1280x1024 or 1024x768

What types of Load balancing and fail over are available?

Almost all modern VDI technologies employ some form of load balancing technology and the concept of server 'farms' or 'pools'.

These software solutions can also be combined with DNS based load balancing solutions and dedicated hardware or software load-balancers.

**3.6 Managing software and hardware upgrades**

Mainstream support for Windows XP ended in April 2009. Many organisations are now looking to upgrade to Windows 7 but are finding it hard to justify scrapping old computers and buying new ones that are capable of running Windows Vista or Windows 7.

If you are considering a migration from Windows XP to Vista or Windows 7 here are the official 'Minimum systems requirements'.

**Windows XP**

Pentium 233-megahertz (MHz) processor or faster (300MHz is recommended)

At least 64 megabytes (MB) of RAM (128MB is recommended)

At least 1.5 gigabytes (GB) of available space on the hard disk

**Windows Vista and Windows 7**

1 gigahertz (GHz) or faster 32-bit (x86) or 64-bit (x64) processor

1 gigabyte (GB) RAM (32-bit) or 2 GB RAM (64-bit)

16GB available hard disk space (32-bit) or 20GB (64-bit)

DirectX 9 graphics device with WDDM 1.0 or higher driver

Although no sensible IT department would ever try and run computers on bare minimum requirements, what the official specifications reveal is that the

requirements have increased to between four and 10 times what they were previously.

For most companies, this means having to scrap old computers, and buy new ones if the 'software upgrade' is not to become a 'performance downgrade'.

#### **Time and effort**

It should not be underestimated how much time and effort is required to test and deploy a new operating system on hardware it was not designed to run on. Historically, IT departments would simply buy a new computer with the new operating system already installed.

Now that budget reductions and spending reviews are happening, the rip-and-replace mentality of old is no longer acceptable to most businesses, and new ways need to be found to keep computers running the right mix of software, at a price the business is willing to pay.

#### **64bit Computing**

Modern software is written with the assumption that organisations are moving to new computers and laptops fitted with 64bit processors. A computer with a 32bit processor cannot run a 64bit operating system, or 64bit applications under normal circumstances. Desktop Virtualisation can be used to allow a 32bit computer to run 64bit software without making any expensive hardware modifications or upgrades.

**NOTE:** A good way to minimise the number of software and hardware upgrades you have to perform is just to eliminate them altogether for the next 5-10 years by deploying a VDI infrastructure with 'thin clients' or 'zero clients'. It really could be that simple, and could buy you some additional time and breathing space until budgets and investment levels in IT return to normal.

### **3.7 Managing ever decreasing budgets**

In these difficult times managing budgets has become a top priority. It is all too easy to look at cancelling projects and making redundancies before actually getting into the finer detail about which areas of expenditure are delivering real business value, and which are just consuming budget for little or no tangible benefit.

The IT department is traditionally the first casualty of such budget cuts, as at first glance the IT department does not seem to generate any income (although this is 'technically' true, without the IT department none of the other departments would be able to generate, or indeed collect any income).

#### **Running costs**

It now costs more to run a computer, than to buy a computer.

Depending on the make and model of computers that you use, and the working habits of your staff, you could save between £40 and £120 per year, per PC if you manage the energy usage intelligently. Many organisations have deployed software to automatically shut computers down at a certain time every night, but this is only part of the solution.

Most staff do not work non-stop between 9:00am and 7:00pm each evening, they have internal meetings, external meetings, travelling time, telephone conversations and lunch breaks. Blanket policies that shut down computers at a specific time of day are only a partial solution. Real-time dynamic power savings and individual shut-downs based on actual usage are the key to energy efficiency, and reducing overheads. Unlike a traditional desktop, VDI solutions allow you to automatically power-off a device after a set amount of inactivity, without losing information (as the session is still running on the server)

#### **Replacement costs**

In the past organisations would replace IT equipment every three years. For many this has now become four to five years as IT departments are being asked to 'sweat their assets'. Typically the issues around this are the gradual slow-down of systems struggling to cope and a general sense of discomfort and frustration from other employees.

*'Now that budget reductions and spending reviews are happening, the rip-and-replace mentality of old is no longer acceptable to most businesses, and new ways need to be found to keep computers running the right mix of software, at a price the business is willing to pay'*

*'Most of the perceived hurdles focus on the complexity in realising the benefits from VDI, although in practice VDI actually simplifies the desktop estate'*

### 3.8 Reducing complexity

Some IT departments have become worried about the high-end components that make up a modern VDI infrastructure. Most of the perceived hurdles focus on the complexity in realising the benefits from VDI, although in practice VDI actually simplifies the desktop estate.

#### **Consider this:**

What if you could replace a large number of simple unreliable pieces that are scattered across your organisation with a small number of complex, but highly reliable pieces of infrastructure that are located in a central place, and managed with a single set of tools. Would you do it?

#### **This is promise that VDI makes good on**

Sure, some parts of the solution are more complex than others, but an enterprise class storage array or SAN hosted in the datacentre is much easier to manage than thousands of commodity IDE or SATA hard-drives spread across the country, or the globe.

To take this a step further, an Enterprise SAN would have built-in monitoring, alerting and redundant components, and is very unlikely to be put in a laptop bag and dropped on the floor, left in the back of a taxi or train, or have a cup of coffee knocked over it or be stolen without anyone noticing.

Virtualisation actually takes the important pieces of your infrastructure and keeps them safe and secure in the datacentre, therefore reducing complexity.

### 3.9 Reducing Capital Expenditure

Every few years most organisations will perform a desktop refresh and replace some of the older computers with new computers.

#### **Refresh cycles**

It was not uncommon only a few years ago to replace every computer or laptop every three years. This normally happened because organisations would often amortise or 'write-off' the cost of computer equipment over three years. Once the three years were up, and new computer or laptop could be bought and the process started again.

In the current financial climate these desktop refresh cycles are often extended to four or five year interval in order to keep costs down.

Server Based Computing and Virtual Desktops can extend this cycle even further and offer another five to 10 years of useful working life to the equipment you already own. This could save most organisations between £400 and £600 per PC, just in purchase costs alone.

#### **Configuration**

Once this equipment has been purchased, most organisations will then spend additional time and money customising and configuring each new PC before it can be deployed. All of this takes time and resources and in some cases involve the physical transportation of the device from one location to another.

#### **Deployment**

In larger organisations some IT departments completely erase and overwrite the existing operating system and applications on the computer and replace it with a corporate 'image' that is tested and tweaked by the IT department to try and standardise all of the computers in an organisation.

Server Based Computing and Virtual Desktops can eliminate the need to pre-configure or pre-image devices at one location before transportation of the end users desk.

It can also deliver a standard, consistent desktop experience across each device without having to repeat each process manually on each device the end user will work on.

### 3.10 Reducing Operational Expenditure

It now cost more to run a PC, than to buy a PC, and as energy prices continue to rise, it looks like it could get even more expensive in the future.

**Keeping the lights on**

On average, organisations in the UK spend £3,000 per year providing, configuring and supporting each desktop PC or laptop they own. Source: National Computing Centre, *Benchmark of IT Spending 2010*.

Security updates, software patches and application upgrades all take time, and the more devices you have to manage the more time and effort you need to consume, just to 'keep the lights on'. And by 'keep the lights on' we mean, keep the computer doing exactly the same as it did the day before.

All of this time and effort provides no actual benefit to the business, it is just house-keeping and maintenance.

Server Based Computing and Virtual Desktops allow organisations to patch hundreds of desktops at once centrally, reducing this wasted time and effort to a bare minimum.

**Energy costs**

Depending on the model of computer you use, it could be costing up to £120 per year to run. Add a monitor and this could easily add up to £200 per year.

**Energy savings**

Because most staff are only actually working at the computer for 15-40 hours a week once meetings, travelling time, telephone conversations and breaks are taken into account this can lead to computers wasting up to 150 hours of electricity a week.

If you can intelligently manage this and eliminate the wasted energy, you could save between £40 and £120 per year, per device.

*'Server Based Computing and Virtual Desktops allow organisations to patch hundreds of desktops at once centrally'*

**3.11 Reducing the amount of time spent managing desktops****Reducing complexity**

When your operating system and all of your applications are stored and configured in a central location, the amount of time spent installing, configuring patching and upgrading desktops is greatly reduced. As you move down the stack from a Fat PC, Overweight PC, Thin Client then Zero Client the complexity of the hardware and the skills necessary to deploy them is also significantly reduced.

**Stateless devices**

As devices desktop devices become simpler and any local storage devices with mechanical parts are removed the devices themselves become less likely to break as they contain little or no moving parts and are completely 'stateless'.

These stateless devices can load a complete operating system and any configuration settings in a matter of seconds and can quite easily present the user with a login screen within 15 seconds or less from a 'cold start'.

As these devices do not hold any local operating system, applications or configuration settings, all support tasks can be done remotely, reducing the number of site visits or desk-side visits required when compared to a traditional Fat PC model.

**3.12 Enabling flexible working solution****Hot-desking**

Another additional benefit of Server Based Computing and Virtual Desktops is the ability to hot-desk. Some organisations have been able to reduce the number of offices and physical desks by a third (without affecting staff), once hot-desking has been introduced.

Most businesses do not have 100% desk occupation, a 100% percent of the time so hot-desking makes perfect sense for them, and reduces office overheads.

**Branch offices**

Server Based Computing and Virtual Desktops also make it easy to move between offices seamlessly. It can also enable branch offices to have access to the same applications, databases and ERP/CRM systems as everybody else at the head office, without costly infrastructure upgrades.

**Home working**

Server Based Computing and Virtual Desktops also make it easy to move between corporate offices and home offices seamlessly.

**3.13 Enabling an improved disaster recovery solution**

'Disaster recovery is the process, policies and procedures related to preparing for recovery or continuation of technology infrastructure critical to an organisation after a natural or human-induced disaster'

**Disaster Recovery**

IT departments will often have to dedicate a significant portion of their budget to the provision of 'redundant systems'. In most cases 'redundancy' means buy twice as much of everything that is important, just to be sure.

As the name suggests, these systems are sat idle (sometimes for years on end) just waiting for a disaster to happen. It is quite common for redundant systems to have become obsolete before they have ever been called into service.

The modern generation of Virtual Desktops, Server Based Computing and Cloud Computing allows organisations to provide Disaster Recovery without needing to pay for redundant systems.

**Redundancy**

To an IT Manager 'redundancy' means having more of something than you actually need just in case one breaks. Redundancy is how IT departments cope with failures in key components and try to recover without anyone realising that it has happened.

To a Financial Director having 'redundant' IT equipment means paying for something that is not actually needed and might become outdated and end-of-life before it is ever used. The technology behind Server Based Computing and Virtual Desktops allows organisations to provide highly reliable 'redundant' infrastructure, but one that makes use of all available resources and distributes load over all devices.

This 'load balancing' ensuring that no processing power is sat idle waiting for a disaster that might never happen.

**3.14 Enabling Green IT****Reducing energy consumption = Reducing running costs**

Reducing your energy consumption will also reduce your running costs. When done properly a new VDI infrastructure can be deployed and paid for entirely by the energy savings it provides.

Where existing PC and laptops are re-deployed as Thin Client or Zero Client devices instead of buying new PCs or laptops the return on investment can be realised on day one of a VDI project going live.

**4. Cultural changes****4.1 Cost reductions and changes of working patterns**

Technology to reduce costs and increase flexibility is currently available on the market... Savings can be made through making staff more efficient by delivering them applications and data securely at their point of use.

**Hot-desking**

Hot-desking undoubtedly introduces many new benefits in terms of flexibility for users and the business. It allows end-users to work from the closest office to them when travelling between sites or customers, and it allows the business to drastically reduce overheads and running costs.

One of the downsides for some end-users when they no longer have a piece of their own territory is the loss of 'my desk', 'my chair', 'my picture of the kids' and other personal decorations and modifications that previously marked out 'my personal space'.

Sometimes companies will introduce 'drop-in areas' and open plan 'social areas' and coffee machines to make end users feel more relaxed, and promote it as a positive change, instead of something that has been taken away.

Often infra-red sensors will also be used to detect activity and automatically control the lighting (and sometimes the heating), so that lighting and heating is automatically switched off when a bank of desks or area of office space is unoccupied for any amount of time.

#### **Home working**

For all of the concerns that Managing Directors and line managers have about allowing staff to work from home and losing sight of if they are working or not, most people do more work, when they can work from home.

It is very common for staff to pick-up work or catch-up with emails again once the kids have gone to bed, or to start preparing for Monday morning on Sunday night.

Most VDI technologies incorporate logging of activity and logging of idle time somewhere in the management tools, however common sense and regular staff updates or conference calls are usually sufficient to make sure staff are not skydiving or playing World of Warcraft when they should be working. It is quite common for virtual teams (which can be set up very quickly with VDI) to meet at least once a week face-to-face, even if they spend the rest of the week working from home.

#### **Flexible working and part-time working**

VDI is perfect for organisations who make use of flexible, seasonal or part-time workers. It is especially suited to organisations such as call centres, telephones sales and shift workers, or any other kind of organisation lots of staff that have to share a small number of terminals or computers.

#### **Disenfranchised workers**

VDI can also bring disenfranchised staff back into the workforce (and the economy), by allowing physically disabled people to work from home, or families with small children to work around the 'school run'.

Without this kind of flexible, home working solution many adults would otherwise be excluded from the workforce and may be financially better off by remaining on state benefits.

#### **Extreme weather**

VDI can keep your organisation functioning and trading through extreme weather. It can be good news for your business and customers, and bad news for your competitors. What better way could there be to poach new customers, than providing a functional service, when their incumbent supplier has just let them down?

#### **Personal computers and mobile devices**

If your users have their own smart-phones, net-books, laptops and home computers, why not let them use them productively to perform work tasks when they are otherwise away from their desk? (assuming that they are not handling sensitive data).

Several industry commentators have suggested that we are only a few years away from providing staff with their own 'computer allowance', much as they now receive a 'car allowance'. This would allow staff to buy their own computers and allow the IT support teams to concentrate on delivering a service and business value, rather than managing hardware devices and component failures.

#### **The iPad generation**

Love them or hate them the new generation of iPads, iPhones and Android devices are being purchased by staff and brought into work.

Is this a threat to the walled garden of IT, or an opportunity to deliver sales presentations in a more engaging way, or to update jobs and task to mobile staff and engineers more effectively?

An iPad has email functionality, apps to connect to the most common CRM/ERP systems, a functional web browser and can hold thousands of documents, proposals, circuit diagrams or service manuals. For users that 'use' information,

*'What better way could there be to poach new customers, than providing a functional service, when their incumbent supplier has just let them down?'*

rather than 'create' information some of these devices make more sense that large, heavy laptops with poor battery life.

#### 4.2 Understanding and managing the costs benefits

Many of the VDI projects fell foul when the storage costs of scaling the solution up from pilot to production became known. In an emerging market, it's important to get advice on the range of choices, implications and costs.

##### **Where are the costs?**

- Servers
- Storage
- Networking
- Licencing
- Management tools
- Training

##### **How big are the costs?**

Servers can be expensive, but not as expensive as replacing the desktop PCs they will replace. It makes sense to buy new 64-bit servers wherever possible. Older 32-bit servers could be re-used to host up to 50 or so SBC sessions on Terminal Service 2003/2003-R2 or Remote Desktop Service 2008, but Remote Desktop Services 2008-R2 is 64-bit only. It is not recommended that you use 32-bit servers for VDI due to the 4 Gb memory limit on 32 bit platforms. Good candidates would be the Dell R710/810, HP DL380/580, IBM x3650/3850 or higher.

Storage cost can vary greatly. Hosting 200 VDI desktops on SAN storage could be very expensive. Hosting 200 SBC desktops on internal DAS storage could be very inexpensive. SAN storage is very expensive and some organisations would struggle to justify moving from storing Windows XP on £30 IDE or SATA drives onto a single 8 Tb SAN, unless a tangible benefit could be found. The simplest, most pragmatic approach to take is to put as many users as you can on an SBC solution and only put users on a full VDI solution where justification can be found (and the cost is less than managing a traditional PC). If you can manage 80-90% of your users on an SBC platform and the remaining 10-20% of your users on VDI or traditional PCs, the storage costs become acceptable again. Good candidates for shared storage are traditional FC-SAN and iSCSI. For those on a budget ATA-over-Ethernet storage devices like those offered by Coraid, Open-E SAN or the open source OpenFiler iSCSI solutions make an excellent place to start a small test lab or pilot project.

Networking costs are somewhat easier to predict. The servers and storage need fast, dedicated bandwidth across the server backbone. Multiple NICs might need to be installed, and multiple VLANs might need to be created if you are to virtualise hosts that need to be presented on different subnets, but most of this is straight forward networking best practice, much the same as in the physical world. Where a multi-site implementation, or DR site implementation is required then some consideration needs to be made regarding site replication and data snapshots.

Licencing is another concern for organisations beginning a SBC or VDI project. At the lower end of the scale a Terminal Services CAL can be bought for approx £70 and is good for 10 years. At the higher end of the scale a gold-plated VDI solution could cost you upwards of £1,500 if a balance cannot be struck between what the IT department want, and what the business actually needs.

The good news is that most VDI solutions contain basic management tools as standard, and in many cases a basic hypervisor can be had for free. The downside of this is that most virtualisation companies recoup this investment by charging a premium for some of the higher end management tools. Add-on third party management tools can be even more expensive again. The best advice is usually to start with the free/included tools to a small trial or pilot, then buy all of the licences and management tools at the same time in some form of vendor bundle or 'accelerator kit'.

It is worth spending some time and effort on engineer training and end-user training. If you don't engage your engineers they may feel that the solution

*'Many of the VDI projects fell foul when the storage costs of scaling the solution up from pilot to production became known'*

has been forced upon them, and may not understand and utilise all of the benefits. If you don't engage your staff and do some form of 'familiarisation' they will clog up your helpdesk with reports that 'everything has changed, and nothing works', even though most of the issues will actually be psychological, not technical.

#### **Who owns the costs?**

From the outset you need to establish who owns the cost. If the organisation has separate server teams and desktops teams you need to be up-front with them and involve them in the process.

Where desktop support teams are worried that VDI is no different than 'Turkeys voting for Christmas' and that desktop support jobs will disappear it makes sense to point out that economics dictate that things cannot continue as they did before, and that change and reduced budgets are inevitable. If managed properly, the message 'lose desktop support, gain server virtualisation' can be pitched as a step-up or promotion, especially when combined with additional training, books, online resources or exam vouchers.

#### **Who owns the Capex expenditure?**

It is likely that a VDI solution will involve some CapEx investment up front. This can usually be offset against desktop replacement costs and upgrades, however the OpEx savings should be included in order to present a compelling business case.

#### **Who owns the Opex savings?**

Once the CapEx investment has been made, the majority of savings will appear as operational savings in time, effort and energy costs. There may also be reductions in spending in areas such as travel, governance/information security and investment of time and money performing disaster recovery testing and practice drills.

#### **Why would one department spend money if the benefits were delivered to a different department?**

The simple answer is, they won't.

That is why it is important to get all of the key stakeholders together, once the technical teams have developed the solution and can prove (or better still demonstrate) that it works for the business.

Developing a solution like this alongside the 'normal' IT service can give you breathing space to continually tweak the service and pay massive dividends during unforeseen disasters, emergencies, extreme weather and mergers/acquisitions.

#### **4.3 Understanding the real environment costs and savings...**

The old saying goes, 'If something sounds too good to be true, it usually is'. We have all become de-sensitised to the 'next best thing' and the 'deal of the century', but VDI does offer some genuinely compelling benefits.

If we revisit the list we made earlier in section 3.1 (page 8) we can remind ourselves see some of the teasers that SBC and VDI are trying to tempt us with...

So if we extended the working life of our existing equipment, and were aggressive with power-management energy usage and built a solution that would last for at least another five years, would these savings be enough to actually pay for the solution outright?

#### **4.4 VDI for free: myth or reality?**

Well lets run the numbers. We will model two scenarios (a high and low watermark if you will):

- 1,000 enterprise desktops, standard working patterns, no power management.
- 250 SME desktops, flexible working patterns, some power management.

*'We have all become de-sensitised to the "next best thing" and the "deal of the century", but VDI does offer some genuinely compelling benefits'*

#### 4.5 1,000 enterprise desktops, standard working patterns, no power management

Lets assume that we extend the useful working life of these desktops as 'zero client' devices and we don't replace them for the next five years. For easy reckoning, we will assume that each desktop cost £500 to buy and install at a desk. We will then assume that we can save £100 per year every year, for the next 5 years with dynamic power-management on our new zero client.

Over the next five years each desktop will be saving us £1,000:

£500 in CapEx (In avoided replacement costs)

£500 in OpEx (£100 a year, every year in energy savings)

Times that by 1,000 desktops and we have a saving of £1 Million over five years. Would that cover the cost of a few SBC/VDI server and 1000 licences?

#### 4.6 250 SME desktops, flexible working patterns, some power management

Lets assume that we extend the useful working life of these desktops as 'zero client' devices and we don't replace them for the next five years. For easy reckoning, we will assume that each desktop cost £400 to buy and install at a desk.

We will then assume that we can only save £40 per year every year, for the next five years with dynamic power-management on our new zero client as some form of power management was already in place, and the working patterns and end users attitudes towards energy efficiency had already made some progress in this area.

Over the next five years each desktop will be saving us £600:

£400 in CapEx (In avoided replacement costs)

£200 in OpEx (£40 a year, every year in energy savings)

Times that by 250 desktops and we have a saving of £150,000 over five years. Would that cover the cost of a few SBC/VDI servers and 250 licences?

#### 4.7 Try this for yourselves

Why not start a pilot project yourselves, say 25 desktops or 250 desktops (depending on the size of your organisation).

Involve all of the key stakeholders and tell them about the pilot and what you are hoping to achieve as well as the individual business benefits and financial benefits.

Hopefully these Guidelines will whet your appetite for a fresh look at SBC and VDI, and provided you with answers to the conundrum we started with:

'VDI is on the wish list of most CIOs and IT Directors and has to be one of the hottest topics around at the moment. However, most of the evidence including the pulse point of the room at the NCC's recent conference – *Maintaining Service Levels with reduced budgets...* the reality is that less than 10% of corporate enterprises have virtualised their desktop environment. So if the economic climate is tough and cost savings paramount, the technology mature enough, just what are the issues inhibiting VDI adoption?'



#### **The Author**

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He has been working with the NCC to develop thin client solutions and best practice guidelines since 2005, and also writes articles for *ITadviser* on low-carbon computing and Green IT.

He has worked as an independent advisor to the Cabinet Office and the Conservative party, and reviewed the 'Greening Government ICT' policy, as well as co-writing the current Conservative IT strategy around Open Standards, Open Source and software re-use in the public sector.

After spending several years working as Head of IT for a group of UK companies in the media industry, Jason became a technical architect and product specialist working in the public sector for Serco PLC, before taking his current role at One Planet Computing in 2009.

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