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WHITE PAPER

Reducing IT Costs with Client Virtualization

Sponsored by: NComputing

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June 2010

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IDC OPINION

Organizations are always looking for ways to reduce their IT costs and increase their flexibility and agility — but that combination rarely comes together at the same time. The development and the proliferation of virtual client solutions provide a notable exception, however, because the technology can give businesses, government organizations, and educational institutions a cheaper yet more flexible solution for their client devices. Virtual client solutions leverage the horsepower of centralized computing resources (both servers and PCs) to provide access to a traditional desktop computing experience for end users, but in a less expensive and more controlled manner. The combination of low-cost, energy-efficient access devices and software that creates, delivers, and lets IT centrally manage virtual user sessions is a powerful package that can transform the way companies use and think about their end-user client computing services.

IN THIS WHITE PAPER

This white paper dives into desktop virtualization technology — explaining what it is, what it does, how it works, and how it can be beneficial to businesses of all sizes as well as government and educational institutions from an overall cost and management perspective.

SITUATION OVERVIEW

Desktop PCs may not be the sexiest technology devices, but they are unquestionably the workhorses of most institutions and continue to make up a large majority of the commercial client installed base. As a result, when organizations start to think about trying to rein in their costs or improve their overall environment, desktop PCs often are the first target.

Lately, desktop discussions have become more complicated because of the introduction of desktop virtualization technologies, which are designed to provide end users with an experience that's roughly equivalent to a regular PC in terms of performance but offer significant cost advantages in terms of initial purchase, ongoing support costs, and management control.

The basic concept behind virtualization involves reassigning different parts of the computing process to different elements in a networked environment. Specifically, instead of having all of a PC's software, including both the operating system (OS) and

applications, reside on a hard drive in the PC and then having all the program execution occur using the CPU inside that PC, virtualization moves much of the storage and program execution to a server or other centralized computing resource. As a result, the client access device functions much like a terminal accessing a centralized mainframe. But unlike the old command line–driven mainframe applications of the past, in this virtualized environment, end users can work in a familiar Windows operating system environment complete with normal Windows and multimedia applications. So, end users have an experience that's akin to using a regular, standalone PC, but IT departments can enjoy a number of important benefits, including:

- **Centralized storage.** With all data stored in a central location, backups are easier and more robust network storage devices can be used.
- **Centralized management.** IT departments can easily ensure that all the latest operating system security patches and application versions are being used by all end users and are in compliance with their license agreements.
- **Enhanced security.** By managing and storing all the organization's critical applications and data in a central location, IT departments can limit access to the data infrastructure, creating a more secure environment.
- **Reduced client support costs.** By controlling what end users can install and run on their client devices, IT departments can avoid issues with rogue software and other end user–generated issues.
- **More efficient use of resources.** By moving computing tasks to centralized servers, IT departments can eliminate wasted compute resources at client desktops, saving hardware, maintenance, and energy costs.

Creating an environment that leverages virtualization typically requires setting up (or leveraging existing) centralized computing resources (typically servers, but in some instances it's possible to use regular PCs), installing and configuring the necessary software on the centralized resources, creating accounts for each user, and then setting up access devices at each end user's working environment. Conceptually, it isn't far removed from traditional networked PC applications — the critical differences are the software used on the centralized computing resources and the end-user devices. One of the other benefits of creating the environment necessary to enable virtual clients is that many of the same steps are necessary to enable cloud-based computing solutions. In fact, thin clients and virtual clients are a perfect match for companies looking to move to cloud computing.

Regardless of the type of hardware used as the centralized computing resource, a server or other multiuser operating system is installed first, and then additional software is used to create and manage each of the end-user sessions. The end-user device logs into an account that gets associated with its own session and then is presented with a typical desktop environment, complete with applications and data. In most instances, the actual execution of applications occurs on the centralized computing resources, and the visual results are transferred over a network or other connection to the end-user device and onto its attached display. Different protocols

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are used both to send this visual data back to the end-user device and to relay keyboard and mouse input and the data generated by or needed by any peripherals attached to the end-user device (e.g., printers, smart card readers) back to the centralized user session.

The real "magic" of the system derives from the software used on the centralized computing resources to enable and manage the various user sessions. The manner in which this software utilizes the hardware resources (that is, "virtualizes" the hardware) and the different levels of capability enabled by this software determine the effectiveness (and strongly influence the cost) of the overall solution.

Traditional centralized client environments virtualize applications that are accessed from either traditional PCs or thin clients that still have a local operating system and CPU that must be managed. Many organizations have deployed these kinds of solutions to centrally manage a select set of applications — often important applications that IT wants/needs to closely monitor. While these types of solutions provide reasonable cost benefits by improving application management, they can be limited by the fact that certain applications, particularly critical custom corporate applications, won't run in shared environments. In addition, these "traditional" deployments still rely on PCs or thin clients that have their own management requirements. Newer virtual desktop infrastructure (VDI) solutions solve the application compatibility problem of older applications by running them in separate independent instances of end-user operating systems, each of which runs as a virtual machine on a server. While this type of solution does offer benefits versus the "traditional" thin client model, it adds to the cost of the entire solution by requiring expensive license fees for each unique OS instance and reducing the client-to-server ratio to numbers that are often less than 30:1, even on a high-end server. Plus, most VDI approaches still rely on full PCs or thin clients at the user's desktop that must be managed.

One of the newer options for centralized computing models takes the concept even further — the entire computing experience occurs on the host server device, and very simple devices referred to as "zero clients" are placed on individual users' desks. These zero clients have no traditional CPU or memory — often they have just a monitor, mouse, keyboard, speaker, microphone, and USB connection — and just enough firmware to point the device to a host server, where they connect to one of the individual user sessions being run on the server device. Input data from the zero clients is forwarded along to the host session, and the screen output from the session is passed backed down to the client and shown on the connected display.

While most of the host software for these newer options is designed to run on server-class hardware, several solutions, including NComputing's vSpace and Microsoft's new Windows MultiPoint Server 2010 OS, open up new opportunities by bringing this capability to traditional PCs. These solutions provide for multiple licensed user sessions on a single PC, leveraging the significant horsepower found in today's desktop CPUs that would otherwise be underutilized.

Typical Applications

Virtualized client solutions have traditionally been used in environments where large numbers of users share the same endpoint devices (such as call centers), places where government regulations require centralized computing solutions (such as healthcare), and highly secure environments (such as government and military institutions). Recently, however, many general businesses of all sizes as well as educational institutions have discovered the benefits offered by these kinds of solutions.

For businesses, the benefits of virtualization are many:

- First, it allows them to reduce their cost outlays for client devices in two different ways: in terms of both the cost per device and the frequency with which the devices need to be bought. In some cases, the client devices can be purchased for under $100 per device. Plus, because they don't have any moving parts, the expected lifetime of these devices is typically twice that of desktop PCs (six years versus three years).

- Second, the energy usage per device is much lower than that of even notebook PCs, leading to reduced utility bills.

- Third, the ability to allow remote access gives businesses the flexibility to let their employees work from home or from any branch location they choose. Some organizations also use this capability to allow limited access to part-time or offshore workers.

- Fourth, setting up these kinds of systems forces organizations to create structured accounts for users and determine precise methods for managing all their applications — a step that goes a long way toward ensuring IT best practices around management and security.

- Finally, tools are available to easily manage hundreds and even thousands of these accounts and devices, further extending the potential benefits of these kinds of devices and the structure they demand. Related to this, businesses can create different groups of users with different levels of permissions and access.

Most of these same benefits apply equally well to school environments, but there's also the possibility of putting additional controls on the client devices. Because the devices have no local storage, it's impossible for students to install software that could cause problems either for that particular system of for the entire school network. In addition, management policies can control what type of USB devices are permitted to be connected to the client devices. Also, in many educational institutions, IT departments are relatively small (or even nonexistent), so any steps that can be taken to organize and then automate the process of managing client devices can make a huge difference.

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NComputing Offerings

One of the vendors that offers virtualized client solutions is NComputing, a five-year-old company based in Redwood City, California. NComputing offers software that runs on either PCs or servers, which allows companies to create virtual sessions for multiple users as well as several different types of client hardware solutions. NComputing's software is called vSpace, and its primary function is to enable the creation and management of individual user sessions (either Windows or Linux based) that its client devices can access. The company uses its own User eXtension Protocol (UXP) to provide the critical link between the user sessions and the devices.

Direct Connect Clients

The company's lower-cost U-series and X-series access devices are zero clients that are designed to work with regular desktop PCs through a direct cable connection (typically under 10 meters in length). The U-series requires only the addition of NComputing vSpace software on the host PC and connects through a standard USB 2.0 cable, making it ideal for small deployments of about five users per host. The X-series uses one or more plug-in cards that are installed into the PC and enable it to scale more effectively by hosting more user sessions from a single machine (five users per card). Both solutions require the installation of a server operating system on the host PC — essentially turning the PC into a low-cost server.

Ethernet Connect Clients

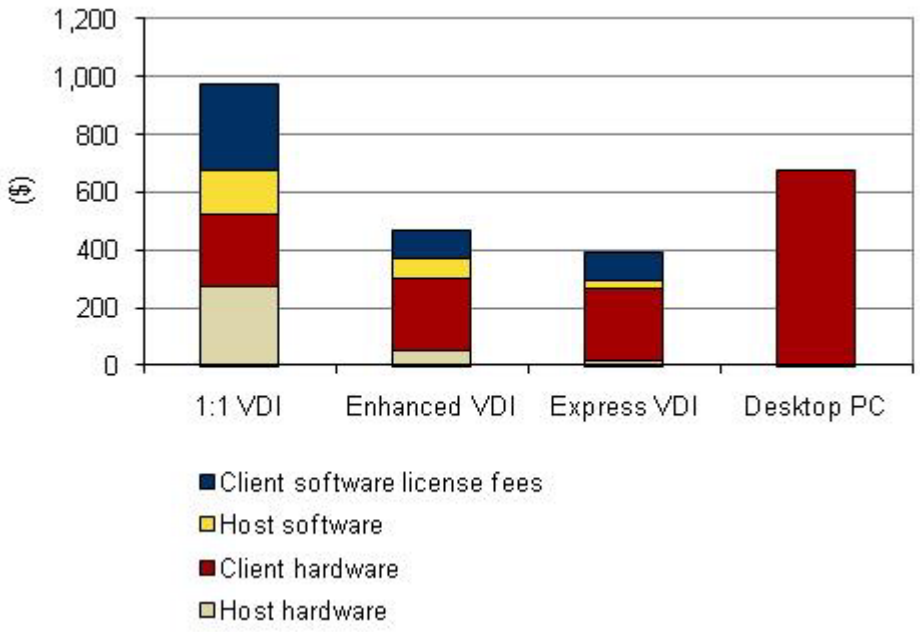
The L-series access devices are slightly more expensive but are designed to be used with traditional servers and connect via Ethernet, providing greater deployment flexibility with unlimited distance between the host system and the users. The L-series product line delivers multimedia desktops with transparent USB redirection, simple but powerful deployment and management tools, and the ability to connect up to hundreds of devices to a single server. Powered by NComputing's Numo system on a chip (SoC), the newest L300 model uses patent-pending hardware technology to decode and scale multimedia locally, eliminating network strain while delivering full-screen, full-motion multimedia playback at up to 1,920 x 1,080 resolution.

Translating these examples into numbers, Figure 1 shows how the per-seat pricing breaks out (based on 300 users) for NComputing L-Series and vSpace software in various types of client virtualization configurations. The per-seat pricing is compared with the average sale price of a desktop PC. Starting from the bottom, the Express VDI solution includes the cost of running standard Windows Server 2008 and vSpace on desktop PCs and connecting directly to L-Series thin clients. For Enhanced VDI, the model assumes the usage of servers as host hardware, running hypervisors to enable multiple virtual machines, each running Windows Server 2008 and vSpace on top of that to connect to L-Series thin clients. Finally, the 1:1 VDI model assumes a 40:1 ratio of virtual clients per physical server where all users are given their own separate operating system running in a virtual machine, each connected directly to an L-series thin client.

In all three virtual client configurations, the cost of the NComputing thin client with vSpace is represented by the "client hardware" category and comprises $250 (L-series products range from approximately $150 to $250 including vSpace). "Client software license fees" include Microsoft CALs or Virtual Desktop Access (VDA) licenses as appropriate. "Host software" includes the server operating system(s) and hypervisor licenses, while "host hardware" represents the cost per seat of the server hardware. Comparing these costs with the standard desktop PC model, where an average PC costs $673 per seat (including the client OS), we see that while the 1:1 VDI model costs more, the Enhanced VDI and Express VDI configurations save immediately on up-front system costs.

FIGURE 1

Costs per Seat of 300-Seat NComputing-Based Virtual Client Solutions



Source: NComputing, 2010

Working Within Existing Environments

Many of the organizations that are considering moving to virtualized client solutions already have some level of centralized computing tools in place. The popularity of Microsoft Terminal Services and Citrix XenApp (formerly Presentation Server), in particular, has created a large base of organizations that have already started working with and appreciating the benefits of shared centralized applications — an important, but not complete, part of virtual client solutions.

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NComputing's vSpace is compatible with these application-sharing environments — all that's necessary is to install the RDP or ICA client software necessary to access Terminal Services or XenApp within the client environment created by vSpace. This allows companies to continue using their existing virtualization investments while deploying the NComputing solution.

In addition, many organizations are now deploying hypervisors on their servers, which enables them to treat one physical machine as if it were several independent servers, each running their own set of software.

NComputing's vSpace is also compatible with popular hypervisors from VMware, Citrix, and Microsoft, allowing it to function within each of those environments for "Enhanced VDI" configurations. This enables companies, for example, to run several iterations of the vSpace software on a single server, permitting huge numbers of clients to be supported from that one machine.

Combinations of these solutions can also be created, including hybrid VDI environments where IT creates individual virtual machines for each user (1:1 VDI) or one virtual machine for each group of users (Enhanced VDI). The level of complexity can get as sophisticated as an IT department wants to take it, but at the same time, it can be scaled down to very simple environments that would be well suited for even very small businesses (Express VDI). As one would expect, costs scale up with the complexity and the size of the installation but also scale down as solutions get simpler and smaller.

CASE STUDY

NComputing's products were recently selected by India's Employees' State Insurance Corporation (ESIC), which is similar to the U.S. Social Security Administration, as part of a large project that required bringing low-cost computing capabilities via Web-based applications to 2,200 sites around the country. NComputing L-series thin clients and vSpace software were selected as part of the total solution put together by Indian IT company WiPro, which won the bid — the largest egovernment project ever awarded in India. This particular deployment involved modernizing the process by which employees request and receive medical insurance benefits and creating the country's largest database of medical records.

The challenge was creating a solution that could be easily deployed and managed across numerous regional sites — and doing so for a very low cost. The NComputing client solutions were included because the costs of the clients were very low and they allowed the organization to use regular PCs as the host devices instead of more expensive servers. Using vSpace software, ESIC employees could create multiple independent user sessions on each of the host PCs and then easily connect to them from the simple, maintenance-free client devices. Even better, the simple nature of the client devices requires little to no end-user support, and in the event of failure, even nontechnical employees could plug in spares, helping mitigate the costs of sending IT specialists all over the enormous country to provide support.

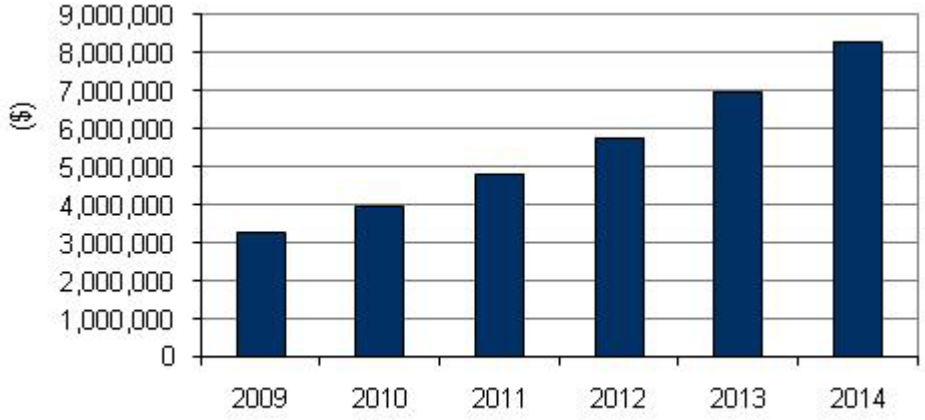
NComputing devices have found favor in U.S. companies as well, including a large tire company that chose NComputing solutions to run in its retail branch operations. In that situation, a single PC running vSpace serves as the host device, and L-series clients are used to drive both the customer sales systems and the "shop" devices. Thanks to the ability to use low-cost PCs as the host devices, this organization has also chosen to have a preconfigured spare host PC available in each branch in case of failure. Again, this allows even nontechnical employees to switch to the spare host with minimal downtime and little to no support from IT — thereby reducing operational costs.

FUTURE OUTLOOK

The future market opportunity for products that offer virtualized client capabilities is strong. According to IDC's research on the worldwide thin client market, shipments of these end-user devices will double between 2010 and 2014, growing from around 4 million units in 2010 to just over 8 million units at the end of the forecast period. Figure 2 illustrates the growth trend.

FIGURE 2

Worldwide Enterprise Thin Client Forecast, 2009–2014



Source: IDC, 2010

The desire to reduce IT costs and improve the overall manageability and security of the client environment is a strong one for many organizations, so there's little doubt that it not only will continue but also will grow. The move toward virtual client solutions has already begun to gain momentum and, as the numbers show, will grow strongly over the next several years.

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CHALLENGES/OPPORTUNITIES

As appealing as virtual client solutions may be, they do face some limitations. First, most of these solutions are not well suited to end users who need and regularly use mobile computing devices, such as notebook PCs. A speedy, always-on network connection between the client device and the centralized computing resources is an essential part of these solutions. While wireless network speeds and availability are improving, they are not completely ubiquitous. In addition, even with reasonable network connectivity, it's often difficult to move an individual's "virtual client" onto the mobile device and then back onto the server. Plus, even if one can, the security benefits of a centralized computing model are potentially compromised if they are moved out of a central datacenter and onto an end-user device — in essence, it becomes no different from a regular notebook PC.

The performance of multimedia applications, such as video streaming and Adobe Flash, can also be limited with virtual client solutions because of the architecture of most solutions. As discussed previously, most of these solutions require the use of specialized protocols to deliver screen updates to the end-user devices. In the case of video playback, the amount of screen refresh required places enormous demands on these protocols as well as the network connection — both of which can compromise the video playback performance experienced by the end user, particularly if a large number of users are simultaneously trying to access video content over a network connection. Thankfully, video compression algorithms and network display protocols have greatly improved lately (and hardware performance continues its inexorable path forward), so this has become less of an issue than it used to be, but it's still something that needs to be considered. In addition, devices that connect directly to host PCs, such as NComputing's X-series products, typically don't have this issue because of how the technology works and the lack of network traffic required.

Finally, as beneficial as these devices can be, they do require a rethinking and reorganization of many companies' existing IT infrastructures, which can be a difficult process for some organizations. Companies and institutions will need to work out the technical structure they want to use to support these devices and then also determine which parts of IT will "own" virtual clients. They also need to determine policies around the creation, usage, and management of virtual machines because while analogous, the process is not exactly the same as that used for traditional PC clients. In addition, effort is required to create the load of software that each virtual machine will run and to test that configuration to ensure that it works properly.

CONCLUSION

For most organizations that are considering virtualized client solutions, the overall benefits are very compelling. Greatly improved security, lower end-user support costs, and more efficient management can all help improve the effectiveness and value of most IT organizations. In addition, lower acquisition costs, reduced energy usage, and longer lifetimes for the client devices can contribute to more bottom-line improvements for organizations overall. Making the change to virtual clients can be a bit daunting for organizations that find themselves in the comfortable rut of using only traditional PCs, but once organizations make it past that mental roadblock,

the changes can be transformational. Organizations will gain the ability to provide their users with access to their applications and data in a more flexible way than they have ever enjoyed and at the same time gain greater control than they have ever had. It's a powerful combination that's poised to make a dramatic impact on all IT in the years to come.

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