NComputing desktop virtualization

Abstract

We've all become accustomed to the PC model, which allows every user to have their own CPU, hard disk, and memory to run their applications. But personal computers have now become so powerful that most people can't possibly use all the processing power they purchase. NComputing desktop virtualization is a modern take on the time-honored concept where multiple users share the processing power of a single computer. This approach has several advantages over the traditional PC model, including lower overall costs, better energy efficiency, and simplified administration.

Introduction

Over the past 30 years, PCs have changed the way we work, play, learn, and think about computer technology. From the first single-chip microprocessor in 1971 to the latest multi-core CPUs powering today's PCs, users have come to rely upon owning and controlling their own processing power. In large part, the PC became successful because it took the processing power out of the data center and placed it directly on our desktops.

But with that desktop power and control also came responsibility— the responsibility to maintain, troubleshoot, and upgrade the PC when needed. After all, the PC is a machine and all machines need regular care. As PC buyers and users, we may have welcomed the capabilities and productivity increases the PC brought, but no one warned us that even with help from a dedicated IT department, we'd have to spend over 17 hours annually maintaining our own PCs. (That annual maintenance number is more like 60 hours if you act as your own IT department.)[1]

Computing market trends

IT services costs are trending upward with ever increasing software and support costs. Security, data privacy, manageability, uptime, space, power, and cooling challenges are driving many organizations to look for alternatives to the traditional distributed PC model. Thin clients faltered because they are still "too fat" with PC-like local operating systems (Windows XP Embedded, Linux, etc.), "full-power" processors, PC memory, local flash drives, virus vulnerabilities, and the management challenges associated with these components.

While the traditional PC market is not growing very fast, its enormous size continues to drive significant innovations such as multi-core processors. The result is that today's PCs can outperform high-end servers of just a few years ago. This opens the door to a new age of virtual computing where the power of an everyday PC gets used as efficiently as possible by multiple users at once.

1 IDC White Paper: "Analysis of the Business Value of Windows Vista", December 2006

Recently, the Wall Street Journal reported in "The Office PC Slims Down" that network computing adoption will accelerate as more organizations seek to efficiently use their existing resources and minimize management costs. Large corporations are no longer the only organizations looking at PC adjustments. Schools and small/medium businesses are also looking for new ways to deliver computing access. These trends all favor the virtual desktop computing approach pioneered by NComputing and now seeing tremendous adoption worldwide. In recognition of this rapid growth and impact on the computing industry, the Wall Street Journal awarded NComputing with its prestigious Technology Innovation Award.

In order to fully understand the significance of the NComputing solution, it helps to look back and see how computing technology has evolved over the years.

Mainframes and server-based computing: the prequel

Since we've been putting PCs on people's desks all these years, many have forgotten how computers worked before the PC came along. In pre-PC days, computing was done on mainframes—large boxes that sat in specially cooled rooms on raised floors—and they had connections to dumb terminals spread out over the premises. This single centralized computer performed the processing for all of the users. Users also didn't have to administer the box—that was the responsibility of the technicians of the day. If a user had a problem, all they had to do was call the computer room and ask for help, since support had to be centralized along with the computer. Of course, the IBM System/360's big disadvantages were cost ($133,000 for the entry-level model in 1965)[2] and environmental considerations (space, power and cooling). It also required dedicated staff to support and maintain the system. People spent years training to understand and learn the tasks necessary to keep these systems running. This meant that the number of people qualified to maintain a System/360 was very small. This relegated the System/360 to large corporations, governments, and educational institutions. The next step was the minicomputer, which also used centralized resources, but at a much lower cost than a mainframe.

With the arrival of the PC (and its close cousin, the PC-based server), mainframes fell out of fashion. Servers replaced mainframes in the data center and many were called upon to perform the same duty. This gave rise to the concept of server-based computing (SBC), which is like mainframe computing with a few minor differences. The dumb terminal is replaced by a PC that communicates with a server and receives a full screen interface that is transferred across the network. The most popular application of server-based computing has been to host a small subset of applications on a server that are accessed by a PC client in this way. In this case the PC is still used to run local applications in addition to running the server-based applications hosted with Citrix or Microsoft Terminal Services software. In some SBC installations, a slimmed-down version of a PC with a low-end processor and flash storage, called a "thin client" is used. With the thin client approach, most, if not all, applications are run on the server.

2 Computer History Museum: http://www.computerhistory.org/VirtualVisibleStorage/artifact_frame.php?tax_id=03.02.02.00

SBC was intended to provide the same advantages as mainframe computing while mitigating the cost and environmental factors, but it created a completely different set of disadvantages. These disadvantages include:

- Constrained user experience with limited desktop interface performance, especially when graphical applications are used.
- Expensive thin clients that are fundamentally still PCs and commonly require special customizations.
- Expensive, high-end server components.
- Complex setup and administration requiring network administrators with specialized skills.

The next step: NComputing desktop virtualization

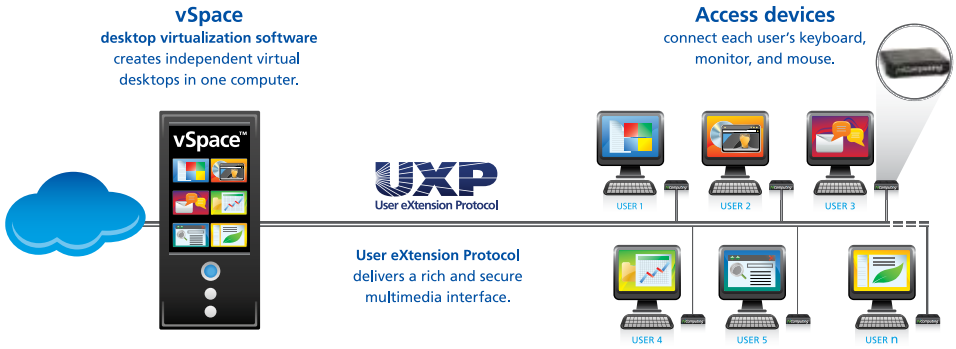
So how can you get the benefits of SBC without its disadvantages and not go back to mainframe technology? The answer is a new model: NComputing desktop virtualization.

NComputing desktop virtualization enables a single PC to simultaneously support two or more users – each running their own independent set of applications. The key to this unique solution is the fact that all three core components of the technology are optimized to work together: the software that virtualizes resources on the PC, the protocol that extends the user interface, and the client or access device. Because of this high degree of optimization, NComputing desktop virtualization solutions can run on PC hardware (not just server hardware). The resulting solution provides all of the benefits of SBC without the drawbacks.

Many of the concepts behind the NComputing solution are similar to the old thin client model. However, NComputing has developed a completely unique implementation that delivers better user performance at a lower cost. NComputing access devices are much smaller and more highly integrated than traditional thin clients—which for the most part are built with previous generation PC components. NComputing has also developed its own virtualization software, vSpace, and user extension protocol to optimize the solution further. In effect, NComputing has developed a set of technologies that work together to enable not only high-end server hardware to be shared, but standard PC hardware as well. This unique approach has demonstrated its ability to extend computing access to a whole new set of users in schools and the developing world, while slashing computing costs for small, medium and large businesses worldwide.

How it works

The unique NComputing technology is composed of three primary components: vSpace™ virtualization software, a user extension protocol, and access devices. By combining all three of these components into an integrated solution, NComputing delivers unmatched performance at an incredibly low cost. Traditional thin client solutions and other PC alternatives all rely on separate components from disparate vendors, resulting in sub-optimal performance at higher costs.



NComputing technology components

vSpace desktop virtualization software

NComputing vSpace desktop virtualization software was developed to tap into the unused power of PCs and efficiently divide their resources into independent virtual workspaces that give each user their own full PC experience. It functions as a data manager that transmits and handles the desktop display and remote activities from the user's keyboard, mouse, and other interfaces. NComputing vSpace was developed specifically for NComputing's unique access devices in order to achieve the best user performance. Also, it was developed to be independent of the host computer's operating system and runs on both Windows and Linux platforms. Best of all vSpace is easy to install and use, unlike the complex software associated with traditional server-based computing.

Extension protocol

A key part of being able to deliver a full remote computing experience is the extension protocol used. Traditional thin clients use protocols that were developed for occasional use by administrators for temporary remote control. NComputing developed its unique User eXtension Protocol (UXP) for continuous use by end users demanding a full PC experience. As a result, multimedia applications including streaming video, Flash, and 3D graphics can be supported. UXP provides the communication link between the NComputing virtualization software and the access devices that connect through Ethernet (L-series products) or directly (X-series products). UXP was developed to reside on a software layer outside of the operating system on the shared PC and works with both Windows and Linux. UXP provides the communication link between the NComputing virtualization software and the access device.

L-series access device

Access devices

The NComputing access devices do not use PC-based processors or chipsets and do not run a local operating system. All of the primary functionality is integrated into a single chip that has an optimal set of resources for working with the NComputing virtualization software and extension protocol. This System-on-Chip (SoC) contains patented technologies for delivering unmatched performance from a very low-power device. The device also contains a small amount of DRAM used to perform local screen display.

The SoC in the access device executes several processes including boot management, initialization, network connection, protocol decoding, bitmap cache acceleration, and administration. This approach results in access devices with very low power requirements (less than 5 watts). This enables significant power savings when compared to individual PCs that draw over 100 watts each.

Access device options

The NComputing System-on-Chip (SoC) is at the heart of each access device

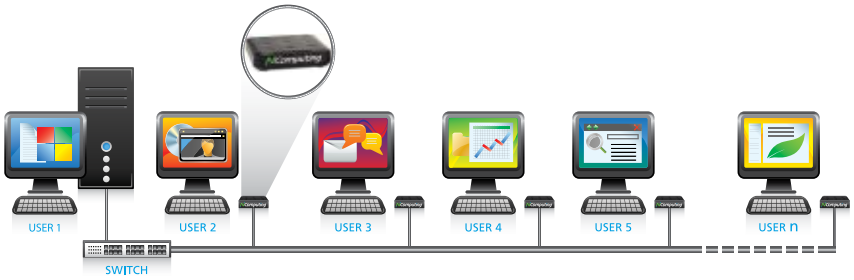
X-series kit

The NComputing SoC technology is used in several different access devices that serve a variety of application needs. With each solution, the end user still has their own monitor, keyboard, mouse and speakers. However, instead of connecting directly to a PC, these peripherals connect to the small NComputing access device on their desk or mounted directly to the back of the monitor. The access devices then connect either directly (X-series) or over Ethernet (L-series) to the shared computer, running the NComputing vSpace software. The L-series devices use UXP to deliver a PC experience through a standard network connection and come in a variety of versions to suit specific needs.

The X-series products include a PCI card, which installs inside the PC. The card houses the NComputing SoC and has either three or five RJ-45 ports that connect to the X-series access devices directly through Cat5e or Cat6 STP cables (up to 5 m or 10 m long respectively).

The following diagrams show how the L-series and X-series access devices connect to the shared PC.

X-series configuration – direct connection



L-series configuration – Ethernet Connection

Integrating with other virtualization technologies

NComputing vSpace can be used together with other virtualization technologies to address specific business needs. For example, machine virtualization software (from vendors including VMware and Microsoft) can be used to create multiple "virtual machines" running on a single server. Each virtual machine can run a fully independent operating system with its own unique set of applications.

For example, in a configuration commonly referred to as "VDI," each end user is given their own complete virtual machine including their own instance of a desktop operating system such as Windows XP. NComputing vSpace is installed on each Windows XP instance to enable a 1:1 connection to an assigned L-series access device. In this way each user has their own private operating system accessed remotely via the NComputing access device and UXP. While the overhead required for machine virtualization is much higher than for standard NComputing implementations, certain environments can benefit from the user and application isolation properties of this approach.

Furthermore, machine virtualization can also be used with NComputing systems to setup environments with a very large number of users running on a single high-end server. In this case, each virtual machine runs a server operating system with vSpace installed. Each virtual machine can then host up to 30 users connecting through NComputing L-series access devices and UXP. So with this configuration, large numbers of users (60, 90 or more) can run on a single high-end server. This is commonly referred to as "server consolidation," and gives IT managers a way to further reduce the amount of hardware in their environment – an important benefit when the hardware has been centralized to a data center with limited space.

Conclusion

By delivering all of the key components of the solution including the access device, extension protocol, and desktop virtualization software, NComputing uniquely delivers a high performance solution at the lowest cost. Your IT staff and end users don't need special training since this highly efficient solution is very easy to set up and maintain and is compatible with standard PC applications. In addition, NComputing technology integrates with other technologies such as machine virtualization to solve unique business problems.

Any organization responsible for more than one PC should seriously consider the advantages of moving to desktop virtualization. By taking advantage of today's low-cost yet ever-more-powerful computers, even the smallest organization can realize immediate benefits without the high expense of mainframe computing or the complexity and performance limitations of server-based computing. Best of all, desktop virtualization makes computing available to more people within your organization for less money.