



| Technology White Paper

www.ncomputing.com

February 22, 2007

Introduction

NComputing has a full suite of hardware and software technologies that have established it as the market leader in multi-user computing. Many of the concepts behind the NComputing solution are similar to the traditional thin client model; however, NComputing has developed a completely unique implementation that delivers better performance at a lower cost. NComputing access terminals are much smaller and more highly integrated than traditional thin clients – which for the most part have been built with previous generation PC components. NComputing has also developed its own terminal services software 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 servers to be shared, but standard PCs as well. This unique multi-user computing approach has already 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 businesses worldwide.

Market and Technology Trends

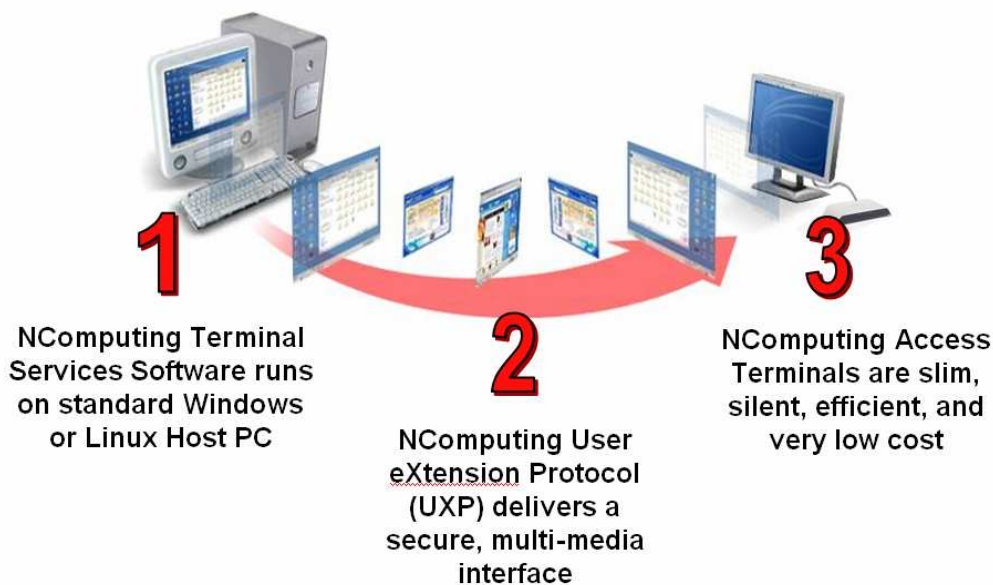
PC market revenues are approximately \$200 billion dollars per year, while the traditional thin client market is currently at approximately \$500 million. PCs are only seeing single digit year-over-year growth while thin clients are enjoying double-digit growth. Hardware costs for both PCs and thin clients continue trending downward while IT services costs are trending upward with increased 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. This has driven the relatively strong growth in thin clients in the past several years. However, this growth has not accelerated as fast as it could. This is primarily because traditional thin clients are still “too fat” with PC-like local operating systems (Windows XP Embedded, Linux, etc.), x86 processors, PC memory, local flash drives 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 and improved power management. 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 multi-user computing where the power of an everyday PC gets used as efficiently as possible by multiple users at once.

In August, 2006 the Wall Street Journal reported in "The Office PC Slims Down," that network computing adoption will accelerate as more organizations seek to more efficiently use their existing resources and minimize management costs. Large corporations, where traditional thin client and server-based computing approaches have had some success, are no longer the only organizations looking at PC alternatives. Schools and small/medium businesses are also looking for new ways to deliver computing access – but the costs of traditional thin clients are still too high for these segments. The traditional server-centric thin client solutions enabled by Microsoft Terminal Services with RDP or Citrix Presentation Server with ICA are simply too expensive and complex for smaller organizations. Furthermore, traditional x86 thin clients are still too costly and difficult to manage. These trends all favor the new multi-user computing approach being pioneered by NComputing.

NComputing Multi-user Computing Technology

The unique NComputing technology is composed of three primary components: terminal services software, a user extension protocol, and ultra-thin access terminals. By combining all three of these components into an integrated solution, NComputing can deliver unmatched performance at an incredibly low cost. Traditional thin client solutions rely on separate components from disparate vendors resulting in sub-optimal performance at higher costs.



NComputing Multi-user Computing Technology Components

Terminal Services Software

NComputing terminal services software was developed to be independent of the host computer's operating system. It runs on a variety of Windows desktop and server operating systems as well as several varieties of Linux. The software divides the computer's resources into independent sessions 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 terminal's keyboard, mouse, and other interfaces (including USB for remote data I/O). The NComputing terminal services software was developed specifically for NComputing's unique access terminal platform in order to achieve the best performance.

The core terminal services software is included at no extra charge with each NComputing access terminal. NComputing offers other complementary software tools including NControl and NShield that further improve the manageability of the overall system.

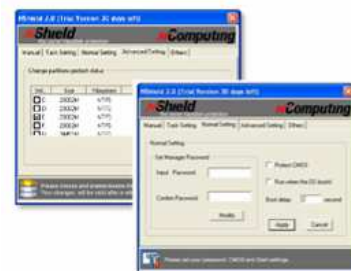
NControl

NControl allows IT administrators to remotely monitor what users are doing on their terminals from a single station. In school applications, teachers can also send warning messages and even take control of students' computing environments if they use improper applications. Without NControl, you would need to be connected directly to the host PC to monitor, control and configure the connected access terminals and the host PC. With NControl, a master host PC can be configured specifically for management of all host PCs from one location. By installing this software, one console can monitor and control up to 128 simultaneous sessions.



NShield

NShield is an innovative backup tool, which enables recovery of a previously stored backup of a host PC's hard disk via a manual or automatic reboot of the protected PC. Complicated manuals, complex configuration software or expensive storage solutions are not required. NShield recovers applications, Windows system settings and data easily and within just a few minutes. Even Viruses, malware/spyware, failed software installations, uninstallations or even damage to the Windows OS files are no longer a problem, because after every reboot a PC can be reset to a known-good state. This solution is ideal for schools and public access applications where user changes are to be temporary.



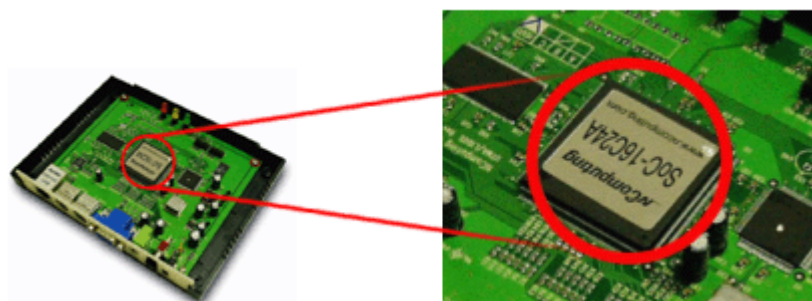
Extension Protocol

A key part of being able to deliver a full computing experience to a remote user is the extension protocol used. Traditional thin client approaches use protocols that were developed for only 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, multi-media applications including streaming video, flash and 3D graphics can be supported. UXP functions with access terminals that connect through both 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 host PC and functions with both Windows and Linux. It is installed during the terminal services software installation. UXP provides the communication link between the NComputing terminal services software and the access terminal hardware. In network applications, UXP features 128-bit encryption to ensure the highest possible level of security.

Access Terminals

The NComputing access terminals do not require on-board PC-based processors and chipsets. All of the primary circuitry is integrated into a single chip (NC16C24A or NC26C24A) that has an optimal set of resources for working with the NComputing terminal services software and extension protocols. This System-on-Chip (SoC) contains various patented technologies for delivering unmatched performance from a low power device. A small (512 KB or 1 MB depending on model) flash ROM contains the NComputing firmware used to run the access terminal. Local memory is similarly very small (8 MB or 16 MB depending on model).



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

The NComputing SoC in the access terminal executes several processes including boot management, initialization, network connection, protocol decoding, bitmap cache acceleration,

and administration. The system has been designed to be highly efficient so as not to require x86-class CPUs and chipsets like traditional thin client devices. This approach also results in access devices with very low power requirements (less than 5 Watts). Finally, the NComputing access terminal technology has been developed to be independent of the host computer's operating system enabling support for a variety of host OSes.

Access Terminal Options

The NComputing SoC technology described above has been embodied in several different access terminal products intended to 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 terminal on their desk. The access terminals then connect either directly (X Series) or over Ethernet (L Series) to the host computer which runs the NComputing terminal services software. The L Series products use UXP to deliver a multi-media PC user experience through a standard network connection. L Series terminals come in two primary versions. Base L Series models features standard PS/2 mouse/keyboard connections, VGA, and speaker connections as shown below:



L120 Connection View

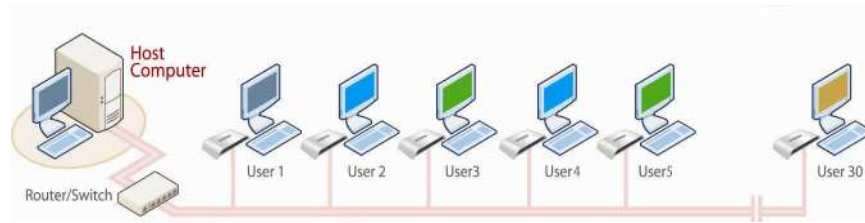
Other L Series models include a serial touch screen interface and a USB port for flash memory connection as shown below:



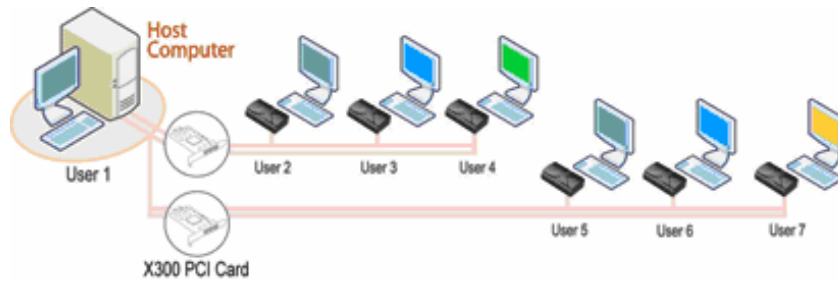
L200 Connection View

The X Series products include a PCI card which houses the NComputing SoC and installs in the PC. The PCI card has three RJ-45 ports that connect to the X Series access terminals through a direct Cat 5 or Cat 6 cable (up to 10 m or 33 ft in length).

The following diagrams show how the L Series and X Series access terminals are connected back to the host PC:



L Series Configuration – Ethernet Connection



X Series Configuration – Direct Connection

Conclusion

By delivering all of the key components of the solution including the access terminal, extension protocol and terminal services software, NComputing uniquely delivers a high performance solution at the lowest cost. Best of all, your IT staff and end users don't need special training since this highly efficient solution is very easy to setup and maintain and is compatible with standard PC applications.