The Educator's Technology Dilemma:

Providing more students with greater access to leading edge technology under declining budgets

NComputing™

Introduction

Technology plays a pivotal role in education. Classroom instruction aided with the use of computers prepares students to live in a complex and challenging world and provides nations with a competitive advantage in the global economy. Provisioning technology for today's student means more than occasional access to a computer lab installed with a few tutorials. Rather, it encompasses a much richer experience with access to the internet, social networking, online research, virtual teaming and so on.

Today's student has evolved into an active learner and consumer of educational services and, being more technically savvy, is making greater demands for technology in the classroom. When speaking on the need for universities to make students career ready, Bill Gates urged today's students to "Insist with both fists that your education puts you at the gate to your career"[1] Computers and technology are at the forefront to accelerate learning and career preparation. Students need access to the latest technology and information. Educators need a way to keep pace with ever advancing technology trends.

The fundamental challenge for educational institutions of any size is to provide consistent access to computers and associated technology for all students, starting at the elementary grade levels up to the university. Access to the latest technology, however, continues to be limited and often lags behind the trends. According to an article in the 2010 edition of *Technology Counts*[2], only 50 percent of students in the United States have access to computers in their classrooms.

In an era of declining budgets, educators are looking for a cost effective solution that satisfies their need to provide frequent computer access with less hardware maintenance and reduced obsolescence. The NComputing Classroom in a Box solution enables educators to provide leading edge computer resources to more students at all levels of education including K-12, community colleges and universities at a lower cost. Classroom in a Box is the ideal hardware alternative for classrooms, computer labs, testing centers and libraries. Measurable results of the Classroom in a Box include:

- Tripling the size of a computer classroom without increasing the IT budget
- Reducing maintenance and support costs by 75%
- Reducing power and cooling requirements by 90%
- Reducing device theft and loss
- Building flexible and smaller footprint labs and maximizing classroom space

Classroom in a Box is helping educators all over the world to improve the quality of education with the latest technology while managing costs. This paper provides additional details on how this solution addresses the needs of any educator struggling to meet the needs of students and tax payers.

1 James D. Duderstadt, Daniel E. Atkins, Douglas Van Hoeweling, Education in the Digital Age, (Westbury, Praeger Publishers, 2002), 4

2 http://www.edweek.org/ew/tc/index.html

NComputing Classroom in a Box – At a Glance

Classroom in a Box is an all-inclusive, pre-tested, easy-to-deploy solution that provides a complete classroom lab for schools. NComputing, along with its partners, has designed the Classroom in a Box solution, which combines NComputing's world class desktop virtualization technology with products and services offered by our partners. This solution can be right-sized to fit your current needs and expanded in the future with modular add-ons. Classroom in a Box includes the following components:

- Host Server(s)
- vSpace Virtualization Software
- OS licenses (as needed)
- NComputing virtual desktops
- Peripherals (monitors, keyboards and mice)

Solution add-ons are available for scaling larger deployments such as virtual desktop failover, storage, and server virtualization infrastructure. Assessment and deployment services are also available through NComputing's experienced partners. The diagram below shows the various configuration options and their solution components.

Diagram 1: Configuration Guide

Solution Components	Single Classroom (Workgroup)	Campus-wide (Network Connect)	District or Statewide (Network Connect)
Host Server(s)	PC Class Hardware	Server Class Hardware	Server Class Hardware
vSpace DV Software	•	•	•
OS Licenses	Win/Linux	Win/Linux	Win/Linux
NComputing Virtual Desktop	X550	L300	L300
Basic Peripherals	Monitor Keyboard Mouse	Monitor Keyboard Mouse	Monitor Keyboard Mouse
Desktop Failover +	•	•	•
File Storage +	NAS	NAS	SAN/NAS
Server Virtualization Infrastructure +		Microsoft VMware Citrix	Microsoft VMware Citrix
Data Back-up +		•	•
Assessment Service +		•	•
Deployment Service +		•	•

+ *Add-on*

NComputing Classroom in a Box – Benefits

Classroom in a Box meets your goals of providing greater technology access to more students at a lower cost and with less obsolescence, delivering to educators these immediate benefits:

- **Turn-Key Solution** - Eliminates the complexities of desktop virtualization by providing all the components (keyboards, monitors, host PCs or servers, mice, etc.) for easy deployment.
- **Pre-Tested & Validated** - All components have been pre-tested and validated to ensure they will work together. This means no surprises when it comes to deployment. Your solution can be up and running in hours.
- **Modular Configurations** - Offers flexible configurations ranging from 11 seats to 100 seats. Install the configuration that works for your needs and expand it at any time when growth demands more user access.
- **Virtual Desktop Flexibility** - Depending on your needs, NComputing offers workgroup or network connect virtual desktop solutions. Existing computer labs can be retrofitted in hours to utilize the Classroom in a Box solution.
- **Lowest Cost Per Seat** - NComputing's award winning virtual desktop solutions reduce the per seat cost of a PC by more than 75%. The entire solution typically costs between $70-$250 per seat (prices vary by model and region). Many sites choose to reuse existing monitors and peripherals to further minimize expenses.
- **Simplified Support & Maintenance** - NComputing virtual desktops are much easier to access, update and maintain than a traditional desktop PC. IT administrators have 24x7 access to the virtual desktop environment and can easily and quickly monitor, back up, recover, patch, or upgrade a virtual desktop. In addition, the number of operating systems that need to be managed can be dramatically lowered. Manage one operating system centrally instead of 100 operating systems in a lab.

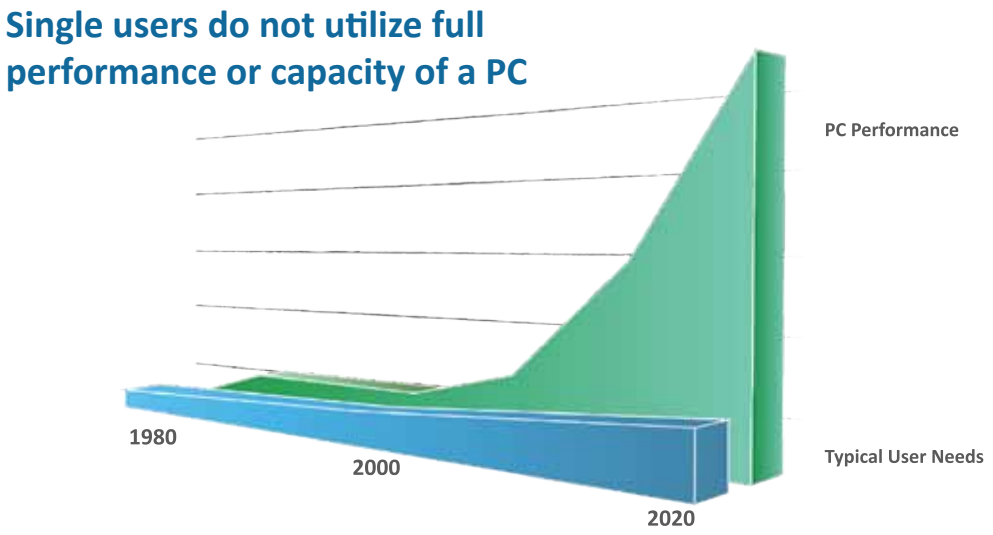
NComputing also delivers a green solution in an age of heightened concern about the environment:

- **Green Computing** - NComputing virtual desktops draw less than 5 watts of electricity (compared to 110 watts for a typical PC). Schools and colleges can reduce their carbon footprint by as much as 90% per user, which also translates into utility savings. NComputing has won numerous prestigious awards for its eco-friendly approach to computing.
- **Minimized E-Waste** - A typical PC weighs about 10 kg (about 22 lbs.) which generates significant e-waste when it reaches end-of-life. In contrast, NComputing virtual desktops are small and weigh less than 200 grams (less than 0.5 lbs.). And since the virtual desktops don't have any moving parts, their expected lifetime is typically twice as long as a desktop PC, so replacement cycles can be stretched.

NComputing Classroom in a Box – Desktop Virtualization

Virtualization technologies have been used for many years to simplify server infrastructures and reduce capital and operating expenses. Now, the same concept is being applied to end-user computing by virtualizing desktop PCs of students, staff and faculty. The concept behind the NComputing virtual desktop solution is simple: Today's PCs are so powerful that only a small fraction of a PC's power is typically utilized—the rest is wasted. Why not harness the computing power of these underutilized PCs to the benefit of more students? For most educational institutions the total cost of acquiring, managing, and replacing hundreds (often thousands) of desktop PCs is prohibitively high. The diagram illustrates typical underutilized computing power by an end user's PC.

Diagram 2: PC Utilization



NComputing provides each end user with an individual computing session without the need for a dedicated user PC. This is accomplished by virtualizing a PC session and hosting it on a single (or few) shared PCs or servers. Depending on the configuration, a single operating system can host up to 100 simultaneous users and a dedicated virtualized server can host hundreds of users with their own PC sessions as illustrated in Figure A.

Figure A: Virtual Desktop

Support up to 100 virtual desktops for each operating system

The NComputing system consists of virtual desktops that connect an end user's monitor and other peripherals to a virtualized shared computer via USB, PCI or Ethernet. NComputing virtual desktops are small, about the size of a deck of cards, durable connection boxes that can be mounted on the back of the user's monitor or under the desk. The virtual desktops have ports for the user's peripherals (such as monitor, keyboard, and mouse) as well as a port to connect to the host computer. Since all the computing is done at the host computer, the virtual desktops do not need PC-based processors or run a local operating system, so they use very little electricity (fewer than 5 watts). All of the primary functionality is integrated into a single chip that has an optimal set of resources for working with the NComputing vSpace software.

vSpace™, NComputing's patent pending software, virtualizes the host computer to create multiple sessions. NComputing vSpace software is included with the virtual desktop so there is no additional virtualization software to purchase. vSpace loads on the host computer and virtualizes it so that its resources are efficiently divided to support many independent virtual desktops. The vSpace management console allows an IT administrator to set up, configure, and manage shared computers and virtual desktops. The administration console allows an administrator to remotely monitor and, if necessary, control a user's session. Virtual desktop settings can be configured centrally from the administrator console, including the ability to lock out connection of USB devices. The vSpace console is easy to use and requires no special training. The virtual desktops, combined with vSpace technology, deliver a full-motion, "no-compromises" user experience while reducing acquisition and support costs by up to 75% and electricity use by 90%.

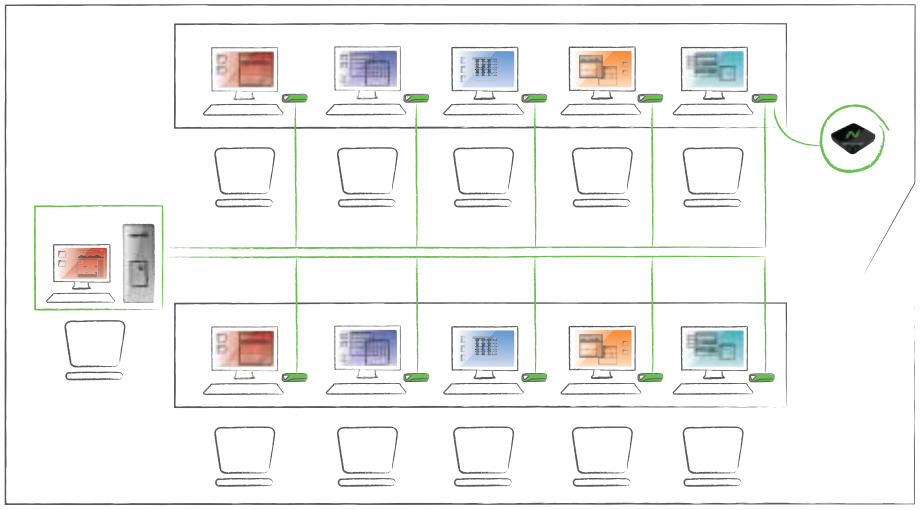
NComputing Classroom in a Box – Deployments across the globe

NComputing's Classroom in a Box solution has been installed in thousands of universities, community/junior colleges, K-12, and technical schools around the world. NComputing, along with its partners, has helped educators reduce hardware costs, limit greenhouse emissions, provide wider computing access in tight work areas, and simplify the support and maintenance burden. The following actual examples highlight how Classroom in a Box has been deployed to provide technology access for classrooms and labs, to integrate technology across campuses, and to bring entire schools districts and universities online.

Classroom & Lab Deployments

NComputing Classroom in Box is ideal for classrooms and science labs where computers need to be integrated into the learning environment. (See Figure B below for architecture illustration)

Figure B: Single Classroom (Workgroup)



A single host transforms into a classroom computer lab using X550 Workgroup Virtual Desktops connected to a PC via Cat 5/6 with supplied PCS card in PC.

Real World Example 1:
New College Leicester (NCL) in the United Kingdom wanted to invest in state-of-the-art classroom computing technology that delivered educational benefits in the most environmentally friendly and cost-effective way possible. NCL had aging desktop PCs that were constantly in need of repair. Over the previous 5 years, the cost of running 500 desktop PCs was approximately £70,000 (US $109,256), and emitted nearly 260 tons of carbon dioxide.

With NComputing, the approximate cost will be £23,000 (US $35,898), and carbon emissions will be reduced by 66%. *"The NComputing solution will pay for itself in under a year,"* said the ICT manager for the college.

Computer labs can be easily installed, upgraded or expanded by using the NComputing Classroom in a Box solution. A computer lab that needs to be built within an existing facility can use NComputing's virtualization

technology to significantly reduce networking equipment and installation costs. A traditional 30-seat computer lab, for example, using an all-PC deployment would require 30 network drops. An NComputing computer lab with a 10:1 user-to-host computer ratio would only require three host systems with just three network drops. If a computer lab already exists, then upgrading to use NComputing is a snap.

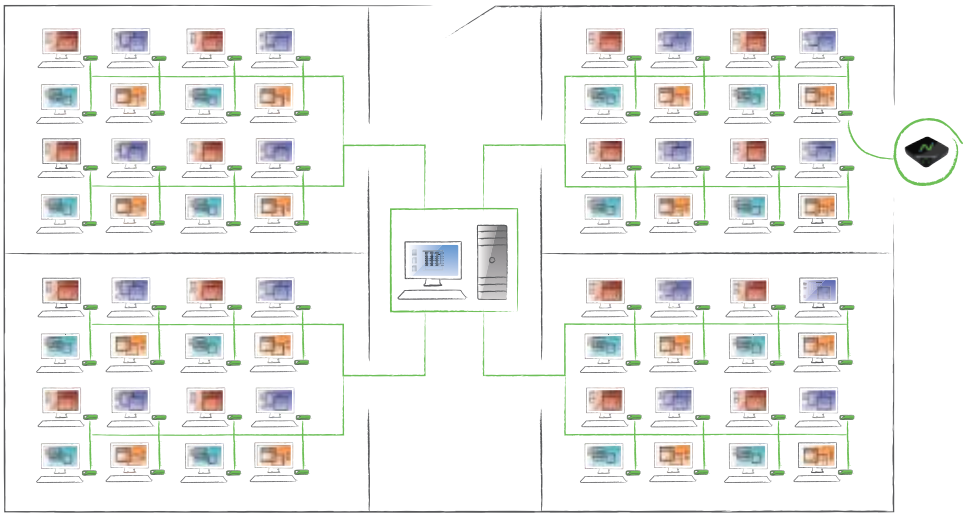
Such an upgrade would simply involve replacing the 30 individual PCs with NComputing virtual desktops, and then connecting them over the Ethernet network to the virtualized host computer. Depending on the age and usability of existing monitors and peripherals, they can either be reused or replaced. A lab can be upgraded in a few hours instead of days.

Real World Example 2:
The Joeun Computer Art School in South Korea has deployed NComputing virtual desktops in its main and branch campus labs. Joeun wanted to reduce the cost and installation time of its campus computers. *"It's a burden to spend huge resources in funding, staff and time to install so many computing systems. There is not enough time or staff to manage each individual computer, yet the systems must be operational within a short time,"* said Jouen's Director of Instruction. Joeun installed NComputing X-series devices throughout their campuses and the IT staff and students have been impressed with the results. *"Our students are fully utilizing our computing resources with NComputing."*

Universities and District Wide Deployments

Classroom in a Box can be deployed to integrate and provide anytime, anywhere access across school districts and universities. Since Classroom in Box can be configured and expanded using a modular architecture, it can be readily adapted to meet the more demanding requirements of bringing online and integrating dispersed school districts and university campuses. (See Figure C for architecture illustration)

Figure C: Campus-Wide (Network Connect)



Combine multiple classrooms to power an entire school using L300 Network Connect Virtual Desktops. Enables rich multimedia playback and powerful USB redirection, integrates with server virtualization infrastructure and provides high ratio of users per host.

Real World Example 3:
With its computers nearing end-of-life, Pepperdine University's IT management recognized that it needed a more flexible computing solution for its administration, learning lab, library, classroom and public settings. *"Like every university, we had a limited budget. We had to find a computing solution that was affordable, secure, reliable, and efficient,"* said the Director of Instructional Technology Support.

Pepperdine has deployed NComputing in many areas of its campus including computer labs, classrooms, and study halls. Perhaps the most unique use of NComputing technology is during new student orientation week. Setting up and tearing down PCs for student orientation can take many hours. The lines were long and the students often got aggravated with the wait. Pepperdine deployed the NComputing L-series as access stations for the students to complete required forms. *"We were able to process 650 students with no lines and saved at least $8,400 in hardware costs in just this instance. With the time and labor savings in set up and tear down, we actually saved thousands more,"* said Thomas Hoover, Director of Instructional Technology Support.

In another example at Pepperdine, NComputing's L-series desktop virtualization has been deployed across multiple campuses and has proven to be affordable, secure, reliable and efficient. Pepperdine has future plans to expand the NComputing deployment into every classroom campus wide. Pepperdine has reduced hardware costs by 70%, reduced demand on IT support, and been able to renew their focus on strategic technology initiative

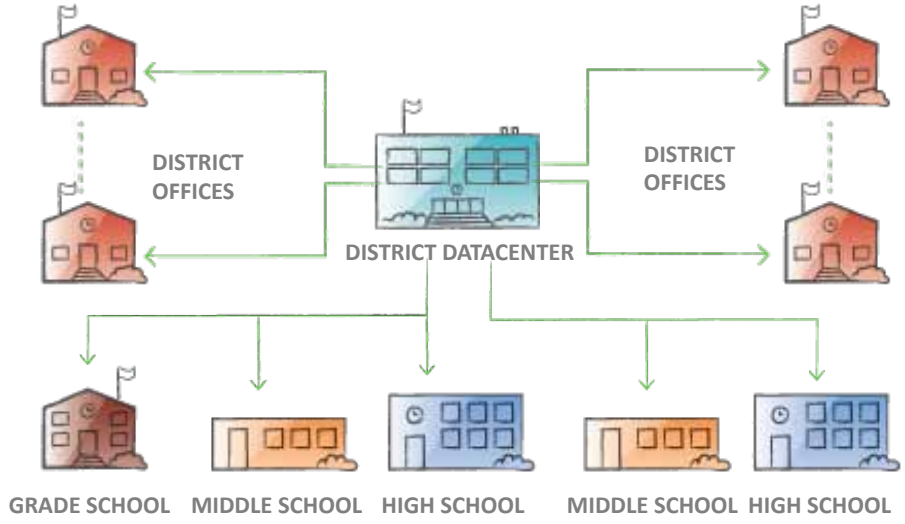
Real World Example 4:
McDowell County Schools were challenged with upgrading their old computers and adding more computer access while working under tight budget constraints. Barry Pace, Director of Technology explained, *"One of our top priorities is to engage, prepare, and educate students on using technology, but limited state and local budgets were making it a challenge to keep our PC labs up to date."*

McDowell School District found their answer in the NComputing X-series, a virtual desktop solution that enables four to seven students—depending on whether they use one or two X-series kits in each PC—to benefit from a single shared personal computer. Over 25 school districts throughout North Carolina with more than 10,000 additional computer seats have been added. The results have contributed to significant cost savings, reduced power consumption, and minimal system maintenance.

State and Countrywide Deployments

Classroom in a box is ideally suited for local, state, and even federal governments that need to provide computer access to thousands of students across multiple campuses. Governments have limited budgets and must utilize technology to solve their technology challenges. Because more students enter the educational process each year, providing laptops is prohibitively expensive. (See Figure D for architecture illustration)

Figure D: District or Statewide (Network Connect)



Combine multiple classrooms to power an entire district or state using L300 Network Connect Virtual Desktops. Enables rich multimedia playback and powerful USB redirection, integrates with server virtualization infrastructure and provides high ratio of users per host

Real World Example 5:
With a burgeoning population and millions of children to educate, India, like all countries, is looking for economical computing solutions that can scale to their demands in secondary education. India also has the added challenge of limited electricity infrastructure in many of its remote regions where a significant percentage of its population lives.

Through NComputing, the government of India has been able to bring wider access to technology while minimizing costs and reducing their dependence on electricity. Over 5000 schools in the state of Andhra Pradesh have deployed the NComputing's X-Series, implementing 10-seat computer labs using only 2 PCs at each school. As a result, over 1.8 million students now have computer and internet access for the first time.

Real World Example 6:
Once considered the least developed of the former Yugoslavian republics, Macedonia is leaping into the 21st century. The country set a very ambitious goal to provide computer access to all of its 360,000 primary and secondary students. Providing laptops was considered but proved to be too expensive. Using Classroom in a Box, educators in Macedonia were able to complete a rapid two-year rollout across 430 schools that enabled seven users access to a single computer simultaneously. Over 200,000 students have been brought online and more deployments are in progress. The Republic of Macedonia was able to reduce long-term maintenance and replacement costs to a fraction of what it would have been if they had purchased individual laptops for every child. This cost savings has enabled them to deploy more computer systems and make tangible progress toward their goal of one computer per student.

Conclusion

Today's educators face constant budget constraints, yet still need to provide their students with consistent access to leading edge technology with less support. No school or university in any country can afford to fall behind in one of the most important areas of education, technology.

NComputing's Classroom in a Box solution helps educators reduce their end-user computing costs dramatically by deploying NComputing virtual desktops instead of traditional PCs. Thousands of schools and school districts, colleges and universities around the world have been able to reduce up-front PC acquisition costs, minimize on-going support costs, and lower their energy bills by leveraging the power of NComputing virtual desktops.

Through the NComputing Classroom in a Box solution, educators can provide more students with access to leading edge technology, reduce obsolescence of hardware, and stay within their limited IT budgets. In short, NComputing provides the answer to the educator's technology dilemma; broader computing access, lower costs, less support.

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