



THE GLOBAL LEADER IN
CLOUD CLIENT COMPUTING

Improving Student Access to Technology in the Classroom - in a Declining Budget Environment

The Role of Cloud Computing
and Virtualization in Education

A white paper by Wyse Technology Inc.

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Introduction

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Technology and Education

Technology is transforming society, and educational institutions today do not have a choice as to whether they will incorporate technology, but rather how well they will use it to enhance learning. At the turn of the millennium, access to technology was relatively limited and wiring schools was one of the nation's highest education priorities. Over a decade of substantial investments have vastly improved this picture, with virtually every school having access to computers and the Internet. Along with expanded access has come a growing pervasiveness of technology in society. For a generation of young people, technology, particularly the Internet, has assumed a substantial stake in their social and educational lives.

Technologies available in classrooms today range from simple tool-based applications (such as word processors) to online repositories of scientific data and primary historical documents, to handheld computers, closed-circuit television channels, and two-way distance learning classrooms. Even the cell phones that many students now carry with them can be used to learn. However, the continued technology evolution and adoption necessary to keep pace with changes in society, particularly in the public K-12 sector, faces daunting challenges as traditional funding sources for public education diminish as a result of the recent economic recession.

Many schools in the United States enjoy the benefits of computer-based learning, yet suffer from low graduation rates directly attributable to insufficient infrastructure – shorthanded staff, over-crowded classrooms, and fewer teachers. Reduced budget allocations and diminished resources will only exacerbate this problem. The situation puts additional pressures on IT staff to deliver more with less; this means maintaining existing infrastructure such as networking devices, security solutions, and desktops to the maximum and beyond of their average life-cycles, as well as looking at innovative and more cost-effective ways to deliver more flexible and powerful computing resources to more students.

The Impact of Reduced Education Funding

Over the past three years, the U.S. education system has faced the largest budget cuts in history, forcing administrators to seek ways to substantially reduce expenses, including system-wide IT costs. With tax revenue still declining as a result of the recession and budget reserves largely drained, the vast majority of U.S. states have made spending cuts that impact public education and associated learning technologies. States made these cuts because revenues from income taxes, sales taxes, and other revenue sources used to pay for these services declined due to the recession. At the same time, the need for these services did not decline and, in fact, rose as student enrollment increased. These pressures have not abated, and sizable budget gaps are likely to continue for the next several years.

At least 34 states and the District of Columbia have implemented cuts to K-12 education and various education programs.¹ Some of the more extreme examples include:

- California reduced K-12 aid to local school districts in 2010 and 2011 by billions of dollars as a result of significant cuts required to balance the state budget.
- Colorado reduced public school spending in 2011 by \$260 million, nearly a 5 percent decline from the previous year. The cut amounts to more than \$400 per student.
- Georgia cut state funding for K-12 education for 2011 by \$403 million or 5.5 percent relative to 2010 levels.

Data from The Center on Budget and Policy Priorities indicates that funding for public colleges and universities also decreased between 2009 and 2010. At least 43 states have implemented cuts to public colleges and universities and/or made large increases in college tuition to make up for insufficient state funding. State and local support per full-time-equivalent student was \$6,454 in 2010 which was a 7 percent decrease from 2009, and the lowest in the last 25 years. Higher education has historically experienced large increases in enrollment during times of economic recession, and this tendency has been accentuated by the growing economic importance of post-secondary education. This decrease in per student support was ironically driven by an increase in enrollments of more than 6 percent between 2009 and 2010, 15 percent between 2005 and 2010, and 35 percent between 2000 and 2010.²

How can new Information technologies address these issues and help stabilize the imbalance between the requirements of educational institutions and students, and the dwindling financial resources available to support the deployment of the learning technologies that our students need to ensure competitiveness in a global economy?

Using the Internet, and leveraging a data center computing model that leverages powerful and relatively inexpensive cloud-client desktops and mobile devices, Virtual Desktop Infrastructure has paved the way for organizations to do better with fewer resources and greater innovation. Desktop virtualization offers the user opportunities to reduce capex and opex costs, and optimize resource management. As a critical sector in our society, K-12 and higher education can reap tremendous benefits from the adoption of desktop virtualization and the data center computing model.

¹ The Center on Budget and Policy Priorities

² 2010 State Higher Education Finance Report - State Higher Education Executive Officers (SHEEO)

A New Computing Model for Education Institutions

Funding pressures, the need to improve academic performance, and advances in information technologies have directed the focus of IT to a new model for providing innovative desktop shared learning resources within educational institutions. The data center model utilizes Virtual Desktop Infrastructure to reduce IT overhead, enhance security, facilitate student and administrative record-keeping, and ensure greater reliability and simplified access to the latest server-based and online applications within the learning environment. Desktop virtualization is a data center computing model that leverages the best attributes of a network computing environment: System administrators centrally manage virtual desktops in the datacenter, and students and teachers are provided with a traditional PC desktop experience on a cloud client.

Rather than utilizing traditional dispersed and fragmented platforms such as PCs, the data center model provides a secure, unified, centralized repository leveraging powerful virtualization software. The virtualized server is integrated with a Virtual Desktop Infrastructure from Wyse, which uses a cloud-client approach to provide end-users with improved access to all of their critical applications. For example, students, teachers, and administrators can securely log-in to the system at any virtual desktop and immediately access the Internet, student records, or software application for learning, teaching or administrative productivity.

A Virtual Desktop Infrastructure using cloud clients has many advantages over traditional PCs, foremost among them being cost. A PC desktop averages \$1,000, while a cloud-client averages \$350 per desktop, and some educationally focused units are available (e.g. Wyse E01) for under \$100 each. Cloud clients not only have lower initial capital cost, but also have lower maintenance costs and higher levels of reliability as they have no moving parts such as a disk drive and do not run a local PC operating system. Thus, there is no need to install and patch software on these devices, rendering them unsusceptible to security vulnerabilities.

For IT, virtualization of the server environment can deliver multiple benefits. Critical applications can be managed securely from a centralized environment, where redundant systems can be deployed for secure backup and additional reliability. Centralized server environments can run multi-user systems software such as Citrix XenApp, Microsoft Remote Desktop Services or Terminal Services, or Citrix XenDesktop, Microsoft VDI Suites, or VMware View to deliver popular applications such as MS Office and PC-based learning software from a spectrum of providers to virtual desktops. Updates, new applications and specialized services can be provisioned rapidly by network administrators. Applications run simultaneously, and can be accessed on demand from any secure cloud client regardless of the application OS. Access to applications is centrally controlled and can be based on user roles, i.e. teacher, student, administrator, for example, or other security hierarchy.

Economic and Operational Benefits of Cloud Client Solutions

The benefits of Virtual Desktop Infrastructure and centralized server environment are largely financial: Software and storage are hosted and supported on the centralized server infrastructure, so educational institutions don't buy software for each desktop or laptop device that only one person use, invest in technologies that are quickly outdated, or spend hours and hours on technical support. This model enables IT organizations to choose from a wider range of software than would be practical to purchase for each individual PC, for example.

Research firm Gartner recently compared the Total Cost of Ownership (TCO) of personal computers versus what they term server-based computing (SBC). SBC is simply one implementation of cloud client computing. According to their findings, the "TCO of a SBC deployment used to deliver all applications to users is around 50% lower than that of an unmanaged desktop deployment, and 11% to 18% lower than that of a locked and well-managed PC deployment." In addition, the direct costs "of SBC are between 12% and 27% lower than those of traditional PCs."³

Gartner also points out that SBC deployments "are particularly attractive when client devices are shared by multiple users," exactly the scenario in nearly every school district today. Over the lifespan of a PC, support and maintenance costs continue to grow. The cumulative effects of viruses, malware, disk fragmentation and more – all compounded by multiple users on a single device – render the benefit of PCs to a relatively short-term proposition.

Other benefits associated with cloud client capex and opex are also compelling; on average, it costs more than twice as much to provision a PC vs. a cloud client. PCs typically incur significant annual maintenance costs associated with software maintenance and upgrades, hard drive failure, and troubleshooting, while cloud clients are essentially maintenance-free, and can be easily swapped out when necessary. The average lifespan of a cloud client is six to eight years, vs. the three to four year lifespan of a PC, thus extending the buying cycle and reducing costs over time. In addition, cloud clients provide a greener solution from an energy perspective, consuming 10% or less of the wattage (under 7 watts versus 100 or more) required to operate a PC.

Additional benefits associated with cloud clients include:

Improved security – Cloud clients do not store data or sessions, and all data resides on highly secure servers. That makes it much simpler for IT to comply with data security and back-up policies, especially for resources that are restricted to teachers and administrative staff such as student records. End points and individual access can be completely locked down by the IT administrator through centralized control of the virtual machines hosted by the servers as needed.

Greater reliability – Cloud clients do not have moving parts such as disk drives and fans, and require no native OS to be loaded on the machine, since they are completely dependent upon the centralized servers. With no PC OS to corrupt, cloud clients, and more secure 'zero clients',

³ Total Cost of Ownership Comparison of PCs With Server-Based Computing, August 2008, by Federica Troni, Mark A. Margevicius, Michael A. Silver.

reduce or eliminate virus or vulnerability issues. Unlike a PC, it is impossible for unauthorized users to “customize” the cloud client with outside software which could potentially disrupt the workstation and the network.

Anytime, anywhere access – The lower per-unit costs of cloud clients vs. PCs means that more cloud clients can be deployed throughout the learning environment, including classrooms, libraries, and science labs. The centralized server architecture also enables users to access online resources from home or other remote locations, thus creating classrooms without walls. Software such as Wyse PocketCloud enables secure access to this information from tablets and smart phones from Apple and Google.

Simplified desktop environment and ease of use – Since information and computing resources are resident on centralized servers, cloud clients are not cluttered with multiple applications which can impact desktop performance and distract users, particularly students. A single cloud client can efficiently display any application and OS supported by the virtual server environment.

Moving to the Cloud

A virtualized data center can also provide a distributed computing environment for entire school districts as well as extended campus environments in higher education, thereby creating further economies of scale by eliminating redundant resources and centralizing and simplifying maintenance for over-burdened IT staff. Schools and campuses can be connected using secure WAN links, and centralized servers and software resources can be accessed using virtual desktops located anywhere. With the proliferation of cloud-based applications, students can take advantage of collaborative solutions such as Google Apps for Education, invite their classmates to review their work, and complete their work in the lab, the classroom, or at home. For support staff, a cloud-based system can substantially reduce their load, leveraging efficiencies across the nationwide or statewide school network. The problem of overcrowded classrooms or distance learning challenges can be surmounted through virtual classrooms, with students attending class in their own homes on their own computers, with the teacher being present hundreds of miles away.

Many colleges do not have sufficient hardware or software to provide students a complete learning experience. This problem is especially pronounced in the technical and science fields. However, cloud-based approaches using virtual desktop infrastructure can pave the way by enable access to resources that would be impractical to provide in a PC-based environment. Some countries are already moving in this direction. In early 2011, the Higher Education Funding Council for England announced a plan to allocate £12.5 million to a new program that will fund shared services in cloud computing at colleges and universities across the country.⁴

A major benefit for budget-conscious colleges and school districts is that you don't have to “own” the cloud. Much like a common utility, you just pay for what you use, when you use it, and then turn it off when you're done, without having to invest any hard dollars in server

hardware. The real economy of scale of clouds comes in its expandability. Most institutions have sufficient server capabilities for normal operations, but there are times when that's not enough...or when it's too much. For example, K-12 school districts can buy the cloud services needed during the school year, but can easily dial back their usage, as well as their expenses, during months when classes were not in session such as during summer and holiday breaks. Colleges and universities can buy more cloud server capacity during registration sessions to meet increased demand for computing resources. And all of these services and related applications can continuously be accessed by flexible and efficient Virtual Desktops.

Virtual Desktops in Action in the Classroom

Beech Grove City Schools in the state of Indiana is committed to educational excellence—on an ever-tightening budget. Having been forced to cut IT staff budget by 75% without compromising student education, the school district re-designed their technology infrastructure to make it less expensive to maintain for the long term, as revenues for ongoing funding are still unpredictable.

While Beech Grove City Schools' existing IT system delivered the essential educational and administrative support, it required a staff of seven full-time people just to maintain the system, which comprised a server in each of the district's six buildings, and approximately 1,000 PCs, 200 Mac Book Laptops, 250 Apple iPod Touch Mobile Devices, and an additional 30 HP Mini laptops. This huge maintenance overhead left no resources for improving the system to support better performance and remote access, for example.

To operate within reduced budgets, the district had to slash maintenance spending. The only way to do that was to replace PCs, many of which were at least six years old. To simplify repairs and improve communication across the system, the district also needed more consistency in desktops, so each machine would have the same operating system version, e-mail client, browser, and applications as well as improved security.

As district leaders explored options, they mapped out a new system with servers consolidated into one data center, faster point-to-point network connections, and cloud client virtual desktops. The district saw cloud computing and adoption of the cloud-client model as a way to solve the challenges they faced, while gaining additional benefits such as improving services while reducing the total of ownership: conserving staff resources, saving electricity costs, and getting more years of use from desktop devices.

Greater Economic Efficiencies with Cloud Client desktops

The district has deployed 300 Wyse V10L cloud clients as well as Wyse Device Manager (WDM) software. Today, Beech Grove City Schools' servers are all located in one data center, running Citrix Presentation Server 4.5 on Windows 2003 to manage applications centrally and serve them to approximately 2,000 PCs, Macs, and Wyse V10L cloud clients over point-to-point fibre channel networks. The new infrastructure enables greater consistency across all desktops, even allowing Mac laptop machines to run Windows applications using a Mac ICA client to interface with the Citrix-based applications.

⁴ Higher Education Funding Council for England (HEFCE); February 7, 2011

Both teachers and students now benefit from the latest web-based virtual learning environments, such as Moodle, to enrich classroom learning. All administrative staff and teachers now use cloud clients for management, financial, personnel, grading, and productivity applications, as well as for educational resources. Teachers can use Wyse cloud client desktops in their offices or log in remotely 24 x 7 to access specialized grading software and data warehouse applications that only run in the data center. Students use Wyse cloud clients to access online web services, student information systems, library programs, and assessment testing programs.

Before adopting Wyse cloud client solutions, Beech Grove City Schools required one person to maintain every 200 desktops. Now, they have one person for every 1,000 desktops. This efficiency gain freed up savings of \$200,000 per year for Beech Grove City Schools' IT services. While PCs need to be replaced every four years, Wyse cloud clients last twice as long. The district initially saved \$700 for every cloud client that replaced a PC, and expects an additional savings of \$200 per unit over an eight-year period. The district also predicts it will save approximately \$30,000 a year in electricity costs, based on the new system and adoption of cloud clients, which use a fraction of the energy of a PC. The district's oldest school building recently received a federal grant to implement green technologies, and it is expected that the district will increasingly pursue green initiatives and use part of that funding to replace PCs with cloud clients.

Exposing the Hidden Costs of PCs

The Danbury school district in the state of Connecticut firmly believes in the ability of information and technology to help prepare their students for their personal and professional futures. Each classroom is outfitted with at least one computer, and every school has at least one computer lab. However, as the population grew, the economics of placing PCs throughout the district began to break down.

Budgets are tight enough at U.S. educational institutions without having to worry about the hidden costs of owning and managing personal computers, but that was exactly the quandary facing the bare-bones IT staff in a district with 10,000 students across 18 schools. With a growing student population, there were some funds available for new computers, but no money to add additional staff to support those PCs. The long-term implications of PC upkeep are substantial, and led the school district to adopt a new technology infrastructure comprised of Wyse cloud clients on the desktop combined with Citrix XenDesktop at the back-end.

Considering that maintenance is particularly difficult in school environments where multiple users share devices and applications, the school IT administrator is in an unenviable position. Any new patch or software revision previously required the IT team to individually update each and every PC. With the Wyse cloud client implementation now in place, IT requires just a single individual overseeing more than 500 cloud clients. The time and resources formerly spent replacing and fixing PCs has gone away, and the IT team is now in a position to be proactive about the district's computing needs rather than putting out PC fires.

The 10,000 students who comprise the Danbury student body are benefitting from hands-on technology experience with greater access and training in applications such as Illustrator, Photoshop, DataCAD, as well as the Microsoft Office suite. With XenDesktop and Wyse cloud clients in place, the technology environment provides as good or better performance as PCs for CPU-intensive applications such as graphics.

Wyse Device Manager (WDM) software was critical to improving IT efficiency, both during implementation and in ongoing operation. At implementation, staff simply plug in each cloud client and assign it to the server for that building. This automatically sets that cloud client's defaults to printers and other resources in that building, without requiring custom set-up. Day to day, WDM provides administrators with up-to-date status information about each device on a central console with remote diagnostic capabilities, reducing unnecessary desktop visits.

Another Kind of Green: Sustainability

Northumbria is a large metropolitan university based in Newcastle-Upon-Tyne in the UK, and has over 30,000 students. Northumbria anticipates significant growth, creating an urgent need for more space, and improved facilities for the delivery of core activities. The new campus development has been designed for sustainability building on Northumbria's reputation for environmental innovation, utilizing solar panels for heating and a special cold water system for cooling. However, the University had to find a way to reconcile the environmental impact of heavy IT usage with the buildings' inherent sustainability including strict limits on the use of air conditioning in public areas. High concentrations of conventional PCs would have pumped out too much heat for the natural air cooling system to deal with.

A green IT solution came to mind quite easily because the university was already a user of cloud clients, which consume a fraction of the electricity compared to a standard PC and generate hardly any heat. In fact each Wyse cloud client computer uses approximately 10% or less of the power required by a PC and generates less heat than the person using it. Northumbria's requirements extend beyond environmental features alone. The cloud clients must be easy to manage remotely and deliver a user experience equivalent, if not better than using a PC. For that reason alone, the University had invested in a Wyse virtual desktop solution with cloud clients.

Northumbria uses Wyse Linux-based cloud clients with a very simple configuration that makes the units much easier to support. There also is added security because the cloud clients are useless unless connected to the central servers, which is important in the open learning spaces. Citrix software is used to publish desktop applications to each cloud client terminal. All of the standard Microsoft applications plus some specialist statistical software are made available via a user's personal login detail, which also provides access to personal data. The same software supports desktop ANYWHERE, a service that allows staff and students to access their personal applications and data offsite.

The design and cost efficiencies of the Wyse solution has enabled the University to flood the public areas with over 450 cloud clients and create new areas for accessible learning. The public areas rely on environmentally friendly air cooling rather than traditional air conditioning. The much lower heat output of the cloud clients therefore was an essential part of Northumbria's plans which had to take into account the thermal discharge of both people and PCs. Wyse cloud clients are an ideal solution that integrates with the sustainable design of the new buildings as well as increasing computing resource accessibility for all students.

Summary

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These examples illustrate the value of deploying cloud clients and a Virtualized Desktop Infrastructure in educational institutions, whether they are K-12 or higher education. Not only does the cloud client computing platform from Wyse Technology, consisting of complimentary software and hardware, deliver better VDI with clear and compelling operational benefits to schools and colleges, it also enables more efficient economic deployment models for school districts and public colleges that are struggling in the face of severe budget constraints. Wyse Technology continues to deliver ground-breaking software and hardware solutions in virtual computing environments which provide more flexible and cost-effective computing power for greater numbers of students, reduce desktop maintenance costs and IT overhead, enhance security, and provide more energy-efficient solutions that help educational institutions to meet both the economic and learning challenges ahead.

Wyse Technology is the global leader in Cloud Client Computing. The Wyse portfolio includes industry-leading thin, zero and cloud PC client solutions with advanced management, desktop virtualization and cloud software supporting desktops, laptops and next generation mobile devices. Cloud client computing replaces the outdated computing model of the unsecure, unreliable, energy-intensive and expensive PC, all while delivering lower TCO and a superior user experience. Wyse has shipped more than 20 million units and has over 200 million people interacting with their products each day, enabling the leading private, public, hybrid and government cloud implementations worldwide. Wyse partners with industry-leading IT vendors, including Cisco®, Citrix®, IBM®, Microsoft®, and VMware® as well as globally-recognized distribution and service partners. Wyse is headquartered in San Jose, California, U.S.A., with offices worldwide.



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