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

The Role of Cloud Client-Computing and Virtualization in Education

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Contents

Introduction

Technology and Education

The dreams of many educators have been realized, now that students can access a wealth of educational materials at any time both in and out of the classroom. Indeed, technology has enabled online courses in the form of MOOC's, Khan Academy lectures, educational podcasts, Open CourseWare, iTunes U, Blackboard, and other avenues to expanding educational opportunities. Interest and excitement are still growing with the total educational cloud computing market and is projected to expand from $5.05 billion in 2014 to $12.38 billion by 2019.

Even students in elementary schools are increasingly able to access online repositories of scientific data and primary historical documents, direct to classroom TV channels, and two-way distance learning from their classrooms. Communication apps such as Skype, Citrix GoToWebinar, and FaceTime are also being used to reinforce classroom lessons and keep students engaged.[1]

However, the ability to support these capabilities is at risk as traditional sources of funding for public education have come under continued pressure. Because of gaps created by static or falling tax revenues,[2] some school districts have been ruled to be illegally underfunded, creating a temporary crisis over taxes and state spending.[3]

Many schools in the U.S. have had access to computer-based education to complement in-class lesson plans, yet still struggle with low graduation rates, insufficient infrastructure, crowded classrooms, and limited staff. As just one example, student enrollment in Arlington, Virginia's public school district increased by an unprecedented 5.2 percent in 2014, pushing two of its middle schools over capacity.[4]

These additional pressures have forced IT departments to extend the lifecycle of their existing network devices, legacy security solutions, and aging desktops. To address these and other issues, IT professionals are considering innovative and cost-effective ways to deliver flexible computing resources to even more students.

1. *The Berkshire Eagle,* "Teaching In The Age of Computers," Derek Carson, February 27, 2015.
2. *The Associated Press,* "Indiana Legislators Eye School Funding Revamp," Tom Davies, January 4, 2015.
3. *The Kansas City Star*, "Three Judge Panel In Kansas Calls School Funding Inadequate," Brad Cooper, December 30, 2014.
4. *The Washington Post,* "Overcrowding Has Arlington Officials Debating Plans For Middle School Expansion," Moriah Balingit, December 7, 2014.

The Impact of Reduced Education Funding

By some estimates, the U.S. Education system has recently faced some of the largest budget cuts in history. At least 35 states provided less funding per student for the 2013-2014 school year than they did before the recent recession.[5] Specifically, these states have reportedly cut higher education funding by more than 20 percent, with 11 cutting funding by more than one-third.[6] This development has forced administrators to seek ways to substantially reduce expenses, including cutting system-wide IT costs. With tax revenue rising only modestly in most states, school districts have made spending cuts that impact public education and associated technologies.

The cuts were typically a result of lower revenues from income taxes, sales taxes, and other sources that declined due to the recession. For example, while state tax revenues reportedly grew 8.9 percent in the 12-month period ending in March 2013, this figure was still 2.8 percent below 2008 levels after adjusting for inflation.[7] At the same time, the need for these services rose as student enrollment increased. And despite recent economic progress, 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 other education programs:

• Oklahoma cut spending on education by 23.6 percent between FY08 and FY15, the largest percentage decrease nationwide. The state's education general funding formula allocated just $2,769 per student as of the current fiscal year, a figure representing a decline of $875 per student since 2008.

• Alabama cut education spending 17.8 percent between FY08 and FY15, with school spending falling more than any other state in dollar terms. Alabama spent $5,199 per pupil but this figure represented a decline of $1,128 for the interval measured.

• Arizona cut its education spending by 17.5 percent between FY08 and FY15, allocating only $3,114 per student for FY15, a decline of $663 since 2008. In recent years, Arizona legislators have cut both corporate and capital gains taxes, sources of state revenue that ultimately support school funding.

Higher education is experiencing similar budgetary pressures as matriculation has remained flat for the past three years. Indeed, Bloomberg reported that fall-term enrollment at U.S. colleges fell slightly between 2012 and 2014, because of a rebounding job market and a shrinking pool of high school graduates.

5, 7. *Center On Budget And Policy Priorities,* "Most States Funding Schools Less Than Before the Recession," Michael Leachman, May 20, 2014.
6. *Center On Budget And Policy Priorities,* "States Made Deep Cuts To Higher Education, New Report Finds," March 19, 2014.

Additionally, 48 states are spending less per student today than they did before the recession while colleges and universities have been forced to make large increases in tuition to make up for insufficient state funding. Annual published tuition at four-year public colleges has risen by $1,936, or 28 percent, since the 2007-08 school year, after adjusting for inflation. In Arizona, published tuition at four-year schools is up more than 80 percent, while in Florida and Georgia, published tuition is up more than 66 percent. At the same time, President Obama has tried to hold the colleges accountable as tuition and fees have increased faster than inflation, while household incomes have stagnated.[8]

Amidst these changes, IT professionals in the education sector have been looking to technology to align institutional requirements, student expectations, and limited financial resources. Cloud client-computing architectures that leverage powerful and relatively inexpensive virtual desktops and stream data and workloads to mobile devices, have enabled educational institutions to serve more students with fewer resources. Both K-12 and higher education can benefit from the adoption of desktop virtualization and the cloud client-computing model, given the technology's ability to reduce OpEx costs and optimize resource management.

A New Computing Model for Educational Institutions

Several factors have inspired IT professionals in the educational space to consider cloud client-computing architectures. Funding pressures, the need to improve academic performance, and advances in information technologies have directed the focus of IT to a model for providing shared learning resources. The data center model utilizes a virtual desktop infrastructure (VDI) to reduce IT overhead, enhance endpoint security, and ensure greater reliability. It also allows educational environments to leverage server-based and online applications.

The cloud client-computing model provides a secure, unified, centralized architecture leveraging powerful virtualization software. Depending on their specific needs, educational institutions can choose deploy their software of choice including Citrix XenApp, Microsoft Remote Desktop Services or Terminal Services, or Citrix XenDesktop, Microsoft VDI Suites, or VMware View to deliver a range of standard applications such as Office or specialized educational software.

8. *The Wall Street Journal,* "Obama Spells Out College-Ranking Framework," Douglas Belkin, December 19, 2014.

These elements are integrated with a virtual desktop infrastructure from Dell, which uses a cloud-client approach to provide end-users with improved access to critical applications. This allows students, teachers, and administrators to log in from any virtual desktop and immediately access applications for learning, teaching, or administration.

While cloud client architectures can require higher initial capital costs, cloud endpoints enjoy lower maintenance costs given fewer moving parts and higher levels of reliability. Because thin clients do not require individual software installation and patching, they are also less vulnerable to security threats and less prone to downtime. However, the size of an organization and sophistication of its IT department (and its previous investments in data center hardware) play a role in the migration to a cloud client-computing architecture.

Smaller businesses that have not invested in back-end technology that need to build out server support to the level needed to present XenDesktop to employees, would have to spend: $157 per user for local servers; $121 per user for the necessary storage; $33 per user for network-facilitating supplies such as cables and adapters and; an additional $418 per user for Wyse thin client hardware for a total of $729 per user.

Cost estimates for mid-level companies that already have storage networks in place, the network equipment and storage costs are subtracted, as well as the cost of replacing existing monitors, are $457 per user.[9] For large enterprises with significant data center investments in place, the investment cost drops to $300 per user for the thin client device itself. Contrast this with the average cost of a traditional PC per user is typically $944.[10]

9, 10. *Dell, Wyse Reassess the High Cost of Virtual Desktops,* Scott M. Fulton III, December 8, 2014.

Economic and Operational Benefits of Cloud Client Solutions

Virtual Desktop Infrastructures and cloud client-computing environments can provide significant financial benefits: Software and storage are hosted and supported on the centralized server infrastructure, so educational institutions don't need to buy software for each desktop or laptop that may be underutilized or spend an inordinate amount of time 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, and allows for easy and rapid deployment of new applications and software updates as needed.

Gartner pointed 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 traditional PC, support and maintenance are compounded by the cumulative effects of viruses, malware, disk fragmentation and more – all compounded by multiple users on a single device – can mean increased costs for IT departments.

Source: Gartner (http://blogs.gartner.com/chris-wolf/files/2012/12/image.png)
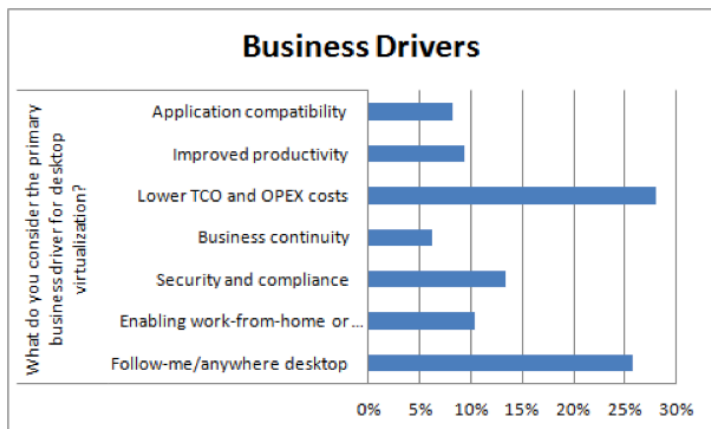
Cloud client endpoints also provide other savings that may not be initially considered in a typical hardware refresh. For example, replacing a traditional 200 watt PC with a 7 watt Wyse thin client can save $69.53 per seat annually. Finally, desktop virtualization solutions allow today's mobile workforce to be more productive as they access their workloads and virtual desktops from nearly any device. 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 also reducing costs over time.

Additional benefits associated with cloud clients include:

Improved security – Cloud clients do not store data or sessions, thereby enhancing endpoint security. And because data resides on inherently more secure servers, IT managers can streamline compliance with data security and back-up policies. Endpoints 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 have fewer moving parts such as disk drives and fans, and require no native OS to be loaded on the machine and are therefore more reliable. With no local OS to corrupt, cloud clients and more secure "zero clients" can reduce or mitigate vulnerability issues. Unlike a PC, it is impossible for unauthorized users to "customize" the cloud client with unapproved software which could potentially lead to downtime.

Anytime, anywhere access – The lower per-unit cost of cloud clients vs. PCs means that more cloud clients can be deployed throughout the environment, including classrooms, libraries, and science labs. Meanwhile it's centralized server architecture allows universities to grant users access to online resources from home or other remote locations, making classwork more flexible. Software such as Wyse PocketCloud enables secure access to this information from tablets and smartphones.

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

Moving to the Cloud

Cloud client architectures can also provide a distributed computing environment for entire school districts over a WAN. This ability to extend campus environments allows institutions to further enhance economies of scale by eliminating redundant resources and simplifying maintenance for over-burdened IT staff. Schools and campuses can be connected using secure WAN links, and software resources can be accessed using virtual desktops located anywhere.

Using cloud-based applications, students can take advantage of collaborative solutions such as Google Apps for Education. They can also review their work and complete assignments in either a computer lab, in a classroom, or at home. For support staff, a cloud-based system can substantially reduce their load, leveraging efficiencies across a statewide or even nationwide school network. Some problems associated with crowded classrooms can be overcome through virtual classrooms. In this distance learning scenario, students attend class from their own homes on their own computers, with a teacher presenting lectures or course materials from another location or even another state.

While higher education enrollment may be flat, many colleges do not have sufficient hardware or software to provide every student with a modern learning experience. This problem is especially pronounced in the technical and science fields. However, cloud-based solutions leveraging desktop infrastructures can mitigate this problem by enabling access to resources that would be impractical to provide in a PC-based environment.

Virtual Desktops in Action in the Classroom

Indiana's Beech Grove City Schools is committed to educational excellence despite an ever-tightening budget. Having been forced to cut its IT staff budget by 75% without compromising student education, the school decided to redesign its technology infrastructure. The goal was to embrace systems that were cheaper to maintain, given its unpredictable funding horizon.

While Beech Grove City Schools' legacy IT system served its educational and administrative role, maintaining a staff of seven full-time IT professionals to monitor its legacy distributed architecture was inefficient. A staff of seven full-time IT professionals was required to maintain a server in each of the school's six buildings, along with approximately 1,000 Windows PCs, 200 MacBook laptops, 250 Apple iPod Touch Mobile Devices, as well as 30 HP Mini laptops. This arrangement left few resources available for improving the system to improve performance or introduce remote access.

To operate with reduced budgets, the district had to develop a strategy to cut its operating budget by limiting maintenance spending. The best way to achieve this was to replace PCs, many of which were at least six years old. To simplify repairs and improve communication across the system, the district would need more consistency in desktops. Ideally each machine would run the same updated operating system version, e-mail client, browser, virus definitions and applications.

As senior administrators explored options, they saw the benefit of a new architecture that could deliver faster point-to-point network connections, cloud client endpoints, virtual desktops, and servers consolidated into one data center. The district saw cloud computing and specifically the adoption of the cloud-client model as the best way to solve the challenges they faced. The additional benefits such as improving services while reducing the total cost of ownership: conserving staff resources, saving electricity costs, and getting more years of use from desktop devices, made the solution that much more compelling.

Greater Economic Efficiencies with Cloud Client desktops

Ultimately the district deployed 300 Wyse V10L cloud client endpoints coupled with Wyse Device Manager (WDM) software. The Beech Grove City Schools migrated its servers into one data center running Citrix Presentation Server 4.5 on Windows Server 2003. This allowed applications to be served to approximately 2,000 PCs, Macs, and Wyse V10L cloud clients over point-to-point fibre channel networks. This new infrastructure enabled greater consistency across all desktops, and allowed Mac laptops to run Windows applications as needed using a Mac ICA client to interface with the Citrix-based applications.

Teachers and students now benefit from the latest Web-based virtual learning environments such as Moodle, a free, online learning management system that lets educators to create private Websites to extend lesson plans outside the classroom. The new system also allows educators to delver downloadable quizzes and study materials. All administrative staff and teachers now use cloud clients for many back office functions as well, such as day-to-day management, financial, personnel, grading, and productivity applications, as well as for educational resources.

Teachers use Wyse cloud client desktops in their offices or log in remotely to access specialized grading software and applications that run in the data center. Students use Wyse cloud clients to access online Web services, student information systems, library applications, and assessment programs.

Before adopting Dell cloud client solutions, Beech Grove City Schools required one IT professional to maintain every 200 desktops. After adopting a cloud client-computing solution the school system employs one IT manager for every 1,000 desktops. This efficiency gain freed up savings of $200,000 per year for Beech Grove City Schools' IT services. And while legacy PCs need to be replaced every four years, Wyse cloud clients can in many cases last nearly twice as long. The district initially saved $700 for every cloud client that replaced a PC, and expects additional savings of $200 per unit over an eight-year period.

The district now forecasts that 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 traditional PC. The district's oldest school building received a federal grant to implement green technologies, and it is expected that the district will increasingly pursue green initiatives and use a portion of that funding to replace its aging PCs with cloud clients.

Exposing the Hidden Costs of Traditional PCs

Connecticut's Danbury School District believes in preparing students for college and for jobs in today's information economy. Each classroom is outfitted with at least one computer, and every school has at least one computer lab. However, as the population grew, the original economics of placing traditional PCs throughout the district began to break down.

Budgets at U.S. educational institutions are under pressure and having to manage personal computers is often seen as an unavoidable operational expense. This was the quandary facing a limited IT staff in the Danbury School District. Students. With a growing population of 10,000 students across 18 schools, funds were allocated for new computers, but not for additional staff to support those PCs. The long-term implications of PC upkeep were substantial, and led the school district to adopt a new technology infrastructure comprised of cloud client endpoints and Citrix XenDesktop in the datacenter.

Considering that maintenance is particularly difficult in school environments where multiple users share devices and applications, school IT administrators can use cloud client architectures to streamline support. While new software patches and virus definition updates previously required the IT team to individually update each and every PC, a school's IT managers can now serve the same centrally-updated image file to as many as 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.

Today the 10,000 students in the Danbury district are benefitting from greater access to sophisticated design applications such as Illustrator, Photoshop, DataCAD, as well as the latest Microsoft Office suite. With XenDesktop and Wyse cloud clients in place, the technology environment provides as good or better performance as legacy PCs for CPU-intensive applications requiring graphics.

Wyse Device Manager (WDM) software streamlined the implementation phase and allowed IT staff to simply assign each cloud client and assign it to the server for that building. WDM also automatically recognizes each cloud client endpoint's defaults to point to printers and other resources in that building. This capability was historically a challenge for desktop virtualization architectures, without requiring a complicated custom set-up. Finally, WDM provides administrators with status updates about each device via a central console with remote evaluation and reset capabilities, reducing unnecessary endpoint visits.

Another Kind of Green: Sustainability

Northumbria is a large metropolitan university based in the north eastern U.K. with more than 30,000 students. The university's growth projections created an urgent need for more space and improved facilities for the delivery of core activities. The new campus development was designed for sustainability building on Northumbria's reputation for environmental innovation, utilizing solar panels for heating and a dedicated cold water system for cooling.

However, the university had to find a way to reconcile the environmental impact of heavy IT usage with its sustainability goals which included setting strict limits on the use of air conditioning in public areas. Lab configurations of traditional PCs would have generated too much heat for natural air cooling to mitigate. The public areas rely on environmentally friendly air cooling rather than traditional air conditioning.

The lower heat output from the cloud clients was an essential part of Northumbria's plans for upgrading its traditional PCs. Because cloud clients consume a fraction of the electricity consumed by a standard PC and generate very little heat, cloud clients were a natural choice. Specifically, each Wyse cloud client computer uses approximately 10% or less of the power required by a traditional PC. The design and cost efficiencies of our cloud client solution have enabled the university to create new areas for accessible learning populated with more than 450 cloud client endpoints.

Of course, Northumbria's requirements extend beyond environmental constraints. The cloud clients needed to be easy to manage remotely and deliver a use experience that was equivalent, if not better than using a PC. For that reason alone, the University invested in a virtual desktop solution with Wyse cloud clients, an ideal solution that integrated with the sustainable design of the new buildings and increased the availability of computing for its students. Today Northumbria uses Dell Linux-based cloud clients with a simple configuration that makes the units much easier to support. An additional layer of security comes from the architecture connecting the cloud clients.

Today, Citrix software is used to deliver desktop applications to each cloud client endpoint. All of the standard Microsoft applications and relevant educational software are accessible by each student's login, which also provides access to personal data. The same software supports DesktopAnywhere, a service that allows staff and students to run approved applications via broadband streaming from their university's suite of applications using Java or HTML5 to their own Windows, Mac, Linux, or iOS device.

Summary

2

These examples illustrate the value of deploying cloud clients and a Virtual Desktop Infrastructure in educational institutions, in any environment from K-12 through college to the graduate degree level. Not only does the cloud client-computing architecture from Dell consists of complimentary software and hardware, our systems deliver better VDI with clear and compelling operational benefits to schools and colleges. Finally, Wyse endpoints also enable more efficient economic deployment models for school districts and public colleges that are facing budget constraints. Dell continues to deliver ground-breaking cloud client-computing solutions that 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 technological challenges ahead.

Dell 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.

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