

**CITRIX**® | Public Sector

## Now and in the Future: Meeting Today's K-12 IT Challenges

Academic Computing Virtualization: The  
Solution for IT

## Executive Summary

Every class and student depends on the delivery of data and applications as an integral part of the learning experience.

Today’s K-12 information technology (IT) challenges surpass anything previous generations could have ever imagined. Tech-savvy Millennials—the largest generation in U.S. history—stand to affect the future of schooling more than ever before as they bring with them high expectations for device freedom and versatility; as will Generation V—the virtual worlders. Every class and student depends on the delivery of data and applications as an integral part of the learning experience, and the burden of maintaining a progressive computing environment has become a consuming task for each school district’s IT department. It comes as no surprise that, according to the Center for Digital Education, K-12 education is forecasted to spend nearly \$10 billion on new technology initiatives and upgrades over the next year alone.

With one-to-one computing initiatives and the need to provide differentiated instruction for students at various skill and ability levels, computer usage needs to be more flexible than ever. Physically updating or modifying every computer between semesters, and even between classes, is too time-intensive to be practical. Educators need a way to deliver individualized, technology-based instruction that can be rapidly re-provisioned and securely accessed to suit the needs of students and faculty members alike.

Incoming capital from the Race to the Top Fund, the Schools and Libraries Program of the Universal Service Fund (E-Rate), and American Recovery and Reinvestment Act (ARRA) adds another dimension to the opportunities and the challenges facing educators. Direct injections of funds into state general education budgets—expected to reach \$98.2 billion in grants and direct funding for education—presents an opportunity for K-12 to advance technology at a never-before-seen pace. The challenge, however, will be to use stimulus funds to implement technologies and data infrastructures that will be sustainable once the money runs out.



Such funding increases, along with the growing need to accommodate electronic-only generations and distance learners, are driving a changeover to digital and online content; consolidation and standardization of the IT environment; and increased use of the Internet and Internet-based services. The specter of ongoing staff cuts and shrinking budgets have now placed a premium on maintaining operating efficiencies and cost savings through tech-based solutions. Evidence of this trend can be found in states like Florida, which is moving to make its educational content all-digital by 2015 and delivered via mobile devices and e-readers.

The Enhancing Education through Technology (EETT) state program, which aims to improve elementary- and secondary-school student achievement through the utilization of technology, is also paving the way toward more connected and tech-integrated classrooms. The federal government's technology plan represents an unprecedented change in the way children are taught and seeks to infuse new technologies into all aspects of education. The ISTE-developed Preparing Teachers for Digital Age Learners Act (PTDAL), which provides grants to develop effective teaching through modern digital tools and content and improve the way schools teach classroom technology integration to teacher candidates, will additionally assimilate ed-tech into America's schools.

A majority of K-12 technology leaders already look to desktop virtualization as a viable solution to their top-priority computing challenges, including:

- Secure delivery of applications and resources to the appropriate students at the right time;
- Easy delivery of semester-, quarter- or course-based instructional applications and resources;
- Reduction of IT costs by extending the lifecycle of existing hardware; and
- Freeing IT personnel to work on other projects.

Virtual desktop delivery and other solutions like server virtualization also improve the green IT profile for school districts of all sizes. Longer lifecycles for expensive desktops, the ability to use power-conserving thin clients and dramatic reductions in power consumption in the datacenter all add up to green IT solutions that positively impact budgets.

Read on to learn how virtualization solutions from Citrix Systems, Inc. create an academic computing virtualization solution to address the desktop, the data infrastructure and the datacenter itself to ease the strain on IT while improving and expanding the delivery of administrative and instructional applications to any faculty member or student, in any location, on any end device with an Internet connection. Working with Citrix can help school systems close the digital divide for all students, develop alternative forms of both teaching and learning, improve the reach of the traditional computer lab and teach new skills for the 21st century. Technology-based administrative functions, such as the management of bus routes, meals, medical records and parent communication, can also be managed and delivered via Citrix virtualization.

### Stepping Back from the Funding Cliff

While it breathes much-needed life into technology investment programs, funding assistance from Race to the Top, E-Rate and ARRA will not last forever. When the money has been spent and current tax revenues might not support ongoing, increased operating costs for anything purchased or implemented, this brings about a precarious "funding cliff" for K-12 schools. As a result, IT must be prepared to leverage this stimulus as quickly and efficiently as possible—and virtual computing provides the solution.

The key to successfully using federal and state funds for education IT is to make one-time, strategic investments that structurally change the way schools operate and lower ongoing operating costs to avoid the inevitable funding cliff. Schools are encouraged to make short-term investments with long-term benefits—rather than ongoing commitments that require high levels of sustainable funding—to avoid financial disaster after an injection of capital runs dry.

## On the Minds of Today's K-12 Technology Leaders

Due to the ever-growing need to do more with less, schools are looking to newer IT infrastructure solutions to get the most out of their resources. A recent survey of K-12 education technology leaders found that primary schools view virtualization as a viable way to deliver applications and resources to students while reducing IT costs.

Citrix surveyed K-12 education technology leaders to determine attitudes and expectations related to virtualization. The vast majority of respondents cited an interest in desktop virtualization, indicating that virtualization solutions in the classroom should see an increase in the months and years ahead.

According to the survey, other top IT challenges include:

- Secure delivery of applications and resources to the right students at the right time;
- Easy delivery of semester-, quarter- or course-based instructional applications and resources;
- Reduction of IT costs by extending the lifecycle of existing hardware;
- Freeing IT personnel to work on other projects; and
- Providing a high-quality user experience.

Survey responses were highly consistent in terms of the challenges and solutions that are at the forefront of K-12 technology concerns. The need for IT in the K-12 environment has grown exponentially, while budgets and staffing have remained flat. Technology and administration experts are looking to IT—specifically, virtualization—to improve the delivery of education and to help IT teams do more with the resources at hand.

The survey also gave K-12 technology leaders the opportunity to provide open-ended responses about the top technical benefits or issues they associate with virtualization solutions. Their responses made it clear that the most meaningful benefit of virtualization in the K-12 environment is the ability to spend less time on the management and support of software and hardware. And, with stimulus funds reaching the educational system, school districts can implement virtualization solutions that will deliver these time and cost savings—benefits that will last long after stimulus money has been spent.

## Introduction

School districts across the country strive to provide the best educational tools possible to every student in kindergarten through the 12th grade. Today, that means providing student access to up-to-date technology and instructional software applications. Computer labs serve only a limited number of students and present a significant challenge in terms of the need to re-provision the lab in the mere minutes of downtime between classes to serve students at different academic levels. Additional computing challenges include security, cost and management of software and hardware assets. With limited personnel resources, tight IT budgets, challenging technology goals and important district initiatives like one-to-one computing, the task can seem insurmountable.

New technologies and fresh approaches are needed to bring the K-12 computer lab in line with the needs of the current primary education environment. Virtualization presents a set of solutions that reach from the desktop level all the way to the datacenter to give K-12 education an IT solution that truly addresses the unique challenges of every grade, every class and every student—all within the parameters of existing computer lab equipment.

In a recent Citrix survey, education IT leaders shared the unique challenges of computing in the K-12 environment and defined the technical benefits they expect to achieve by deploying virtualization solutions in the classroom. Based on the survey results, virtualization—and desktop virtualization in particular—claims a position of primacy in forward-thinking education IT initiatives.

Citrix academic computing virtualization integrates desktop, application and server virtualization in a complete solution that delivers applications and desktops as a secure, web-based service to students and faculty anywhere, at any time and on any type of browser-enabled device—whether a hand-me-down desktop or the latest handheld device. Windows®-based applications are delivered over the network (or securely via the Internet) directly to the student or teacher. Users get access to the most effective educational tools, while software is managed cost-effectively at the server level. End devices last longer, freeing precious budget dollars and stimulus funds for other projects.

## Academic Computing Virtualization: The Solution for K-12

Virtualization has become one of the most talked-about education technologies in recent years. It breaks the hard-coded link between hardware and software, allowing individual computing components to be dynamically combined and reassembled for maximum efficiency and agility. Application virtualization—the ability to deliver any Windows application to any teacher or student—empowers educators to provide class-specific applications to students via any device with an Internet or network connection. Server virtualization optimizes and reduces costs in the datacenter, and desktop virtualization makes desktop management a matter of publishing one “golden image” rather than physically upgrading, patching or repairing thousands of aging desktops.

Top IT Management Concerns	Current Technologies	Virtual Computing
Management	Operationally inefficient due to distributed environment. OPEX largest cost.	Centrally managed reducing OPEX and streamlining support.
Security	Numerous technologies required to lock down systems and keep data secure.	Centralized data and applications allow for increased security & control of data.
Semester Provisioning	Every device manually configured with limited flexibility.	Desktop not tied to device allowing for simplified delivery and updating in single location.
Access	Limited access methods typically by LAN based devices.	Multiple access options provided for students. On/off campus and student or school owned devices.
Availability	Costly downtime and multiple devices to allow for varying curriculum.	Always on and always available from any location.
Cost	High TCO with consistent refresh cycles. CAPEX unchanged.	Greatly reduced TCO due to OPEX reductions. PC refresh extension to 5+ years, Thin Client 7+.

A comparison of traditional computing vs. virtual computing.

What’s more, today’s Millennial and Generation V students are bringing new technologies to the classroom environment and often introducing them to ed staff due to the growing consumerization of IT—and not the other way around. As a result, principals and teachers must be prepared to offer the same device options to students that they’re used to at home—be it tablets, smart phones, e-readers or laptops. Planning for the “Bring Your Own” (BYO) device movement is increasingly at the heart of any school system’s technology strategy since the future of digital learning will not be device-specific. Through the use of virtualization, education can effectively close the digital divide between the technology that students want to work with and what they actually use in school.

As always, budgetary limitations and legislative trends are key factors in this evolution. The governor of Idaho has proposed a plan to put a laptop in the hands of every high school student starting with the 9th grade—although logistical and funding issues have yet to be ironed out. In Florida, the plan to move toward all-digital content by 2015 will draw out \$700,000 a year from the Department of Education (DOE) budget—no small expense, even for a quantum leap forward in instructional versatility.

Academic computing virtualization from Citrix provides a complete virtualization infrastructure that spans from the datacenter to the desktop and is the best way to deliver applications to students on any device, anywhere, at any time. Using this approach, functional components are orchestrated at the datacenter, front end, gateway, remote location and desktop, which assures that the overall system has the required intelligence to adapt to dynamic requirements. With an effective orchestration of end-to-end application delivery, IT will be able to instill lasting improvements in performance, flexibility and security. Administrators do see the need for the leap to BYO, but not as often a realistic pathway.

Through the use of virtualization, education can effectively close the digital divide between the technology that students want to work with and what they actually use in school.

For K-12 education, academic computing virtualization optimizes the computer lab and expands the capabilities of that lab far beyond its walls. It enables rapid re-provisioning of the lab from the datacenter, distributing the correct applications and coursework in moments—which makes it possible to deliver the best lab for each class throughout the day. And, because virtualization allows the school to deliver applications to any device with an Internet connection, educators can also create a virtual BYO computer lab that is available at any time, from anywhere. This gives students and faculty the ability to learn and work whenever they need to—in and out of both the classroom and school hours—and improves student access to the technology-based tools that help them succeed. Instant access to broadband can be provisioned for all students and thus closes the digital divide in ways never before possible.

### Trends in K-12 Investment

- Undertaking virtualization and server consolidation
- Improving security
- Addressing enterprise resource management
- Developing online/distance learning curriculum
- Accommodating mobile classroom technologies (BYO)
- Ensuring campus connectivity
- Developing student information systems
- Developing learning management systems
- Providing digital content

The implementation of end-to-end virtualization solutions creates a data infrastructure that easily supports key education initiatives, such as one-to-one computing and differentiated instruction. Academic computing virtualization accomplishes this while reducing costs and drastically cutting down on the amount of IT management hours required to manage desktops and applications.

Switching to a virtualized computing environment also helps to augment 21st-century skills for students. At present, 75 percent of U.S. school districts offer courses that cover tech-related careers, while 82 percent offer advanced technology classes including computer programming, video game development and multimedia production. Blended learning using the Internet and diverse device platforms provide better preparation for the all-digital world facing today's youth, and seamlessly connects them to experiences never before possible. For example, many schools now use video conferencing to create virtual field trips for students as well as web 2.0 resources like wikis and blogs as real-time teaching aids.

### Virtualization and BYO

Bring Your Own (BYO) computing facilitates the transition to a virtual desktop environment and allows students to use their own devices rather than relying on those provided by schools—therefore helping IT get out of managing lab devices. The cost savings also enable principals to re-allocate budget money toward other services for students including academic support, extracurricular programs, and facilities maintenance.

BYO is expected to be the choice of students who prefer virtual and digital media channels for accessing information anytime, anywhere, thus giving organizations the ability to simplify ownership, management and data security while saving costs and enhancing learning experiences. The rise in popularity of e-books is likely to be a key catalyst for the increase in student-owned devices, and students are also prone to adopt BYO as it empowers them with a sense of ownership, flexibility and freedom.

BYO has the potential to extend the reach of the computer lab outside the physical boundaries of the classroom and school hours as well. As a compliment to these labs, a BYO program means that students don't need to stop learning when the day is done or the school bus leaves the building.



## Augmenting the Reach of the Traditional Computer Lab

The reasons for enhancing the school labs with BYO are many. Managing physical computer labs is costly and burdensome for IT. New and complex education applications that sometimes need to be added or updated every year require a robust device. IT has to continuously scrub and polish existing devices or get rid of legacy devices altogether and purchase new ones to support these requirements. On the other hand, students also demand extended lab hours that can provide them the option to learn anytime. Setting up such new labs and maintaining extended-use labs is often difficult, if not impossible, for schools working on limited budgets. After all, educational institutions have an array of other student development areas to which they need to allocate budget funding as well.

Desktop virtualization provides 24-hour access to labs, while simplifying IT. Instead of providing physical computer locations that are not open around the clock or have student-friendly devices, schools can provide access to virtual labs on student-owned laptops, notebooks or other devices. In a virtualized environment, entire desktops and applications are delivered from the datacenter. Instead of installing software on a lab computer or student's personal device, the applications and the data reside in the datacenter and are accessed remotely.



Desktop virtualization provides 24-hour access to labs, while simplifying IT.

Applications run on the server and not a device, and can therefore be delivered to any type of device securely. This also means that IT can provision new labs instantly while reducing hardware expenses, capital infrastructure expenses (land and building) and energy consumption in the datacenter and cutting down on tech support needed to run physical labs. When introducing new applications, IT can test and develop them quickly while keeping other services running 24/7.

Through the use of Citrix XenDesktop™ technology, K-12 administrators can efficiently institute a tailored BYO infrastructure to augment the lab experience. Citrix XenDesktop additionally affords the power to deliver custom desktops to users with the appropriate level of control and security policies, and can be run with pre-existing setups for those schools not already working with virtual applications and desktops. Hosted shared and hosted VDI desktops are excellent options for labs and student-owned computers, while streamed desktops and hosted blade PCs are ideal for faculty and IT staff with heavier computational needs.

With this infrastructure in place, IT can enable security policies that do not allow saving data on local devices. When virtualizing applications and streamed to endpoints as an on-demand service, Citrix XenVault™ technology also lets administrators automatically and transparently encrypt all data created through Citrix XenApp™-delivered applications streamed to endpoint, even allowing them to remotely wipe the data if the device is lost or stolen.

## A One-Stop Shop for Education IT Needs

With limited funding and resources at stake, administrators cannot afford to waste time or money looking for multiple solutions to their IT hurdles. This is why academic computing virtualization addresses K-12 computing challenges at multiple points: the desktop, the application and the server.

Along the way, virtualization creates a modern IT infrastructure that allows school districts to get the most out of its resources, extending hardware lifecycles and improving the delivery of technology-based instruction as schools become equipped to teach in a variety of ways: via mobile device, the Internet, blogs, digital textbooks, virtual field trips and so on. In turn, students become better prepared to live, learn and develop pertinent skills in the tech-dominated world of the next century.

Adding desktop virtualization to their IT profile represents a growing focus for K-12 technology leaders, and nowhere are the benefits of going virtual more evident than in the classroom itself.

### Finding the Answers in Desktop Virtualization

With desktop virtualization, a single desktop image, including installation and maintenance of software, upgrades and patches, is maintained at the server level and then securely delivered to the end device—which can be a traditional desktop or laptop, or even a thin client—over the network or via the Internet. This enables the IT team to manage a suite of desktop images tailored to fit the needs of different classes and grades, with no need to “touch” end devices in the computer lab or in the students’ possession. This also protects the school’s data and applications from either accidental or intentional student access.

Adding desktop virtualization to their IT profile represents a growing focus for K-12 technology leaders, and nowhere are the benefits of going virtual more evident than in the classroom itself. For example, the traditional computer lab—a physical location within the school that hosts a limited number of desktops and serves students at varying skill levels—presents a host of challenges to a district’s IT team:

**Management:** Time-consuming maintenance and support for lab desktops and applications

**Security:** Assurance of data, application and device security

**Provisioning:** Timely updates required for changes to applications and data between semesters and even between classes during the school day

**Access:** Optimal student access to data and applications, as well as faculty access to teaching tools and digitized content

**Availability:** Addressing student capacity considerations

**Cost:** The need to work within the limits of decreasing budgets and aging equipment to bring technology initiatives within reach

**User experience:** Providing superior performance and delivery at all times

The drain on staff resources from the lab and all other school IT needs presents perhaps the biggest challenge of all for administrators. With every computer, desktop management includes the maintenance of hardware, software, upgrades and patches for each individual desktop in the school district—an extremely time-consuming task.



True desktop virtualization, however, only requires the management of one “golden image” of the desktop in the datacenter. Applications are installed, upgraded or patched once, and that single image is delivered directly to the school computer or even to student-owned end devices. Each student benefits from a fast, virtualized desktop—an experience similar to having a new PC every day—and the IT team can apply personnel and budget resources to other, equally important projects.

The virtual desktop presents clear advantages for school IT:

#### Efficient management of semester- and class-based instructional applications

Installation of and access to semester- and class-based applications are implemented at the server level, with no need to physically handle each desktop. For school systems with campuses spread throughout the district, this creates a phenomenal benefit in terms of the time it takes for the IT team to deploy new or upgraded applications. Data and applications reside safely in the datacenter while only pixels and mouse clicks are transmitted over the network to the computer, creating an added level of security for the school’s applications, data and hardware.

#### Improved around-the-clock student access

Virtualization has the capability to deliver secure, on-demand access and 24/7 availability to the student, who can use instructional applications from the computer lab or from any end device with an Internet connection. Learners enjoy the freedom of working when they want, where they want, and can leverage technology-based instructional tools outside of the traditional school day. What’s more, not being bound to the same classroom, computer or application translates to productivity gains for students as traditional time- and location-based learning obstacles disappear.

#### Extended lifecycles for expensive hardware components

Desktops and other end devices achieve significantly greater lifecycles, lasting years longer and cutting the expense of replacing expensive hardware. This also reduces waste and allows the school district to gradually replace aging desktops with more energy-efficient thin clients or desktop appliances—all with no negative impact to performance.

Schools can even take computer virtualization one step further and eliminate the physical lab altogether, delivering applications on-demand to more portable laptops and making the system available to student end devices. The computer lab becomes a virtual experience, which frees up the lab space for other uses and creates a more efficient IT management scenario.

Academic computing virtualization allows IT to deliver virtual applications and manage access from the server level, with no need to touch each student device. XenDesktop centralizes and delivers desktops as a service across the school district, thus reducing total cost of desktop ownership. Centralizing desktop lifecycle management in the datacenter improves data security. Students receive a high-definition experience and personalized, pristine desktops over any connection.

The open architecture of XenDesktop offers choice and flexibility of virtualization platform and end points. Unlike other desktop virtualization alternatives, it simplifies desktop management by using a single image to deliver personalized desktops to users anywhere and enables IT administrators to manage service levels with built-in desktop performance monitoring.

...virtualization allows IT to deliver virtual applications and manage access from the server level, with no need to touch each student device.



Other challenges in today's K-12 environment extend far beyond for computer lab, or even the current school year. Administrators looking to adapt to the changing technological landscape can also look to virtual computing solutions to address coming evolutions in:

#### Digital content and curriculum adoption

Administrative orders and legislation to promote the transition to digital K-12 curricula are increasing every year, with schools now creating formal strategies around the use of digital content for the first time. Georgia recently expanded the definition of "textbook" to include computer hardware and technical equipment needed for digital content use, and Florida's instructional resources similarly include electronic media and academic software in their definitions. In Oregon, schools added digital content to its science curricula while the state of Texas approved all-new electronic textbook standards in 2010.

#### Alternative approaches to teaching

The rise in popularity of blended learning models, virtual events, online coursework, blogging, "edutainment" and online gaming has caused teachers and administrators to redefine their perception of today's classroom. Virtual computing solutions offer a diverse set of options that allows students a personalized experience through different devices and learning tools.

#### Increasing use of automation

Personnel reductions and evaporating budget money have made the role of automation more critical than ever. Increased reliance on computing also enhances the impact of classroom lessons while better measuring skills and adapting curriculum to an individual student's needs—in and out of the school. As an example, the majority of districts in the U.S. are now using automated "push" technology systems that send electronic notifications to parents and stakeholders about school events and other student information.

#### Enhancing security

Delivering educational applications over the network (particularly the Internet) demands a security solution that can safeguard data from hackers and other cyberspace threats. Within a school system, it's extremely difficult to ensure that remote devices—especially classroom terminals—have full and up-to-date protection. Therefore, it is critical to have a method for remotely controlling the degree of user access to applications based on how secure each device is.

Virtual private networks (VPNs) based on the Secure Sockets Layer (SSL) protocol can provide secure access to specific application resources. In addition to stringent encryption of application data over the network and support for two-factor authentication devices such as tokens, these SSL VPNs offer centralized, dynamic controls over staff and student actions including viewing, downloading, saving, editing or printing based on the security level of each individual. To avoid the exposure of confidential data, application and desktop virtualization keeps sensitive applications and data behind a school system's firewall instead of on individual laptops, PCs or other devices. If a computer turns up unaccounted for, data is not placed at risk because it remains securely in the datacenter.

For today's K-12 security requirements, Citrix Receiver™ provides a high-performance technology that enables schools to deliver virtual desktops, Windows, web and SaaS applications and content as an on-demand service to any user, at any time and on any device. With Citrix Receiver, IT maintains complete control over security, performance, and user experience, with no need to own or manage the physical device or its location.

...SSL VPNs offer centralized, dynamic controls over staff and student actions including viewing, downloading, saving, editing or printing based on the security level of each individual.

## Teaching 21st-Century Skills

Across every school district, arming learners with 21st-century skills has become a top priority—and the ability to work anywhere, anytime, and on any device is at the center of this push. In order to succeed in the classroom and workplace of the future, students need to thoroughly grasp the growing scope of modern-day computing. The state of Idaho has mandated that all high school students take a minimum of two online courses before graduating, and the movement toward remote access and corresponding computer skills training will only grow over time. A virtualized system is more accessible to learners and augments the adjustment to an all-electronic world—one requiring skills like desktop publishing and graphic design, software programming, database and spreadsheet management, web site development and more.

### Where virtual computing can help next-generation teachers and learners

- Adoption of digital curriculum
- Development of 21st-century skills
- Alternative teaching methods
- Increasing automation for cost savings

### Application Delivery Infrastructure

“Application delivery infrastructure” refers to the distributed infrastructure components deployed along the line-of-sight between datacenters and end users to ensure the successful, reliable and secure delivery of any application to any user in any location. Application delivery infrastructure enables true end-to-end virtualization, from the secure datacenter to any end device. For K-12, Citrix academic computing virtualization helps school districts enhance the learning experience by:

- Managing and virtualization for all applications in the datacenter;
- Accelerating application performance while improving web application security and reducing datacenter costs; and
- Quickly provisioning, managing and delivering desktops with a superior end-user experience and the lowest cost of ownership.

From a centralized and scalable Citrix application delivery infrastructure environment, applications and information are easily web-enabled and securely delivered to any device, at any location, over any connection, including low-bandwidth and wireless—enabling K-12 schools to meet their top IT challenges without an expensive overhaul of legacy infrastructure and equipment.

Citrix offers K-12 schools an application delivery infrastructure system that transforms IT into an on-demand service by centralizing the management and delivery of applications and desktops. It simplifies IT operations by managing a single image of all applications, desktops and servers, accelerating application roll-outs and reducing IT operating costs. Its unique integration of network optimization with application, desktop and server virtualization allows users to work efficiently and productively from anywhere. The system accelerates the delivery of applications and other instructional tools with an efficient, agile infrastructure that quickly responds to change and provides the best application performance, regardless of location.

### Server Virtualization

With a growing student body across multiple campuses in the school district, server sprawl can be a cumbersome side effect of technology in education. Large, expensive datacenters require physical space to house, significant time to maintain and manage, and power and cooling costs grow right along with the number of servers—servers that often run well below capacity due to lack of optimization.



Server virtualization transforms the district's datacenter from sprawling and expensive server farms into a performance-optimized, energy-efficient hub. By using one server to process multiple virtual machines handling different applications, school districts increase server utilization while running far fewer servers. This creates drastic cuts in the space and power needed to operate, cool and maintain equipment and multiplies efficiency many times over.

Citrix Essentials™ for XenServer™ delivers industry-best total cost of ownership through faster application deployment, improved server utilization, simple management and accelerated application delivery. Easy to set up and use, it offers intelligent storage capabilities through the most complete native integration with leading system and storage vendors.

Citrix technologies also deliver improved management of IT resources and longer lifecycles for expensive hardware to school districts that are often strapped for IT funding.

### Virtualization and Green IT

Green IT continues to receive increasing emphasis in the education community, and academic computing virtualization plays a critical role in meeting and surpassing green initiatives in the K-12 world. Because power consumption makes up a significant part of virtualization's "green" benefit, this IT solution has a significant, positive impact on the bottom line while improving performance.

By allowing the datacenter to use fewer physical servers, academic computing virtualization also enables a dramatic reduction in the costs associated with powering and cooling that datacenter. In this scenario, the green datacenter is also less expensive to operate and maintain.

Desktops and other end devices in the computer lab face rigorous use at the hands of hundreds or even thousands of students. The lifetime environmental impact of these devices must be considered, especially when it comes to replacing and disposing of obsolete machines that may yield only a two-year life span. Hazardous materials found in these devices, such as lead, cadmium and mercury, require special handling for disposal and can amount to as much as \$200 per device in aggregate disposal costs. Virtualization enables these machines to last longer and makes it easier for IT managers to purchase machines that pose less of a toxic threat in the future.

### Meeting Technology Initiatives with Limited Budget and Resources

Today's IT managers recognize the importance of virtualization to the continued success of the K-12 student. Virtualization solutions optimize the computer lab to deliver student-specific instructional tools and can allow the district to create a virtual lab that reaches any student, anywhere, at any time.

Citrix, the global leader in virtualization, provides the technology solutions needed to deliver data and applications to students across school districts of any size or budget. Citrix technologies also deliver improved management of IT resources and longer lifecycles for expensive hardware to school districts that are often strapped for IT funding.

By understanding the far-reaching capabilities of academic computing virtualization, K-12 technology administrators can design and implement a solution that centralizes application management, enables rapid re-provisioning of

the computer lab to suit the student, improves IT performance and cuts IT costs. Armed with these solutions from Citrix, technology initiatives and improved allocation of IT resources can become reality.

Citrix academic computing virtualization securely delivers Windows-based applications directly to the student or faculty member via the network or the Internet. The user experiences access to the most effective educational tools, while software is managed cost-effectively at the server level and end devices last longer—freeing precious budget dollars for other projects. And, because the investment in academic computing virtualization ultimately creates a more cost-effective, environmentally sound and financially sustainable computing solution for students, staff and faculty, school districts can be confident that their education IT will thrive long after stimulus funds are a thing of the past.

While the need to upgrade is a common concern, in reality transitioning to a thin-client arrangement does not mean a school district needs to replace pre-existing equipment. Further, changes made to school devices can be done as part of a gradual evolution and not a large-scale overhaul. As for long-term cost savings, the clients can be made out of less-expensive hardware than a standard fat client can—which cuts power consumption as well as the costs involved in adding on additional client terminals. The simple design of thin-client computers involve no moving parts and is therefore low-maintenance and long-lasting, with little technical support needed during a typical lifespan.

The implementation of a thin client also streamlines a district's disaster recovery plan when compared to the standard fat-client environment. In the event that a thin-client device goes down, it is simply replaced by another unit and re-configures itself without requiring significant expense or IT assistance. User preferences and settings reside in the datacenter so there is no need for tinkering with individual machines to restore them.

The shift to virtual computing makes the most sense when considering what K-12 IT professionals currently need more than ever—a lasting solution for attaining maximized flexibility and capacity, without requiring extra expense or labor time.

## The Bottom Line: Slashing IT Costs through Virtualization

At present, more than 80 percent of K-12 districts are facing budget cuts. The resulting shortfalls have led to staff layoffs, service delivery reductions, and project delays or outright termination—but also an increased reliance on virtualization, datacenter consolidation and digital content in order to minimize costs. Consolidation and standardization of the IT environment—not to mention heightened use of the Internet and web-based services—are largely driving the K-12 movement toward virtual computing.

Keeping school infrastructure modern, secure and fully functional can be both costly and labor-intensive. With so much hardware and software to manage, the funding needed to install, test and secure only grows over time. Multiply this need across the total extent of education's reach and it becomes easy to see why a simpler means of computing is needed.

The shift to virtual computing makes the most sense when considering what K-12 IT professionals currently need more than ever—a lasting solution for attaining maximized flexibility and capacity, without requiring extra expense or labor time.



Virtualized desktops and applications ensure that schools no longer need to oversee upgrades and worry about securing hundreds if not thousands of individual devices. Instead, users merely pay as they go for what they need and scaling up or down becomes simple.

In one consideration of virtualization's Total Cost of Ownership (TCO) benefits, a school system has 1,000 desktops with 600 being considered for virtualization via hosted VM-based dedicated desktops (all thin clients). In light of the proposed costs and benefits of the XenDesktop solution versus staying with current "As Is" opportunities, implementing a Citrix solution results in a projected TCO savings of \$869,874 for the system over the course of three years. Plus, such a program leads to a longer refresh cycle for devices, server consolidation and easier IT standardization.

Implementing the proposed project will require a three-year cumulative investment of \$846,606 including:

- \$549,000 in desktop infrastructure expenses
- \$216,000 in desktop infrastructure maintenance costs
- \$81,606 in server and storage power and cooling expenses

TCO Comparison: Three-year cumulative	Current (As Is)	Proposed w/ XenDesktop	Savings	
<b>Desktop Infrastructure (Capital Expenditures)</b>				
Desktop Infrastructure	\$463,320	\$549,000	(\$85,680)	-18%
Desktop Infrastructure Maintenance	\$0	\$216,000	(\$216,000)	-
<b>Desktop Infrastructure Management</b>				
Desktop Administration	\$1,009,800	\$369,000	\$640,800	63%
Application Administration	\$295,920	\$70,200	\$225,720	76%
IT Planning and System Management	\$437,040	\$331,200	\$105,840	24%
Standard Utilities and Office Applications	\$397,800	\$324,000	\$73,800	19%
Custom Applications	\$414,000	\$338,400	\$75,600	18%
Power and Cooling	\$144,000	\$12,600	\$131,400	91%
Server and Storage Power and Cooling	\$0	\$81,606	(\$81,606)	-
User Training	\$451,800	\$451,800	\$0	0%
<b>Total Cost of Ownership (TCO) - 3 year cumulative</b>	<b>\$3,613,680</b>	<b>\$2,743,806</b>	<b>\$869,874</b>	<b>24%</b>
<b>Cost per Device per Year</b>	<b>\$2,008</b>	<b>\$1,524</b>	<b>\$484</b>	<b>24%</b>
<b>Total Direct Benefits</b>	<b>\$3,613,680</b>	<b>\$2,743,806</b>	<b>\$869,874</b>	<b>24%</b>



## Case Study: Campbell Union High School District improves student services and saves millions of dollars with Citrix XenDesktop

Campbell Union High School District (CUHSD) serves seven high schools, 10,000 students and 750 employees. It supports about 3,000 desktop devices and 17 computer labs—each with a teacher and approximately 35 desktops—and over 200 applications, including Microsoft® Office, Photoshop® CS and AutoCAD.

### The Challenge—Address Budgetary Constraints and Provide Users with High-Quality, Leading-Edge Services

“Initially, we weren’t looking to solve a technical problem as much as we were looking to solve a budgetary problem,” said Charles Kanavel, director of technology at CUHSD. Their strategic plan called for providing and training students with the best technology possible, and “that requires money,” he said. Perhaps the biggest expense was lifecycle refresh. CUHSD had a four-year refresh cycle, which meant it had to retire and purchase approximately 500 machines a year. “It cost about \$1,100 to replace a physical desktop, and that’s half a million bucks a year and in four years, I’ll have the same problem.”

CUHSD also faced other issues. Because all applications had to reside on the desktops, it “meant that as the kids move from classroom to classroom, they don’t have the same application from place to place. It also meant that kids in a class had access to applications that maybe they shouldn’t have, which creates distractions,” says Kanavel. In addition, having 2,500 individual desktops meant a lot of time spent on maintenance.

After examining options, CUHSD decided upon desktop virtualization through Citrix® XenDesktop, Platinum Edition. “I looked at virtualization to see if we could cut those costs and maintenance issues. We decided upon Citrix because Citrix wins the desktop battle hands-down,” Kanavel states. “On a four-year basis which, if you look at the inventory refresh cycle alone, we’re going to save \$1.2 million.”

### Virtualization Provides Better User Experience and More Services

CUHSD is able to provide better services through virtualization, both on Macs and PCs. “We are virtualizing the computer labs,” Kanavel says. “Students can access their programs from home as well as the classroom. They can go class-to-class and those profiles follow them. This will give students the flexibility to continue work on projects at home as opposed to coming in after school and having to wait for a computer to become available.”

CUHSD also has implemented hybrid courses—online courses that bring students from multiple sites together under one teacher. “It pushes the boundaries of education,” Kanavel says. “It’s very expensive for schools to staff one teacher for 30 students who really need a special course, in one school. So what happens is those students end up taking take a lower-level course.”

### Virtualization at CUHSD: In the Final Analysis

#### Key benefits

- \$4 million in savings over eight years on desktops alone
- \$500,000 in savings over 18 months on servers
- Improved quality of educational services
- Consolidation of server resources

#### Applications delivered

- Over 200, including Photoshop and AutoCAD
- Microsoft Office

#### Networking environment

- Citrix XenDesktop, Platinum Edition
- Citrix Essentials for XenServer, Platinum Edition
- Microsoft Windows Server® 2008



“Hybrid online classes also push the boundaries of school and class time,” he continues. “You can have a class on a Saturday or at 7 o’clock at night.” It also offers an alternative to crowded summer school classes, as students will be able to make up credits after school and on weekends from their homes.

In all, CUHSD knows it made the right decision. “We’re providing better and more extended services to the students. That is an unbeatable argument,” Kanavel says.

## Conclusion

The future of successful school improvement efforts is uniquely and forever tied to properly integrating computing technology—and the future of computing lies in virtualization. The transition to virtual computing has in fact become a necessity as administrators face tighter budgets, reduced staffing levels, increasingly tech-savvy students and other challenges.

Integrating technology into K-12 learning, establishing connected classrooms and closing the digital divide can all be achieved through a move to virtualization—and all while saving precious budget dollars, improving security and freeing up IT staff time. Forward-thinking IT administrators recognize that keeping up with advances in ed tech is the key to effective instruction, and virtualized computing solutions from Citrix are the best way to improve the delivery of learning applications in the school of tomorrow.

To learn more, visit [www.citrix.com/education](http://www.citrix.com/education)

Citrix virtual computing solutions help schools and school districts build simpler and more cost-effective environments that deliver IT as a service and make it easy for students and faculty to work in the most optimal way.

**Citrix® XenDesktop™** is a desktop virtualization solution that delivers Windows desktops as an on-demand service to any user, anywhere.

**Citrix® XenApp™** is an on-demand application delivery solution that enables applications to be centralized and managed in the datacenter and instantly delivered as a service to users anywhere.

**Citrix® XenServer™** is an enterprise-ready, cloud-proven virtualization platform with all the capabilities needed to create and manage a virtual infrastructure at half the cost of other solutions.

**Citrix® NetScaler®**, available as a network device or as a virtualized appliance, makes web applications run better by accelerating application performance, optimizing application availability, and enhancing web application security while substantially lowering costs.

**Citrix Receiver™** is a high performance, universal client technology that enables on-demand delivery of virtual desktops, Windows, web and SaaS applications and IT services to any device.

### About Citrix

Citrix Systems, Inc. (NASDAQ:CTXS) is a leading provider of virtual computing solutions that help companies deliver IT as an on-demand service. Founded in 1989, Citrix combines virtualization, networking, and cloud computing technologies into a full portfolio of products that enable virtual workstyles for users and virtual datacenters for IT. More than 230,000 organizations worldwide rely on Citrix to help them build simpler and more cost-effective IT environments. Citrix partners with over 10,000 companies in more than 100 countries. Annual revenue in 2010 was \$1.87 billion.

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