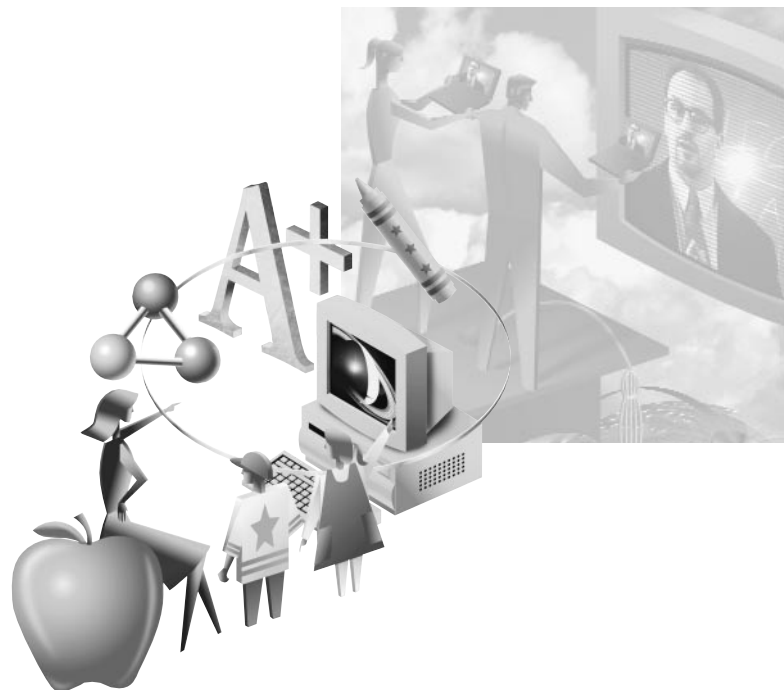# Lowering the Total Cost of Application Ownership in the Education Enterprise

White paper

Purpose of this paper

This white paper documents the high costs of providing students, educators and administrators with access to the software applications they need for learning, teaching, research and productivity. It describes current and projected trends in technology budgeting and purchasing in education. And it demonstrates how a centralized, server-based solution can help schools and districts get the most from their technology dollars.

It is written for educators, administrators, information technologists and other decision makers at all levels—from the neighborhood school principal to the city school board to the statewide board of regents—in both primary/secondary and higher education.
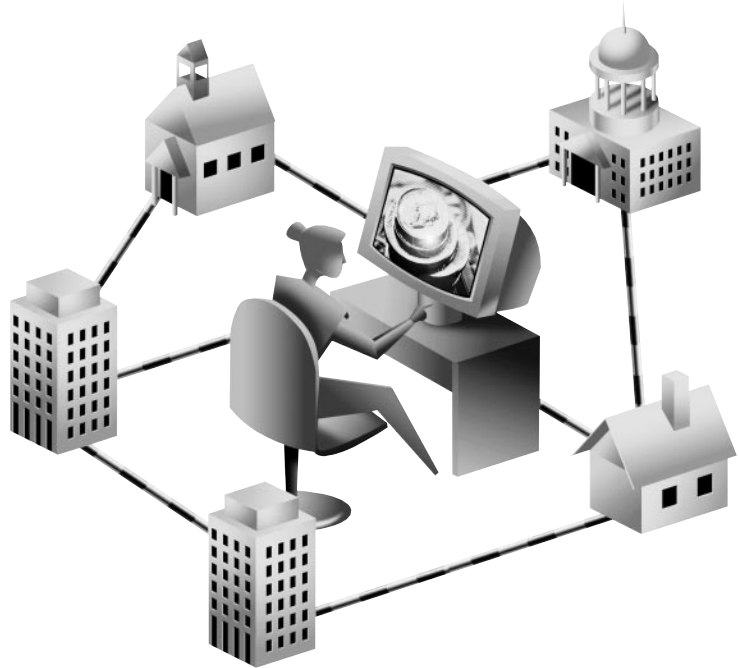
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Executive summary:
Lowering Cost with Application Serving

The Internet age has radically changed the way schools use technology. No longer confined to the computer lab, technology now plays an integral role in the everyday life of students, faculty, administrators and staff throughout the learning process—from primary/secondary schools to higher education.

With technology's expanding role, however, comes a corresponding rise in cost. As a result, educational institutions must cope with the complex and cumulative costs that private sector businesses have faced for years.

In an attempt to better understand the costs of technology, businesses have relied on models that figure their total cost of ownership (TCO). Traditional TCO models, however, are starting to be regarded by many as obsolete. They generally address only the cost of owning and maintaining desktop hardware, without taking into account the bigger picture that includes the additional and substantial costs of purchasing, supporting and maintaining the software applications that users require to meet individual, organizational or educational needs.

A more recently developed total cost of application ownership (TCA) model provides a comprehensive view that goes beyond hardware to include all the elements required to deliver software applications. Unlike TCO, TCA considers hardware as simply one part of the overall picture. In the TCA model, savings can be realized throughout the entire application ownership cycle, from purchasing, deployment, operation and support to actual use.

For educators, TCA takes into consideration the classroom and central-office tools that they increasingly rely on to teach students, conduct research, develop curricula and efficiently administer their institutions.

For an educational institution's IT department, it includes management tools that enable it to efficiently and cost-effectively handle applications that are growing in both numbers and size.

Tools for lowering TCA.

The greatest TCA savings occur when an organization deploys an application server solution.[1] Zona Research, in fact, estimates a savings in system administration costs as high as 54–57 percent over five years using the application server approach.[2]

In application serving, software applications reside and execute 100 percent on the server. Only keystrokes, mouse clicks and screen updates travel the network between the server and the user's device. This enables high-speed performance—even over low-bandwidth connections—and enables users to access any application using any device from any location.

Application serving can help schools and districts reduce expenses that arise from capital, management, support and end-user needs by:

- controlling the cost of new hardware purchases
- lowering the cost of support and administration
- improving the ratio of computers to students
- enabling schools to use legacy equipment
- supporting heterogeneous environments

This white paper will demonstrate how an application serving approach can save money within educational institutions by addressing each of these issues. It will provide examples of schools across the United States that have employed this approach, including facts and figures illustrating actual dollars saved.

Schools Everywhere are Seeking to Lower the Cost of Providing Applications

In the 1990s, educational institutions at all levels wholeheartedly adopted computer technology and software applications as effective tools for instructing students and managing the business of education. First, the Windows® platform's graphical user interface (GUI) made computing easier. Then the Internet expanded the user's ability to access information. Technology moved out of the computer lab into the classroom—and the focus changed from learning about computers to learning with computers.[3]

As a result, the budget dollars spent on technology rose dramatically. Between 1991 and 2000, primary/secondary schools in the United States nearly tripled their instructional technology spending, from $2.1 billion to $6.2 billion.[3]

In contrast to private sector businesses, however, schools that invested in technology during this decade often failed to budget beyond the initial technology purchase. Long-term costs such as hiring support personnel, staff development, parts, maintenance and upgrades, along with the increased costs of utilities and telecommunications, often were not adequately funded.[4] And as school infrastructures and application software needs became increasingly complex, recurring costs soared. Consequently, controlling the total cost of infrastructure and application ownership has become a major concern.

Achieving education's goals using application serving.

Reducing TCA begins with building an efficient and effective computing infrastructure. But it cannot end there. A school that can concentrate its resources on the tools that directly impact education and productivity—software applications—rather than on purchasing and maintaining equipment can achieve its educational goals more efficiently and effectively. Reducing costs throughout the entire application delivery process therefore becomes imperative.

Application server software and services from Citrix Systems enable schools to reduce TCA every step of the way. This server-based solution enables schools to make better use of their infrastructure investments by delivering applications to desktop or portable devices over a network. It improves security. And it reduces the complexity—along with the accompanying costs—of maintenance and support, including application upgrades.

Application serving is rapidly becoming the solution of choice for achieving educational technology goals with funds available. Recently, the International Society for Technology in Education named application serving as one of the top ten areas that had the greatest effect on school technology in 1999.[5]

A principal benefit of application serving is lowered TCA. However, an analysis of the way schools spend their technology budgets—and the expenses they often overlook—demonstrates that today's TCA is a more complex issue than many educators imagine.

How are Schools Spending Their Technology Budgets?

With the technology boom of the 1990s came changes in schools' approaches to instructional technology. Schools reassessed their overall use of technology, installed LANs and WANs and added more desktop systems to classrooms and labs. Teachers—and especially students—became increasingly proficient with computers as technology began to affect the daily life of everyone in the education community.[3]

These changes added new ways for educators and students to access data and applications. They brought new excitement to teaching and learning. But they were expensive.

Some estimates for providing all classrooms in an average-size primary/secondary school with network wiring and equipping them with computers put the per-student cost as high as $500 a year over a five-year period. Since students share computers, figuring expenses on a per-computer basis also provides a useful perspective—a cost of about $2,000 per computer per year.[4]

Either way costs are figured, however, it is readily apparent that computing expenses for schools extend well beyond the initial purchase. These ongoing expenses, which make up the TCA, fall into five categories:

- **Capital:** hardware, network and software capital costs of new acquisitions and upgrades

- **Management:** system and network management costs

- **Support:** technical support costs

- **End user:** IT and related costs shouldered by end users

- **Other:** software development costs, LAN and WAN costs and fees, and system downtime opportunity costs[6]

School expenditures for each of these categories are not the same, however. The typical school district spends $121.23 annually per student on instructional technology. Of that amount, $76.89 goes for computers, networks and peripherals. Other expenses, including training, support, software and Internet services, account for $44.34. This means that 63.4 percent of school technology budgets typically is spent on up-front infrastructure expenses, while ongoing expenses account for only 36.6 percent of school technology budgets.[4]

By contrast, in the world of private-sector business, the cost of hardware—desktops, portables and servers—typically accounts for less than 15 percent of initial and recurring costs of providing applications. The other 85 percent comes from the network and communications infrastructure and the expense of personnel who maintain and support the environment.[1]

The allocation of funds by schools, therefore, is the inverse of the allocation by business—which, as a group, recognizes the importance of ongoing costs and plans accordingly. It is apparent that schools wishing to achieve optimum results from their technology investments must completely re-think the ways they spend their technology budgets.

In the absence of radically increased budgets, schools must find ways to re-allocate funds so that they spend less on hardware acquisition and better ensure that their ongoing technology needs are covered.

Lawrence O. Picus of the University of Southern California made this point well in a recent white paper on school budgeting: "Schools should take advantage of any and all sources of funds for their technology programs, but should be aware that securing one-time funding for the purchase of computers or other equipment is, by itself, inadequate for operating an important program."[7]

Many costs are overlooked.

One problem lies simply in the fact that schools often do not take into account many technology expenses—from the complexity of installing their infrastructures to the insatiable need to keep up with changes in developments and capabilities. Frequently overlooked costs include:

- **Retrofitting buildings** – Of schools that are 35 years old or older, up to 23 percent will need electrical upgrades, at an estimated cost of $240,000 per school.

- **Staff development** – The U.S. Department of Education recommends 30 percent of technology budgets be spent on instructing staff in its proper use.

- **Support** – In primary/secondary schools, the typical ratio of support staff to users is about 1:500. By contrast, the typical ratio in business is about 1:50–75 users.

- **Replacements** – The introduction of new software applications often forces schools to replace computers and peripherals every five years—and in some cases, sooner.

The school or district that fails to understand and predict these and other costs may face problems in the future—ranging from cost overruns and delays in deployment to time spent by staff who neglect their own duties to informally support colleagues who do not understand technology.[4]

As Kenneth C. Green, founder/director of The Campus Computing Project notes: "Two decades after the first desktop computers arrived on college campuses, we have come to recognize that the campus community's major technology challenges involve human factors—assisting students and faculty to make effective use of new technologies in ways that support teaching, learning, instruction and scholarship."[8]

Clearly, the ongoing expenses not covered by schools' technology budgets need as much attention as budgeted items—if not more. Schools and districts that do not find a way to address these issues will find it difficult to meet their ultimate technology goal—to deliver instructional programs and information that enhance the learning experience for all students.

A school or district that plans well can provide the productivity and efficiency its students, educators and administrators require. Institutions that do not plan for ongoing expenses can rapidly fall behind in meeting the needs of their users.

Primary/Secondary Schools
The Problem: Resources Must Go Farther

The cost of technology for primary/secondary schools represents huge sums of money. During the 1999–2000 school year alone, U.S. expenditures were estimated at $5.7 billion. And the numbers are growing. For the 2001 federal fiscal year, administration and congressional leaders recommended a 12.6 percent increase in its funding for educational technology, to $4.5 billion—the government's largest-ever single-year increase.[9] During the four-year period ending in 2001, overall instructional software expenditures are projected to increase by 76 percent, to $537 million.[3]

Given the size of the education enterprise, however, these numbers are not as generous as they first appear. Distributed across the 87,600 public primary/secondary schools in the U.S. and their 47.3 million students,[3] the federal proposal comes to only $51,724 per school—or $95 per student. And software expenditures come to only $6,172 per school—or $11.35 per student.

Since technology has become central to educating children, getting the most out of these funds therefore becomes an issue of paramount importance.

Schools face unique cost issues.

Compared to business, technology expenditures in primary/secondary education are modest. An IDC white paper reported in 1997 that an average school with a median of 75 computers spent $2,251 per year per computer, while a small business with the same number of machines spent $4,571.[3]

These figures may suggest that schools already have control of their TCA—or that any problems that arise can be solved simply by bringing budgets up to the same level as business. Neither is the case, however.

The cost of instructional technology is kept artificially low by several factors, including:

- discounts that primary/secondary schools receive on hardware and software purchases
- donations of hardware and software
- longer ownership—schools keep their equipment an average of five years while businesses generally buy new equipment after three years
- fewer support staff—schools employ about half the number of support personnel as businesses[3]

But these factors present a mixed blessing. Some, such as discounts, are clear financial benefits. Others, such as the use of old equipment, can reduce educators' and students' productivity. And when schools cannot retain experienced IT staff because they pay one-fifth to one-third below the salaries in private sector business,[8] the entire organization suffers. In business, this would be considered a financial loss. In education, it can be a hindrance to a school's efforts to provide an effective learning experience.

Meanwhile, the realities of school budgets mean that educational institutions will never be able to support their computers and computer users in the way that private businesses do. And while schools save money in some areas, other expenses are not reduced. Increasing spending is seldom an option. Instead, schools must spend their money more wisely than ever before—and adopt effective solutions for lowering TCA.

Primary/Secondary Schools
The Solution: The Move to Application Serving

The need to control TCA as a means for enhancing educators' effectiveness is leading to the adoption of new technology solutions.

With more desktops in the classroom, schools are now moving from "a stand-alone desktop world to a Web-connected world," notes the Software & Information Industry Association. And with that move, the association says, application serving "seems to be on its way in primary/secondary schools."[3]

Application server solutions provide the ability to meet the needs of complex technology environments that exist in schools today. For example, primary/secondary schools were early adopters of the Apple® platform, and for years Apple technology dominated educational environments. Recently, however, the use of PCs in schools has increased. Because applications reside and execute on the server instead of the desktop in the application server model, the same Windows-based software can be accessed by Apple and PC devices. This frees schools to fully utilize

their existing equipment or buy new equipment without worrying whether it is compatible with their computing environments.
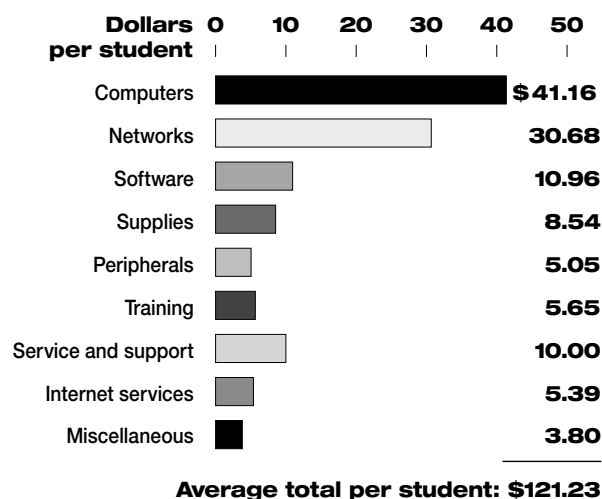
The Internet also brings schools the opportunity to save money. Instructional software and content are moving online—as are technical support and services. And application service providers (ASPs) rent software from centrally located servers and distribute them over a network or the Web—handling hardware and software updates, virus protection and other technical issues offsite.[3] Each of these developments makes application delivery more efficient and cost-effective.

Using the ASP approach.

As an alternative to implementing an application server solution of its own, a school or district can subscribe to the services of an ASP. Under this model, applications are hosted by a third party, freeing the educational institution from purchasing servers or network infrastructure and eliminating the need to maintain and support servers and applications. The ASP functions much the way a utility company —like water or electrical—does, so that the customer's expenses are for services rather than capital expenditures.

And savings can be considerable. The Jackson Public School District in Mississippi, for example, found that by contracting with an ASP, it could add 450 laptop computers at a comprehensive $500 per year each. The result is much less than the $1,300 purchase price for a PC plus its installation and annual support costs.[10]

Average annual U.S. public school district expenditure on instructional technology, 1998-1999[4]

Dollars per student	Value
Computers	$41.16
Networks	30.68
Software	10.96
Supplies	8.54
Peripherals	5.05
Training	5.65
Service and support	10.00
Internet services	5.39
Miscellaneous	3.80

Average total per student: $121.23

Higher Education Institutions
The Problem: Shifting Patterns of Expenditure

Today's institutions of higher learning share many characteristics with complex businesses. They expect their technology infrastructures to handle sophisticated applications and huge amounts of data. They must provide effective communication within an organization whose users range from extremely specialized professionals and policy-minded administrators to entry-level workers. And they are constantly seeking to extend their services to ever-broader audiences.

The average amount spent on technology by colleges and universities, however, is far less than the amount spent by major corporations—where the annual cost of networked computing can run as high as $9,500 per user.[1] On a per-student basis, U.S. colleges and universities in 1998–1999 spent, on average, only $88 for hardware and software[11]—even less than the $121 spent by primary/secondary schools. Calculated by institution, the overall 1998–1999 average technology expenditure in higher education was $1.7 million—with large public universities spending an average of $6.7 million and private two-year schools averaging $183,000.[11]

Colleges and universities spend their budgets differently than either primary/secondary schools or businesses. Many of today's 14.3 million[11] post-secondary students supply their own desktop or portable computers and software. And many technology decisions occur at the departmental level, making them difficult to track.[11]
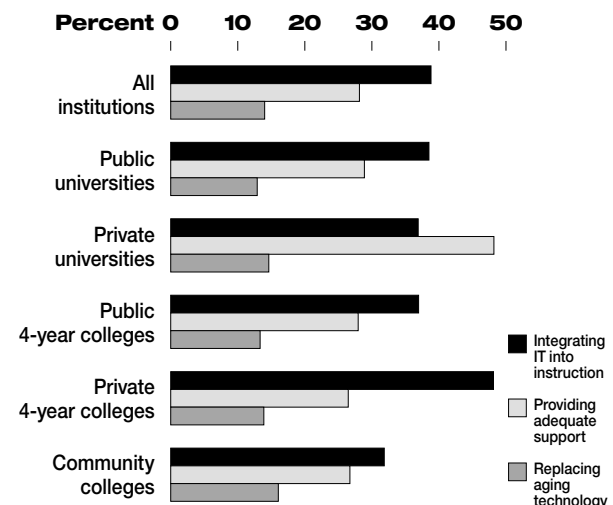
Nonetheless, these figures indicate a tremendous need for colleges and universities to get the most from their TCA to enhance the access they provide to research and learning resources for students, faculty and staff.

Where budget money goes.

A recent study showed that colleges and universities spend the largest portion of their IT budgets—42.1 percent—on personnel. Hardware ranked second, at 31 percent. And software ranked fifth, at 12 percent. For the 1998–1999 school year, Market Data Retrieval estimated higher education's total annual spending for hardware and software at $2.5 billion.[11]

A shift was beginning to occur, however, in the pattern of expenditures. While hardware still claimed the larger portion, the amount spent on software was on the rise.[11] In 1998, software expenditures increased 9 percent to $815 million, and hardware expenditures dropped 14 percent. For the 1998–1999 school year, colleges and universities were expected to spend 48 percent of their software budgets on academic software and 52 percent on administrative software.[11]

Most important IT challenges facing U.S. higher education, 1999[10]
(percentages for top three issues, by campus type)

Legend:
- Integrating IT into instruction
- Providing adequate support
- Replacing aging technology

Categories: All institutions, Public universities, Private universities, Public 4-year colleges, Private 4-year colleges, Community colleges

Higher Education Institutions.
The Solution: Embracing a Business Approach

When The Campus Computing Project asked colleges and universities to identify the major IT concerns that they face, the top three issues were: (1) Integrating IT into instruction, (2) providing adequate user support and (3) financing the replacement of aging hardware and software.[8] Integration, support and technology resources are issues that are commonly faced in business as well.

Coupled with the rise in software expenditures, these concerns suggest a solution that is finding increased use in businesses—the application server model. Citrix application server software and services—in use at more than 80 percent of Fortune 500® companies—enhance application and data access over networks and the Internet. They simplify support and training with centralized application management. And they deliver business productivity applications across any platform to any device.

Cost-effective management.

In an effort to cope with the expense of computing, colleges and universities are instituting a range of unfortunate cost-cutting measures. Some 85 percent expect to reduce the hours of public access, 81 percent expect to reduce staff, and more than 75 percent plan to outsource or reduce services. Already, more than 70 percent are increasing the use of student assistants.[11]

There also is a trend to move campuses to a single IT department rather than the traditional three, which have supported academic departments, administration and libraries.[11]

Management issues such as these are addressed effectively by an application server solution. Using application serving's management capabilities, an institution can save money by supporting more users with a smaller, centralized staff.

Solutions for emerging needs.

The application serving model also provides answers to a wide range of TCA needs that appear as new education trends emerge. Three such trends are:

- Replacing and recycling equipment. In 1997, some 38.2 percent of higher education institutions were replacing computers every three years. By 1998, the number had risen to 48.5 percent. The older equipment was being recycled within the institution.[11] Because applications run on the server rather than the desktop, application server solutions allow institutions to get more use from their older equipment, enabling them to more effectively recycle or slow their rate of replacement.

- Increased use of instructional software. With more than a third of courses linked to Web pages and half making use of e-mail,[8] colleges and universities are well on their way to integrating IT into instruction. As in primary/secondary schools, application serving is well suited for instructional software, as it enables faculty to be more productive, concentrating on teaching, rather than technology.

- Continuing education and distance learning. By 2008, the largest increase in the university population is expected to be among students over age 35.[11] An application server solution will make reaching non-traditional students more cost-effective, as it allows application and data access from any device anywhere.

How Application Serving Saves Schools Money

The TCA model puts the emphasis where it belongs— on the cost of providing software applications to users. It addresses issues that are directly related to schools' software and data delivery goals by taking into account factors that affect availability, performance and cost—such as where applications and data are stored, where applications run, where the user is located and what type of connectivity is provided.[1]

Like TCA, the application server approach also addresses these issues. Citrix solutions provide enhanced connectivity for the entire education enterprise, optimizing technology performance, reaching more people with data and applications and ensuring a high level of performance and security.

Here are ways that application serving can help schools and districts deal with expenses that arise from capital, management, support and end-user needs—along with real-life examples of how schools and universities have met these challenges using Citrix solutions.

Controlling the cost of new purchases.

According to some estimates, hardware can account for nearly half of a school or district's technology budget.[7] So managing and reducing the amount spent on hardware becomes a critical component in controlling TCA. When a school deploys an application server approach, it can reduce these up-front costs by extending the life of existing equipment or purchasing inexpensive thin-client devices instead of new desktops. And updating network infrastructure to achieve additional bandwidth occurs less frequently.

- In McKinleyville, California, the Northern Humboldt Union High School District estimated the cost of replacing all 200 older desktops at one school would be $200,000. Application serving enabled the district to give students access to the latest applications using existing desktops by simply upgrading the servers that drive the network—at a cost of less than $15,000.[12]

- The Dallastown Area School District in Pennsylvania estimated that the cost to install a new computer lab with 29 PCs on a traditional network would be $43,600. A server-based solution using Windows-based terminals lowered the cost to $35,600.[13]

Lowering the cost of management.

In an application serving environment, less time is needed for installing, configuring and deploying applications; systems can be managed remotely; and backups are simpler and more secure. There is no need to touch every desktop for software upgrades and changes. As a result, schools can provide enterprise-level support for more users with fewer staff. In fact, a survey by the DataPro research firm estimates staff support costs in server-based businesses are at least 80 percent less than in traditional computing environments.[12] This is particularly important in education, where institutions often have difficulty hiring and retaining skilled IT workers because salaries cannot match those of private sector business.

- In California, the Lemon Grove School District reduced its IT support costs by 50 percent using application serving—while improving performance of educational software by 60 percent.[14]

- The University of Massachusetts libraries on its Dartmouth and Boston campuses achieved more security, less downtime and faster, less expensive application upgrades—saving at least 20 person-hours each week, or $20,000 to $30,000 a year— with its application server deployment.[13]

Improving the computer-to-student ratio.

Students and educators cannot gain the benefits of technology if they do not have adequate access. So increasing access by reducing the ratio of computers to students is critical. In 1999, the average ratio nation-wide stood at 1:6—down from 1:19 in 1992.[7] But application serving can help reduce the ratio even more, enabling schools to continue using their existing systems while they add new, less expensive computers.

- The Lemon Grove School District in California is working toward improving its computer-to-student ratio from 1:4 to 1:2 using a server-based solution that placed inexpensive Windows-based terminals alongside its existing PCs in classrooms. A typical classroom now has 12 thin clients and four multi-media stations to increase student access.[14]

- The College of Business at Idaho State University found that deploying an application serving solution enabled it to support up to two and one-half times more students with the same hardware budget—while the average wait for desktop access dropped from 35 minutes to zero.[15]

Enabling schools to use legacy equipment.

An application serving solution enables schools to use existing equipment such as Apple computers or out-dated 386 and 486 desktops to access the latest Windows applications. Schools can realize substantial savings—freeing money to add still more equipment or provide enhanced services. And they can give everyone access to the same applications regardless of equipment—a key benefit in colleges and universities where many students bring desktops and laptops from home.

- South Carolina's Clarendon County Adult Education Center uses hand-me-down PCs to

access applications via an ASP. All the center needed to take advantage of the service was its existing Internet access.[16]

- Instead of purchasing the latest desktop hardware, Idaho State University uses previously discarded work-stations in the server-based environment in its College of Business. The average cost per device is $50.[15]

Supporting heterogeneous environments.

Because schools built their technology infrastructures gradually, using year-to-year funding and little, if any, long-range planning, many find that they now have a patchwork of equipment and operating systems. A 1999 survey by the National School Boards Association found, in fact, that more than 56 percent of large districts support four or more operating systems, and nearly 35 percent support more than five.[7] An application serving solution, however, can enable these disparate systems to work together, eliminating the need to buy replacement systems and reducing IT costs through simplified service and support.

- The Bradley Academy for the Visual Arts in Pennsylvania could not get the applications it wanted for its Macintosh® system—but buying new PCs would have cost more than $50,000. An application serving solution extended the lives of the Macintosh systems and allowed the academy to access to the latest Windows-based applications without expensive network upgrades.[13]

- When Watsonville High School in California installed a gigabit network backbone and new servers, it became apparent that older Macintosh and DOS-based systems would need expensive upgrades. Application serving enables the school to continue using older systems and spend funds on additional systems, not replacements.[17]

Conclusion

Citrix application server software can improve the performance of administration and instruction at all levels of education, from primary/secondary to higher education. By enabling educational institutions to control the total cost of application ownership, Citrix solutions can help focus resources on education's ultimate goal—effectively instructing all students. Citrix application server software and services help educators maximize budgets so they can do more with less; use less expensive thin clients and other cost-effective appliances; leverage existing devices and hardware; save time and money on technical support, training and staffing; and reduce the lost opportunities for learning that occur with low performance or availability.

For more information on Citrix application server software products and services, contact your nearest authorized Citrix® Solutions Network™ member. Or visit the Citrix education website at **http://www.citrix.com/education** to learn more about Citrix application server software solutions for education.

Footnotes

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