ONE-TO-ONE COMPUTING

March 2009

"My students are accustomed to one-to-one computing; I too am used to teaching in this environment. Long gone is the adjustment period. The learning curve is soaring for all of my students. I eagerly look forward to the day when all classrooms in the Niagara Wheatfield School District can experience the same..."

- Debbie Haseley
5th Grade Teacher

Niagara-Wheatfield Central Schools

Executive Summary

By Pete Reilly, President, Ed Tech Journeys

From a teaching and learning perspective 1:1 computing makes complete sense and the positive results of this approach have been well researched and documented.[1]

> More widespread access to computers makes it possible for students and teachers in schools to transition from occasional, supplemental use of computers for instruction to more frequent, integral use of technology across a multitude of settings (Roschelle & Pea, 2002). Ubiquitous, 24/7 access to computers makes it possible for students to access a wider array of resources to support their learning, to communicate with peers and their teachers, to become fluent in their use of the technological tools of the 21st century workplace. When students are also able to take computers home, the enhanced access further facilitates students keeping their work organized and makes the computer a more "personal" device (Vahey & Crawford, 2002).

On a conceptual level our present approach to deploying technology; consisting of small pods of 3-4 computers, and/or one computer classrooms, puts a tremendous classroom management burden on teachers and disempowers students in a 'many watching one' or 'shared pencil environment'. Computer labs empower students by allowing them to have their own devices; but access to labs is limited and generally not part of the core classroom experience.

Figure 1: Example of a "shared pencil" deployment.

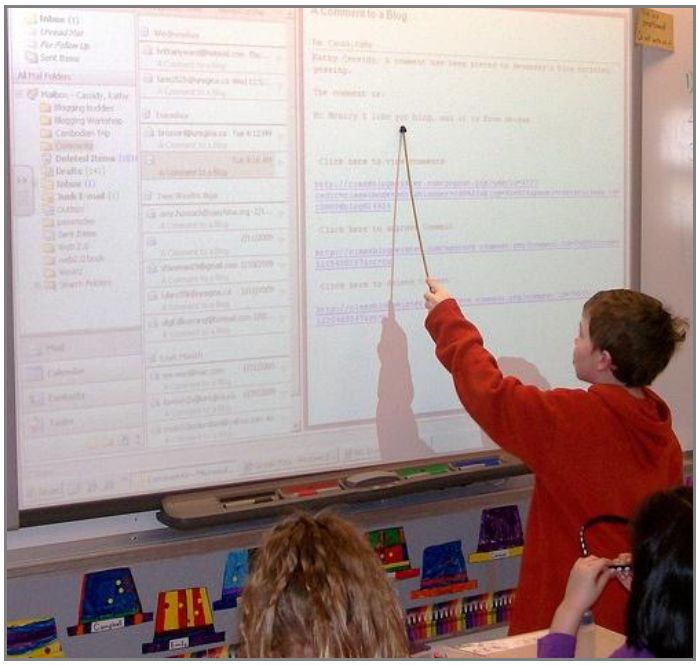


Figure 2: Example of a "many watching one" deployment.

The 21st Century Skills of initiative, self-direction, flexibility, and user responsibility; skills that are fundamental to our children's future success, are undermined by the technology

deployment models described above. We need new technology deployment paradigms that empower students and teachers and serve as catalysts for transforming classrooms into environments that model the key 21st Century Skills that are so desirable in the workplace. Two of those new paradigms are 'one to one' and ubiquitous computing.

So why aren't 'one to one' and ubiquitous computing environments more prevalent?

It is the economics, management, and technical support of 1:1 computing that seems so daunting. How can we envision a ubiquitous, 1:1 technology environment when our educational technology budgets and minimal support staffs can barely support what we are doing today? Using our present models of K-12 computing it's difficult to envision having the money and resources needed to double or triple the number of computer devices in our schools.

The fact of the matter is that if money were no object most of us would take steps to expand our computer inventory so that access to learning technologies was ubiquitous.

Multiple 1:1 & Ubiquitous Computing Scenarios

1. Students have their own devices which they carry with them throughout the day and bring home at night.

2. Students have their own devices which they carry with them throughout the day but do not bring home at night.

3. Each student can access all their resources from any device connected to the Internet, at any time.

4. Each classroom is outfitted with a complete set of laptops that never leave the room or the building.

5. Students bring in their own devices from home with the school district filling in the gaps for those that do not have computers.

6. Specific grade levels are targeted for 1:1 because they are deemed most critical.

Obviously, there are many variations on the theme.

No matter how 1:1 is implemented the concept of unfettered and ubiquitous access to the vast array of learning resources that technology can offer can be a catalyst for transforming teaching and learning, and ensuring that our children are truly engaged, empowered, and responsible for their own learning.

Niagara-Wheatfield Central Schools
Final Project Report

Contents

The Niagara-Wheatfield CSD Project:

Realizing that most districts are having difficulty seeing beyond the financial, technical, and management obstacles presented by 1:1, Ed Tech Journeys (ETJ) set out to investigate and prove the efficacy of several new and emerging 'best practices' that could make 1:1 computing possible for the average school district. ETJ, an educational technology consulting company founded by Pete Reilly, former RIC Director and current President of NYSCATE, sought partners to participate in a 'proof of concept' that would combine 1:1 computing, virtualization, sub $500 Netbooks, and the use of obsolete computers.

Carol Barber, CTO of Erie 1 BOCES and Executive Director of the Western New York Regional Information Center (WNYRIC) and Mary Ann Buch, Director of Technology and Training, CIO for the Niagara-Wheatfield CSD,; both stepped forward to participate in the 'proof of concept'. Berj Akian, CEO of ClassLink, was enrolled because of his long experience in both the 1:1 and virtualization arenas. Dell and CDW-G joined the partnership to provide the Netbook computers. CDW-G assisted with the provision of ACER, ASUS, and HP Netbooks.

The Western New York Regional Information Center (WNYRIC) ordered the application file server and assisted in the project installation and training of project participants. The WNYRIC has been on the forefront of virtualizing school environments as seen in the development of its Enterprise Level Portal.

Niagara-Wheatfield CSD is a technology leader in Western New York with strong administrative leadership and community support for technology. NWCSD contributed technical, instructional, and financial resources to the project including the remote access server. They participated fully and worked through issues diligently to insure that the 'proof of concept' went as smoothly as possible.

The pilot entailed equipping a 5th grade elementary classroom with sub $500 Netbooks (mini-laptops) and two high school courses with laptops from carts that were scheduled to be eliminated because of their age.

The teachers who participated in this project were volunteers chosen from a pool of educators whose classroom styles were thought to be project-based and student-centered. A classroom instructional methodology of self-directed learners was thought most likely to take full advantage of a 1:1 initiative. Without this instructional environment, this project would have required lengthy staff development that could not have been accomplished in such a short timeframe.

In order to evaluate the appropriateness of the Netbooks, four brands were chosen for the project: Dell, HP, Acer, and Asus. Dell and CDW-G contributed a classroom set of these models for the project.

The Netbooks and obsolete laptops connected through wireless access points in their classrooms to the application server located in the district. ClassLink installed educational software, and LaunchPad, to provide a consistent and reliable desktop menu for the users. In addition, ClassLink Information Console was installed on the server to help with the management of the virtualized system.

The home access portion of the project was carefully managed. In order to accommodate the many different home computer types (make, model, age, etc.) that exist in non-school environments, it was decided to utilize a small number of Citrix licenses that were installed on a low-end remote access server. The server acted as a gateway to the application server. By downloading the appropriate Citrix plug-in, nearly any type of home computer could access the school network. Students in the pilot were able to access their applications and files at school with a school Netbook or laptop, and at home with their school Netbook, laptop, or home computer.

As the pilot progressed, the Netbooks were switched to the high school and the full-size, older laptops were moved to the 5th grade students. The evaluation of the Netbooks by both elementary and senior high students was an important aspect of the project.

The project ran from November 2008 until March 2009

Teachers and students after presenting at the WNYRIC - January 2009

Niagara-Wheatfield Project Objectives:

Instructional Objectives

1. Evaluate the teaching and learning benefits of 1:1 computing in the classroom.
2. Evaluate the teaching and learning benefits of 24x7 access.
3. Evaluate the usefulness of ClassLink LaunchPad software as a classroom instructional tool.
4. Evaluate the usefulness of ClassLink LaunchPad software as a professional development tool.

Technical Objectives

5. Evaluate virtualization as a new paradigm for instructional technology.
6. Evaluate the practicality of Netbooks for both elementary and secondary students.
7. Evaluate the wireless requirements needed to support a mobile 1:1 environment.
8. Evaluate operational issues associated with 1:1 (i.e. battery life, home access).
9. Evaluate the technical support required in a 1:1 environment.
10. Evaluate how Erie 1 BOCES would host a virtualized server solution for the Niagara-Wheatfield Central SD and other districts.

Financial Objectives

11. Evaluate the financial case for 1:1 and/or ubiquitous computing for the average school district.

Mrs. Haseley's 5th grade students working on their Netbooks

Instructional Objective 1: Evaluate the teaching and learning benefits of 1:1 computing in the classroom.

1a. Having their own computers helped students learn.

97% of the students who responded to the survey felt that having their own computer helped them learn. 61% of students felt that the computer was ***"Very Helpful"*** in their learning.

1. Did having your own computer in class help you learn?

	Response Percent	Response Count
Not helpful	2.8%	1
Somewhat helpful	36.1%	13
Very helpful	**61.1%**	22
answered question		36
skipped question		**1**

This finding was supported by the teachers who each indicated on the survey that students having their own computers had a ***"significant impact on their students learning experience".***

"The students do not want to go back to learning without one-on-one computing. They feel that the computers have significantly affected their learning, desire to learn, and love of learning." -Teacher

1. Did students having their own computers deepen their learning experience?			
		Response Percent	Response Count
Low-No change in students learning experience		0.0%	0
Moderate-Some change in student's learning experience		0.0%	0
High-Significant impact on student's learning experience		100.0%	3
	answered question		3
	skipped question		0

1b. Teachers in this project felt that the 1:1 environment greatly impacted their teaching.

4. Did the 1:1 environment help you facilitate learning at a deeper level?			
		Response Percent	Response Count
Low - Made my job more difficult		0.0%	0
Moderate - Was a combination of improvements and new difficulties		33.3%	1
High - Greatly impacted my ability to facilitate learning		66.7%	2
	answered question		3
	skipped question		0

"Allowed for a wider range of activities to be attempted, experimented on, and collaborated on in class. Very fun for the students." –Teacher

"It allows the students to complete various activities and procedures as needed vs. them having to be planned by the instructor months in advance - making them more independent and creative in the classroom." –Teacher

"Student focus on learning significantly increased. There is no down time in student time on task. Student engagement in work and positive attitude

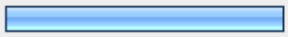
toward work increased. Student pride in work increased. Student motivation increased." -Teacher

"Student reading time, especially non-fiction reading, increased significantly." –Teacher

"Student work completion has been a past issue due to tech availability...this made it a non-issue and it keeps students actively involved and participating in the classroom." –Teacher

1c. Teachers reported that students having their own computers had a Moderate to High impact on homework completion and attendance.

5. Was there a higher homework completion rate with students accessing their applications and files from school and home?			
		Response Percent	Response Count
Low - No Improvement		0.0%	0
Moderate - Some Improvement		66.7%	2
High - Significantly increased student completion rates		33.3%	1
	answered question		3
	skipped question		0

6. Did the 1:1 environment have a positive impact on attendance?			
		Response Percent	Response Count
Low - No Improvement		33.3%	1
Moderate - Some Improvement		66.7%	2
High - Significantly increased student attendance		0.0%	0
	answered question		3
	skipped question		0

Instructional Objective 2: Evaluate the teaching and learning benefits of 24x7 access.

2a. Seventy four percent of students felt that having access to their applications and files from home was "Somewhat or Very Helpful" in their learning.

2. When you could work at home with your school computer did it help you to learn?		
	Response Percent	Response Count
Not helpful	25.7%	9
Somewhat helpful	25.7%	9
Very helpful	48.6%	17
answered question		35
skipped question		2

"I have always used remote access. Chatting with students and shadowing them are new tools for me and I used them frequently." Teacher

Instructional Objective 3: Evaluate the usefulness of ClassLink LaunchPad software as a classroom instructional tool.

3a. ClassLink LaunchPad was a key element of the success of the project. Teachers reported that it had a "High Impact" on making the technology easier to use.

Having an easy to use interface for end-users to access their applications, files, and to collaborate with each other is an extremely important part of a One-to-One implementation. The LaunchPad desktop interface grew in importance as the project progressed. Teachers and students repeatedly pointed to the LaunchPad as the key tool that made the technology environment easier, more efficient, and meaningful. At the beginning of the project many of us not familiar with LaunchPad did not predict this response.

3. Did having the LaunchPad desktop make using the technology easier?			
		Response Percent	Response Count
Low-No improvement		0.0%	0
Moderate-Some improvements		66.7%	2
High-Increased ease of use		33.3%	1
	answered question		3
	skipped question		0

Instructional Objective 4: Evaluate the usefulness of ClassLink LaunchPad software as a professional development tool.

4a. The ClassLink LaunchPad 'shadowing and chat tools' provide a practical environment for professional development.

Using the chat and shadow function together, Model Schools personnel were able to communicate and interact directly with the users at remote locations. By minimizing both windows, it was easy to toggle back and forth between screens. The ability to send files through the chat tool is quite helpful and expedites collaboration.

In the shadow mode, the person doing the shadowing is able to access and control the user's screen and files. The Model Schools teacher sent the user a Microsoft Word document and within the shadow environment, provided instructions on how to use the "Reviewing" tools in Word. Before and after a step, any directions or important information was entered into the chat window.

Niagara-Wheatfield CSD is interested in using these tools as a 'just in time' method of providing professional development.

4b. Several teachers utilized ClassLink LaunchPad tools to host evening 'office hours'.

Teachers communicated with students at home via chat; and assisted them by using the shadowing tool which allowed them to see, and with permission, control the student desktop.

Teacher comment about remote access and the post-project phase:

"Gone will be the opportunity to remotely chat with the teacher about learning, and the ability to have the teacher shadow computer screens, teaching remotely, which one-to-one computing and ClassLink provide."
-Teacher

Technical Objective 5: Evaluate virtualization as a new paradigm for instructional technology.

5a. Client virtualization allowed obsolete equipment to be put back into effective use.
Virtualization allowed the district to put two carts of obsolete laptops back into use. These computers would otherwise have been eliminated. Being able to re-use old equipment presented expanded opportunities for students.

5b. Virtualization created device independence.
Because the end user device is primarily used as a connection to the application servers, its processor and storage requirements are minimal. This allowed the district to choose from a variety of devices for the students. Although they chose to pilot Netbooks and existing laptops; they could also have opted for Thin Clients, NComputers, or traditional desktop computers.

5c. Virtualization allowed home access to become a reality.
With the addition of a remote access server and a set of Citrix licenses students, and teachers were able to access and utilize the applications running on the school servers, as well as their Home and Share Drives.

The remote access server acts as an intermediary between the users connecting to the network from outside the school to the application servers within. In order for the home user to connect they must download a small plug-in that allows them to become a client on the network. Because there are such a wide variety of computers being used at home, Citrix licenses are utilized because they make downloading the plug-in, and connecting to the school network, quite easy for users.

Since there were some initial issues with setting up home access (home firewalls, etc.) it is recommended that for the initial setup period (1-2 months for example) that an evening Help Desk be available to assist home users. ClassLink maintained a Help Desk in the evenings during this project in order to assist with Home Access issues.

4. How easy was it to access school software and your files from home?			
		Response Percent	Response Count
Not easy at all		19.4%	7
I had some trouble in the beginning; but it got better		52.8%	19
It was easy, it was Great!		27.8%	10
	answered question		36
	skipped question		1

5d. Not every application is appropriate for a virtualized environment. Some high-end, processor intense applications such as video editing, computer programming, and some CAD programs are not appropriate for a virtualized client environment. In these cases the programs can be run from the hard drive and the ClassLink LaunchPad icon put on the desktop. This allows users to choose between the local application on the hard drive, or the programs available on the application servers.

Note: A few licenses of these high-end applications can be put on the application servers so that students or teachers can access them from home when there are fewer users taxing the system.

Technical Objective 6: Evaluate the practicality of Netbooks for both elementary and secondary students.

6a . The Netbooks were readily adopted by both elementary and secondary students.

The vast majority of students found having their own computers very helpful and empowering:

"I was able to use it in every environment through out the school. I could always access my files, and could work on anything I wanted whenever I wanted to. This came in handy, as during study halls usually computers are not available to students, so I was still able to finish homework and research papers." –Student

"Having a laptop to take with me all day helped not only in my Local Legends and History class but was also a big help in other classes." –Student

"It changed me because I can get my work done without fighting to get on one of the bank of computers after morning work." –Student

"Oh it changed my life! I get mostly all my work done before I have to turn in. I love having a mini and I like having them right there every time I need to finish something." –Student

6b. Students and teachers both preferred the Netbooks. 69% of students chose the Netbook as their preference and 100% of the teachers preferred the Netbook.

6. Now that you have had a chance to work on both the Mini-Laptops and the full size laptops which do you prefer and why?

	Response Percent	Response Count
Mini-Laptop	69.4%	25
Full Laptop	30.6%	11
Why? view		36
answered question		36
skipped question		1

15. Now that your students have had a chance to work on both the Mini-Laptops and the full size laptops which do prefer and why?

	Response Percent	Response Count
Mini-Laptops	100.0%	2
Full Size Laptops	0.0%	0
Why? view		2
answered question		2
skipped question		0

"I like the mini laptop because it is easier to carry and you could take it anywhere without it being heavy and they are faster than the laptops." –Student

"..because they are so light when I have to bring home after school, the mini laptops had the perfect size I had the right amount of space to still work with the mini still on my desk!" –Student

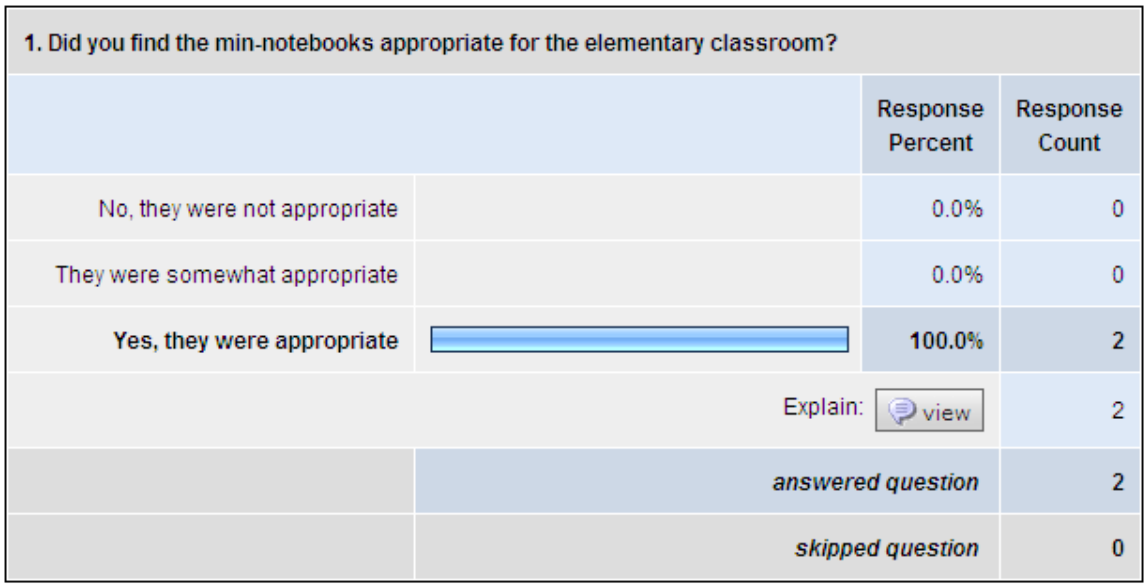
"The full-laptops are really heavy. I have trouble carrying the laptop back and fourth, from school to home. The mini-laptops are light and easy to bring from school to home." –Student

6c. Netbooks are durable and easily transported.

One of the teachers offers the following observation:

"Students stated they were more likely to carry the "minis" vs. the full size laptops, due to books and notebooks they have to carry as well." -Teacher

Project staff survey responses indicate that the Netbooks and laptops are appropriate for elementary students.



1. Did you find the min-notebooks appropriate for the elementary classroom?

	Response Percent	Response Count
No, they were not appropriate	0.0%	0
They were somewhat appropriate	0.0%	0
Yes, they were appropriate	**100.0%**	**2**
Explain: view		2
	answered question	2
	skipped question	0

Staff reported one Netbook monitor broken during the project.

3. Did you experience excessive breakage or loss with the 1:1 model?			
		Response Percent	Response Count
None		100.0%	2
Minor		0.0%	0
Yes, too much to justify the expense		0.0%	0
	answered question		2
	skipped question		0

Technical Objective 7: Evaluate the wireless requirements needed to support a mobile 1:1 environment.

7a. A mobile 'One-to-One' infrastructure requires a robust wireless infrastructure.
When every student is equipped with a mobile device, hardwired connections are not practical. Students need to connect to the network and to the Internet wirelessly. Initially, the district used wireless access points intended for retail home use. This was not sufficient to provide enough bandwidth for a full classroom set of Netbooks. The district added a second access point and configured the Netbooks to connect to one access point or the other. Through these adjustments performance was greatly improved.

7b. Netbooks that support an "N" wireless standard are preferred.
During the project it was discovered that the current Netbooks on the market are using a wireless standard that would not be acceptable in a full One-to-One implementation environment. Niagara-Wheatfield has decided to create a managed wireless infrastructure with access points in each classroom and to purchase Netbook devices with two antennas that support the 5 GHz Wireless-N standard.

Technical Objective 8: Evaluate operational issues associated with 1:1 (i.e. battery life, home access).

8a. The battery life of Netbooks is an important operational issue.
Strategies for keeping devices powered throughout the day need to be developed when planning full-scale deployment.

- Niagara-Wheatfield will seek to purchase only Netbooks with an extended battery life of 7-8 hours. Netbooks will be charged at home.
- Niagrara-Wheatfield adopted a student responsibility approach.
- Another strategy is to maintain several desktops in the classroom for students who forget their Netbook or lose their charge.
- Some schools are using a battery exchange where students can trade discharged batteries for fully charged batteries.

Technical Objective 9: Evaluate the technical support required in a 1:1 environment.

Security (User Login): The students and staff had a single login to be authenticated to the network and to ClassLink LaunchPad.

Setup: Setup required creating and connecting an Active Directory structure to the existing eDirectory (Novell) structure. The district imported users and setup passwords. The ClassLink application server was then linked to the Active Directory structure. The setup is more streamlined for districts already using an Active Directory structure.

Groups (Course Enrollment): For this research project, groups were established based on the students' courses. For this project the work was done manually due to the small number of students participating. ClassLink can provide automated synchronization.

Printers: ClassLink's LaunchPad application associates printers based on three criterion independent of one another ('Printer Mapping Criteria'). Printer Mapping Criteria include geographical basis (e.g. computers in room 101 can print to the printer in room 101,), group membership basis (e.g. 9th grade students can print to the library, high school teachers can print to the faculty room, etc) and individual account basis (e.g. the principal can print to the principal's office printer). All users who connect from home can print to their home printers.

The scope of this project did not test all Printer Mapping Criteria.

During the project the Printer Mapping Criteria for elementary students was relatively simple given that the students' group was also their physical location. This is much more complex with secondary students who move throughout the day. More review would be required to better plan printer mapping from mobile computers that move from room to room and thus do not have a fixed geographical association. This project did not address the methodology for printers in a secondary environment.

Software: It was a dream to be able to install software on the server, conduct maintenance, and to problem solve. The individual devices needed no technical adjustments. All software applications were installed on the application server. This same set of software

no longer needed to be installed on the individual computers. The student and teacher device had a remote desktop installed, an operating system, and a link to the ClassLink terminal server farm.

During this research project, the district found that some highly graphic applications do not run well in this environment, i.e. Windows Movie Maker.

Internet Favorites: The ClassLink LaunchPad provides a teacher with a classroom desktop where they can provide their students with a set of Internet favorites. Students and staff can still save a favorite to their network home directory, but now it is accessible 24/7 through the remote access. Normally, students and staff have their Internet favorites mapped to their network home directories which makes their favorites accessible from any district computer, but not available from home.

Maintenance: During this research project, the technical staff needed to update players, add software and modify printer mappings. Within this environment, player and software updates took minutes to perform. The printer mappings were more challenging. Technical staff had to map printers to print queues on the server and then map the print queues to the logical groups.

Home Connection of District Laptop: The students and staff were permitted to take home the laptops and Netbooks to connect to their own Internet service provider and access the district network. Some parents and staff had difficulties knowing how to connect these computers to either a home wireless, DSL or cable access point. The district had to send home some RJ45 cables.

The ClassLink technical support provided assistance for ClassLink LaunchPad and the connection to home networks. The district realizes that for a full implementation more up-front communication should be provided to parents and staff regarding the methods for connecting district equipment to home networks. Some of the parents involved in the project suggested not sending home district computers if a family was willing to connect their own computer to the ClassLink application. This would decrease possible damage and loss of equipment.

Trouble Shooting: The district experienced minor technical issues with both the terminal application server and the Citrix remote access server which were resolved by the ClassLink technical support who were very responsive.

The district staff needed to reset student passwords, which is a normal activity.

Technical Objective 10: Evaluate how Erie 1 BOCES would host a virtualized server solution for the Niagara-Wheatfield CSD and other districts.

As part of the proof of concept, the WNYRIC explored the technical requirements necessary to host applications at the RIC. There were a number of components that were investigated:

Bandwidth: The WNYRIC wide area network is primarily a fiber/gigabit network. This network should support hosting the virtualized server solution for NWCSD, as well as the other districts in the region.

Included in the further investigation needed to centralize application server hosting for multiple districts is the review of firewall capacity, traffic created by application requests, and related equipment architecture. As network traffic would increase to the RIC/BOCES, that load may require additional infrastructure investment.

Redundancy: One risk factor in hosting the virtual application servers at the RIC is the possibility of a single point of failure should the fiber connection be severed. In discussions it was determined that based on past experience the fiber lines are extremely reliable and the risk of loss of service was low.

Sharing Virtual Application Servers: The WNYRIC investigated the possibility of districts sharing virtual application servers in order to provide economies of scale and lower costs for districts. It found that sharing virtual application servers is not practical since each server would most likely need to be on a dedicated, single blade.

Utilizing RIC Network Operations Centers: There are benefits for districts hosting their servers at the RIC that go beyond the sharing of virtual application servers among districts. The RIC's, in general have robust Network Operations Centers, (NOCs) which have high quality environmental components such as air conditioning, power conditioning, backup generators, and a highly qualified technical staff to monitor, manage, and backup the servers. Migrating servers to the RIC makes sense for many districts that do not have the staff and/or resources to create or maintain their own NOC.

The WNYRIC considered the issue of available space within its own NOC. While there is ample space for NWCSD to host their servers at the RIC; it was determined that this model would not scale for all the districts and that hosting large numbers of virtual application servers would not be possible without significantly expanding the WNYRIC NOC.

Hosting Citrix Licenses: In the model tested in the proof of concept, home users accessed the school network via a Citrix plugin. The centralized hosting of the Citrix Licenses at the WNYRIC so that districts could share a "pool" of licenses would have a positive economic impact for districts.

Included in the further investigation needed to centralize Citrix license hosting for multiple districts is the review of traffic patterns and firewall capacity.

Financial Objective 11: Evaluate the financial case for 1:1 and/or ubiquitous computing for the average school district.

By employing cloud computing, client virtualization, and Netbooks the finances of 1:1 and ubiquitous computing are more within reach of the average school district than if they tried to achieve this with a traditional client/server approach.

See the detailed explanation in Appendix D.

Resources and Contacts

Carol Barber
Chief Technology Officer
Erie 1 BOCES
Executive Director, WNYRIC
(716) 821-7022
CBarber@e1b.org

Mary Ann Buch
Director of Technology and Training, CIO
Niagara Wheatfield CSD
(716) 215-3197
MBuch@nwcsd.org

Berj Akian
CEO
ClassLink
(888) 963-7550
berj@classlink.com

John Margiotta
Senior Account Manager
CDW-G
(866) 784-1619
john.margiotta@cdwg.com

Pete Reilly
Ed Tech Journeys
(845) 553-5059
preilly@edtechjourneys.com
www.edtechjourneys.com
http://preilly.wordpress.com

Thanks to the students of the Niagara-Wheatfield CSD for their hard work and support for this project.

Special thanks to:

Mrs. Dana Mulivich
HS Social Studies Teacher

Mrs. Melissa D'Angelo
HS ELA Teacher

Mrs. Debra Haseley
Elementary Grade 5 Teacher

Appendix A:
Mini Laptop Comparison – Models Used in Pilot

Mini Laptop Comparison					
Vendor	**Acer**	**HP**	**ASUS**	**Dell**	**Dell**
					Current Model
Model	Acer Aspire ONE A150-1126	HP 2133 Mini-Note - C7-M	ASUS Eee PC 1000H	Inspir Mini 9	Latitude D630
OS	XP Home	XP Pro	XP Home	WinXP Home	WinXP Pro
CPU	Atom N270 1.6 GHz	Atom 1.6 GHz -	Atom N270 1.6 GHz	Intel Atom 1.6 Ghz	Pentium Core 2
RAM	1 Gig	1 Gig	1 Gig	512 Meg	2 Gig
Hard Drive Type	HD	HD	HD	Flash	HD
Hard Drive Size	160 Gig	160 Gig	80 Gig	8 Gig	80 Gig
Dimensions					
Size L x H x D	9.8L x 1.1 H x 6.7 D	10W x 1.1H x 10W	10.5 x 1.5 x 7.53	9.13L x 1.25h x 6.77D	13.2W x 1.26H x 9.37W
Weight	2.2 lbs	2.6 lbs	3.2 lbs	2.28 lbs	5 lbs
Ports					
External SD Slot	Yes	Yes	Yes	Yes	No
External VGA Port	Yes	Yes	Yes	Yes	Yes
USB Ports	3	2	3	3	4
Video					
Screen Size	8.9	8.9	10	8.9	14
Max Video Resolution	1024 x 600	1280 x 800	1280 x 768 (3)	1024 x 600	1440 x 900
Networking					
Standard RJ45 Ethernet	Yes	Yes	Yes	Yes	Yes
Ethernet Port Speed	100 Mbps	1000 Mbps	100 Mbps	100 Mbps	1000 Mbps
Wireless	Yes	Yes	Yes	Yes	Yes
Type of Wireless	G 54 mpbs	G 54 mpbs	N > 54 Mbps	G - 54 Mbps	A/G - 54 Mbps
Boot from USB	Yes	Yes	Yes	Yes	Yes
Can image with Ghost	Yes	Yes	Yes	Yes	Yes
Battery					
Stated Battery Life	5 hours	4.5 hours	7 hours	4 hours	4 1/2 hours

HP 2133 Mini-Note PC

Asus EeePC

Acer Aspire One

Dell Inspiron Mini 9

Appendix B:
Students Rate Key Features and Choose Favorite Netbooks

It is important to note that the Netbook models used in this project are now obsolete in their design. Each of the companies has released or is about to release a new model. Our results indicate that students preferred the HP and Asus Netbooks over their counterparts.

The size and weight of the Dell and its ease of use were also rated highly by students.

5. Click on the computer that performed best in a particular category.

	Dell	HP	Acer	Asus	Response Count
Battery Life	25.7% (9)	22.9% (8)	14.3% (5)	**37.1% (13)**	35
Durability	30.0% (9)	**43.3% (13)**	10.0% (3)	16.7% (5)	30
Keyboard	14.3% (5)	**60.0% (21)**	8.6% (3)	17.1% (6)	35
Screen Size	24.2% (8)	21.2% (7)	12.1% (4)	**42.4% (14)**	33
Size and Weight	**41.2% (14)**	20.6% (7)	14.7% (5)	23.5% (8)	34
Speed at home	25.0% (8)	**34.4% (11)**	12.5% (4)	28.1% (9)	32
Easy to Use	**31.4% (11)**	**31.4% (11)**	8.6% (3)	28.6% (10)	35
Other	24.1% (7)	**31.0% (9)**	27.6% (8)	17.2% (5)	29
Your Top Pick	16.7% (5)	**40.0% (12)**	13.3% (4)	30.0% (9)	30
				Comments: view	17
				answered question	35
				skipped question	2

Appendix C:
Presentation to the Niagara Wheatfield CSD

Board of Education
February 2009
By
Debbie Haseley
Fifth Grade Teacher
Errick Road Elementary School

Good evening, parents, students, faculty, staff, Mr. Militello, Mrs. Spasiano, and Board of Education. For those of you that may not know me, my name is Debbie Haseley and I currently teach fifth grade at Errick Road Elementary School.

Although my career spans 30 years, I've taught for only 21 years, in two separate WNY school districts. My career does date back to the days of textbook teaching. The days of read a chapter/answer the questions.

Upon entering teaching for the second time, eleven years ago with the Niagara Wheatfield School District, textbooks were aging and not necessarily being replaced. What was a teacher to do? "Look to the Standards" was the answer. At about that time, a computer lab opened in our building. The Internet was beginning to take hold as a place for children to learn. Computer applications were beginning to be tailored to *elementary*-student learning. A few years later, several computers were installed in each classroom. Our classrooms had more technology to offer than many students had available at home.

To those of us willing to set forth a new path as classroom teachers, the Standards, project-based learning, and computers became a threesome. However, that presented new challenges. Since fewer that half of my students had a computer at home, using computers in school could be frustrating. Students loved their computer time, but often had more questions than I could answer in a timely fashion. Because of their lack of computer experience, they hadn't yet come to believe, that if something wasn't quite right with their computer, it was probably their own doing. Instead, they would utter something like, "Something's wrong with my computer!" and throw their hands up in despair.

Warp ahead only a decade and all of my students have computers at home with Internet access. Students routinely communicate via instant messaging. Some have cell phones and text messaging is commonplace. Gaming systems abound. They fully understand that cyberspace is a connection to the world, where information tailored to their needs exists almost beyond measure. They live in a world where virtual field trips and Distance Learning is available for their learning benefit. No longer do they

blame the computer and throw their hands up in frustration when there is a computer issue. They know from *life-long* experience that there is a solution and they look to solve it independently. They know there are multiple ways to do almost any computer or program function. They eagerly help each other problem solve.

So, when in December, my class was outfitted with mini laptops for each student to use both at home and in school, with remote access to school files through ClassLink, my students felt their classroom had begun to catch up with the information age into which they were born.

With project-based learning and applications like Inspiration, PowerPoint, Safari Montage, Word, Excel, KidBiz and more…with Internet access and one-to-one computing there was an instant increase in student focus on learning. They became fully engaged and readily took ownership over their own learning when given ownership over technology. Reading and writing (especially non-fiction) naturally increased in volume and quality.

When asked, students tell me that the number one impact of one-to-one computing on their learning is focus. Comfortable with computers and preferring computer learning, students focus easily and often go beyond assignments to learn on their own. They automatically turn to their laptops to Google answers to questions, find images, definitions, etc. One child quipped recently, "When I'm done with my PowerPoint on Venezuela, I'm doing one on the Sabres!"

One child who finds it particularly hard to focus and be successful in school, approached me and said, "Look at this Mrs. Haseley! Look at my work!" The student had been studying smooth, cardiac, and skeletal muscles. Part of the assignment was to research muscular diseases and find out how to care for muscles. The student's work was not only rich in content, but written levels above previous non-fiction writing. When I asked why the work had improved so, the student wholeheartedly expressed that access to "my own" computer had naturally increased focus, desire to learn, and desire to create quality work. The student obviously felt empowered.

I recently read an article in the October/November 2008 issue of Edutopia magazine. The article is titled, "Broccoli Brain." [1] If you ask your child why she stopped eating halfway through her meal, she'll probably say, "I'm full." If you reply, "Oh, so there's no room for ice-cream?" You may discover that your child has two stomachs: the broccoli stomach, which fills up quickly, and the dessert stomach which is always ready for more. The author suggests that children have a broccoli brain and a dessert brain. I thought how this comparison describes our experience with one-to-one computing. In short, creative teaching, combined with student ownership over technology through one-to-one computing, feeds the dessert brain. There is always room for more. "What did you do in school today?" Instead of the familiar,

[1] Osborn, Hugh. "Broccoli Brain." Edutopia Oct/Nov 2008: 10.

"Nothing," we might hear, "Wow! You wouldn't believe what we're doing!" The article suggests that we'll get that kind of response when schools change from broccoli-feeding factories into places where students use technology to get in touch with the powerful world of knowledge and begin to innovate with confidence.

One-to-one computing is the next step for us at Errick Road School and across the District. Our pilot with one-to-one computing is coming to an end and students will soon return to sharing a few computers and rotating in and out of computer time. Gone will be the ability to impulsively answer questions to related to project learning. Those questions may be put on hold or forgotten before computer time comes around again. Gone will be the opportunity to remotely chat with the teacher about learning, and the ability to have the teacher shadow computer screens, teaching remotely, which one-to-one computing and ClassLink provide. Fewer projects will be completed with less access to computers and no remote access to school files. But what I fear most, is the decrease in focus and love of learning that is almost certain to occur.

Never once during the pilot did I have to instruct students to power-up their computers. They willingly completed more work that ever before, with more concern for the final product. They eagerly ask what we're going to learn next, and they respect the computers like they are their own.

Finally, my students are accustomed to one-to-one computing, I too am used to teaching in this environment. Long gone is the adjustment period. The learning curve is soaring for all of my students. I eagerly look forward to the day when all classrooms in the Niagara Wheatfield School District can experience the same, expanding their offers of dessert, and when students always have room for more.

Debbie Haseley
Fifth Grade Teacher

Appendix D:
The Intersection of Ubiquitous Access and Virtualization

How can the average school district with limited resources achieve anything near one to one or ubiquitous access to technology for teachers and students? Interestingly, a number of schools throughout the U.S. have successfully done so by adapting the current K-12 computing model from an exclusively traditional client/server approach to an approach that includes the emerging best practice 'client virtualization'.

The traditional client/server approach requires initial purchase and replacement of obsolete computers with regularity, as well as ongoing installation and maintenance of software on individual computers. The 'client virtualization' approach centralizes applications onto servers and allows for any computer, new or old, wired or wireless, to access those applications virtually. 'Client virtualization' also allows for connection from nearly any computer outside the school as well.

While it's possible to achieve ubiquitous access with the traditional client/server model, it is an expensive proposition. It seems that the road to ubiquitous computing for most schools with limited budgets, must include a shift from the client/server paradigm that is in place today to some version of 'Client virtualization' and/or cloud computing.

There are multiple forms of 'client virtualization' but in one form or another it involves taking the software and/or the operating system that presently runs on the hard drives of our desktop or laptop computers, and transferring them to powerful servers (application servers). The end user utilizes the desktop or laptop to access and run their software as they always do; however instead of using their local processor and hard drive, the software runs on servers.

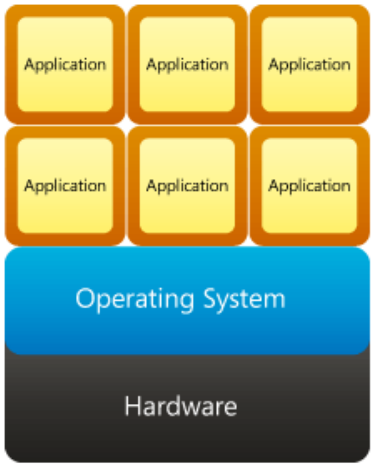


Diagram 1: Application Server

"There's a clear direction ... away from people thinking, 'This is my PC, this is my hard drive,' to 'This is how I interact with information, this is how I interact with the web,'" - Dave Armstrong, Google Enterprise

What is behind the claim that 'client virtualization' is the key to creating a 'cost effective', ubiquitous computing environment? First, it creates a new financial paradigm that makes thinking about 1:1 feasible. It also provides an environment that makes it easier to manage hundreds or thousands of new computers, mobile or otherwise, in the hands of students and teachers.

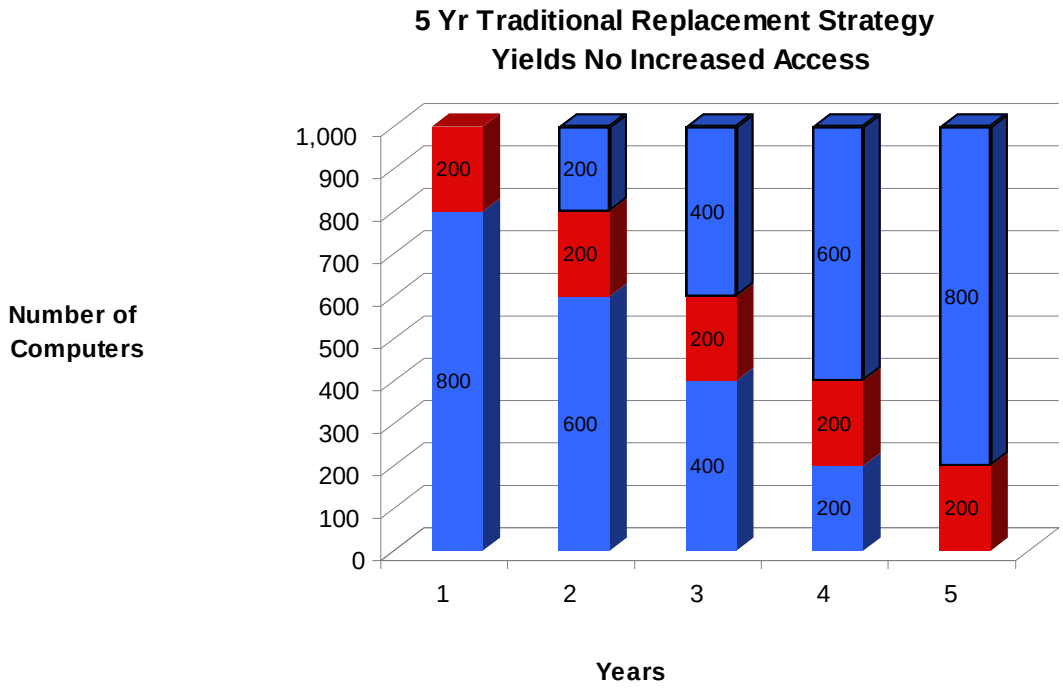
Making the Finances of Ubiquitous Computing Possible

There are several elements to the new financial model that 'client virtualization' creates:

1. Slows the replacement cycle for old and obsolete computers
2. Creates 'device independence' enabling the use of lower cost devices
3. Lowers the per device cost of IT operations and desktop management
4. Lowers the cost of energy used to operate the computers

Slowing the Replacement Cycle

One of the primary advantages of 'client virtualization' is the ability to slow the replacement cycle of old and obsolete computers.



Traditional Replacement Cycle Graph: In a hypothetical district with one thousand computers replacing 20% of the inventory annually (200 computers) might cost $120,000 per year given a unit cost of $600. Notice that replacing 20% of the computer inventory per year results in a never-ending cycle and does not increase the number of computers available to students and teachers. Also note that when we replace computers we generally purchase the highest end computers available in the hopes that they will have longer shelf lives in our classrooms.

Virtualization and Longer Replacement Cycles
In a virtualized environment older and obsolete computers are able to run the latest educational software because the software is running on servers. Not having to replace older computers as often allows districts to re-allocate replacement dollars to purchase new computers. In the previous example, instead of replacing the computer inventory every five years we need only replace our inventory once every ten years. This can save the district an estimated $600,000.

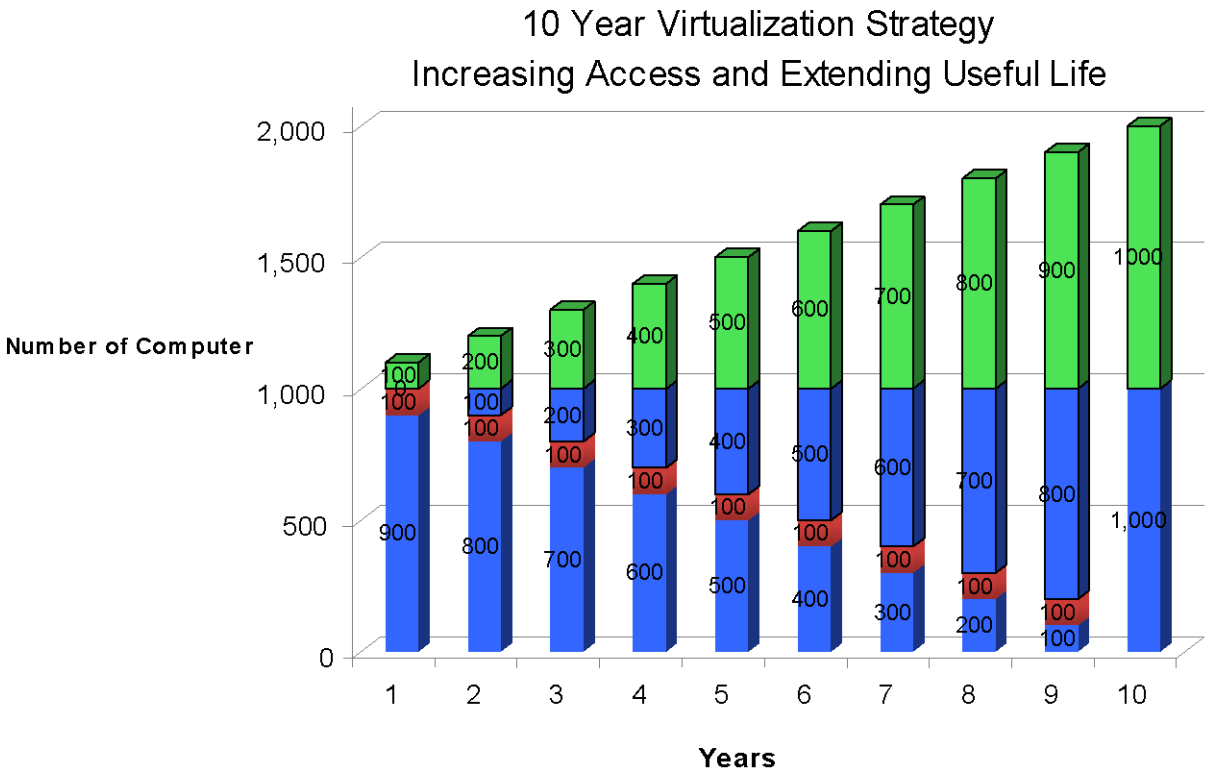
It is important to note that Netbook and laptop batteries will need to be replaced more often. With mobile computers, especially those that travel home, there will be more wear and tear, and unforeseen damage than on stationary desktops and thin clients; thus it can be expected that their 10 year life cycle will be diminished.

Slowing the hemorrhaging of scarce dollars used for replacing old computers is only the first element of the new financial model that virtualization permits.

Virtualization and Device Independence
Virtualization allows districts to become 'device independent'. Since software runs on servers, the end user device can be anything that can connect to those servers. We can purchase:

Device	**Estimated Cost**
Traditional Desktop	$600
Traditional Laptop	$600-$1200
Thin Client	$200-$400
Netbook	$350-$500
nComputing Cluster	$100-$300
PDA	$200-$400

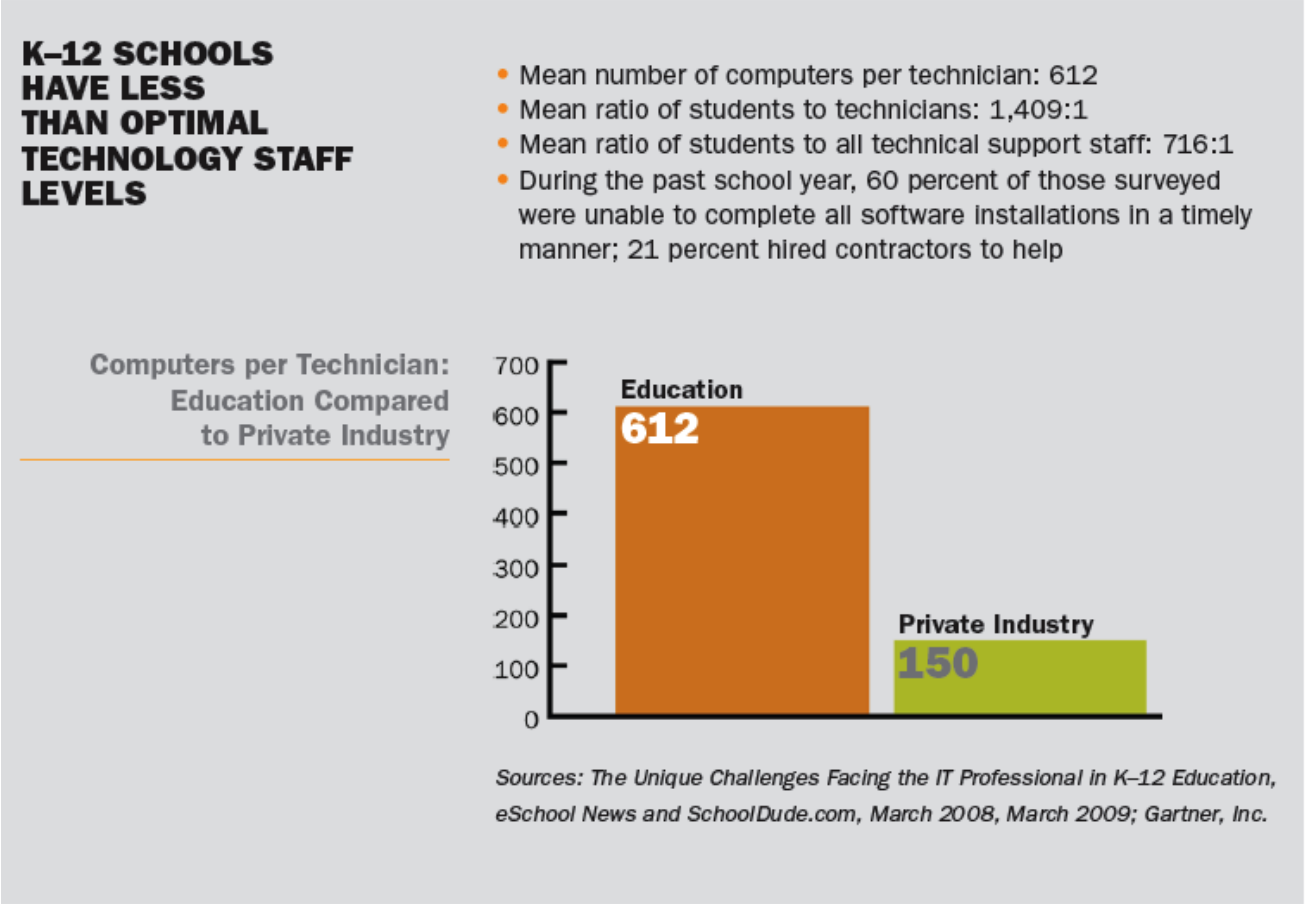
'Device independence' can help schools extend their purchasing power on end user devices by approximately 10%-33%.



Device Independence & 10 Year Replacement Cycle Graph: In the graph above we begin in year one with 1,000 computers. An existing PC replacement budget of $120,000 allows for the replacement of 200 computers per year at a unit cost of $600 each. Moving to a virtualization strategy the district is able to take that same $120,000 budget and purchase 200 new and less expensive devices with all the necessary server infrastructure and licensing needed. Because virtualization extends the useful life of existing equipment only 100 existing computers need to be replaced, thus the 200 new computers yield a net increase of 100 additional points of access for students and teachers.

Over 10 years this approach doubles the number of computers available for students and staff; a 100% increase. Furthermore, because virtualization allows for easier and centralized management of software, this increase in computers may not result in an increase in technology staff. This model shows that it is possible to double our computer inventory without increasing the annual budget.

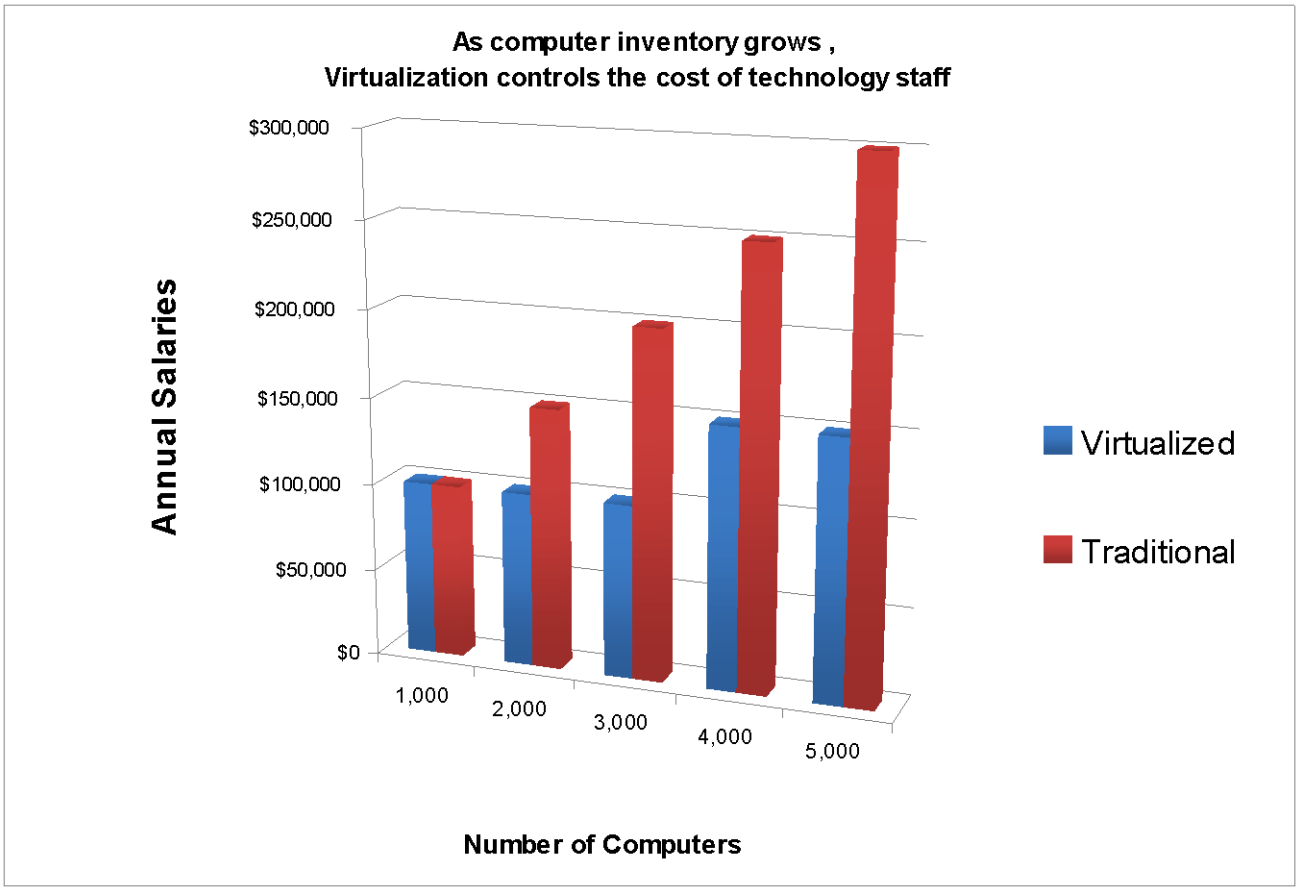
Client Virtualization and IT Costs
Client virtualization simplifies computer management by reducing the work required to maintain end user devices and puts more focus on centralized servers. For example, instead of installing a new application on 1,000 individual computer hard drives, software is installed on the servers and instantaneously every user has access to the new product.



A traditional client server network of 1,000 computers requires two full time technical support staff members**.** If we were to double the number of computers to 2,000 it would require increasing the number of technical support staff by at least one technician, if not two. If we increased the number of computers from 2,000 to 3,000, once again, it would require an additional one to two full time technicians to manage the environment. If these computers were mobile and traveled with students throughout the day, the complexity of technical support would increase exponentially.

	Technician	Computers	Salary& Benefits
K-12 – Traditional	1	500-750	$50,000*
K-12 – Virtualized	1	1000-1500	$50,000*

Note: Number of computers per technical support staff statistics from "The Unique Challenges Facing the IT Professional in K-12 Education, eSchool News and SchoolDude.com, March 2008, 2009; Gartner, Inc.



If we intend to move to a 1:1 and/or ubiquitous computing environment; client virtualization can save significant amounts of money by slowing the growth of full time IT support staff.

***Note:** Actual salaries will vary by location but the percentage of savings will remain approximately the same.

Client Virtualization and Energy Costs

The amount of energy a computer uses can vary greatly based on many factors. Under 'moderate use mode', defined as being powered on and under average application load, a traditional desktop computer uses 100-200 watts of energy. A typical monitor might use 75 watts. Together the computer and monitor consume 175-200 watts of energy each hour. Under 'power saving mode', defined broadly as being powered on but not in active use, a traditional desktop computer with monitor uses approximately 35 watts of energy.

For the sake of illustration let's put the following assumptions into place:

A. The following table shows conservative (lower in the range) kWh of energy consumption.

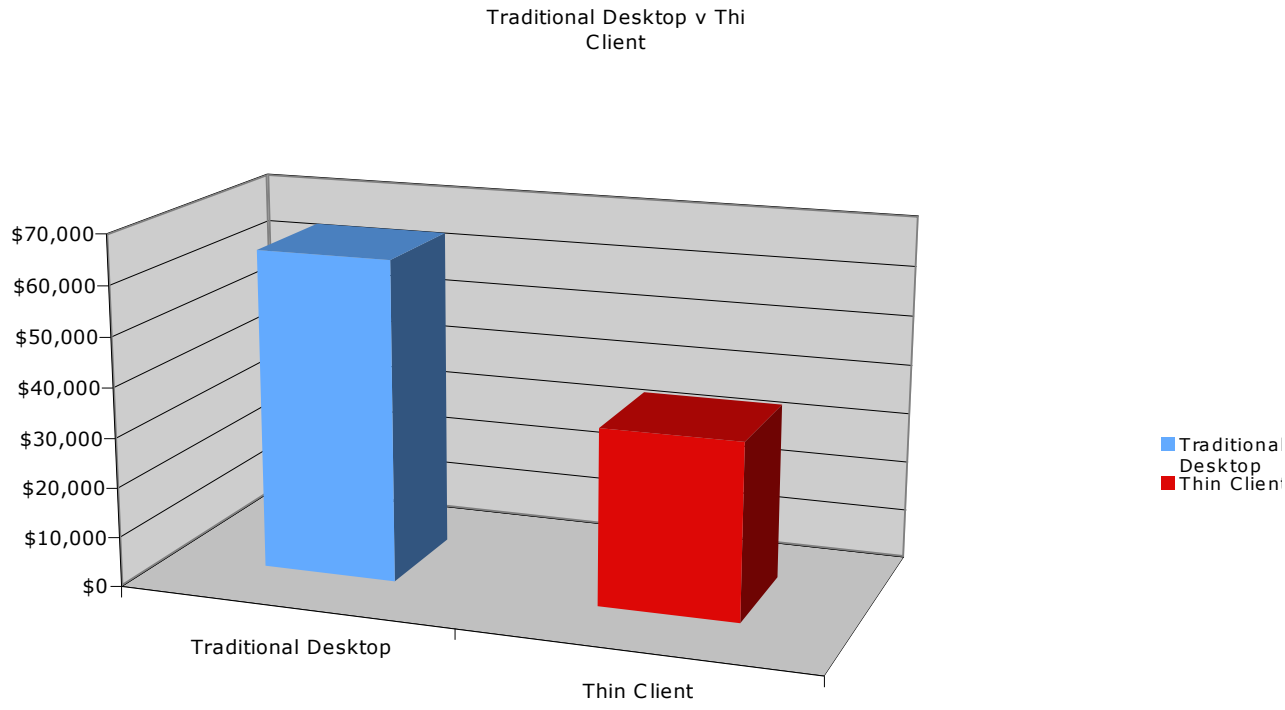
	Traditional Computer Station			**Thin Client Station**		
	Traditional Desktop	Monitor	**TOTAL**	Thin Client Computer	Monitor	**TOTAL**
'Moderate Use Mode'	100 kWh	75 kWh	**175** kWh	6 kWh	75 kWh	**81** kWh
'Power Saving Mode'	20 kWh	15 kWh	**35** kWh	6 kWh	15 kWh	**21** kWh

B. During the school year:
   1. Each computer is in 'Moderate Use Mode' mode 6 hours per day; 185 days per year.
   2. Each computer is in 'Power Saving Mode' mode 18 hours per day; 185 days per year.

C. During the remainder of the calendar year:
   1. Each computer is in 'Power Saving Mode' mode 24 hours per day

D. A utility rate of $.17 per kWh.

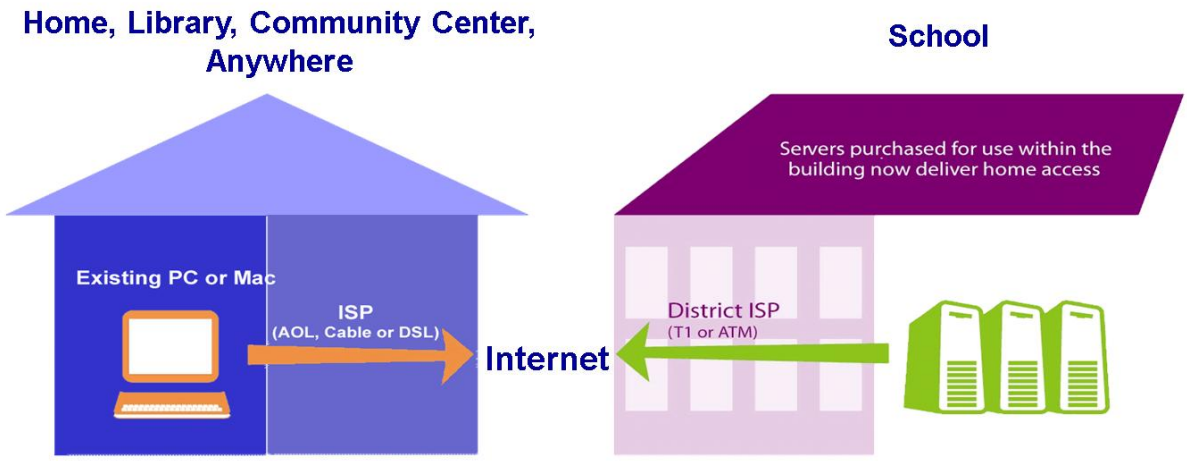
E. A one thousand computer network.



Using Thin Clients instead of traditional desktop computers can save 45%-50% in energy costs. The approximate savings by implementing Thin Clients for a 1,000 computer network is $29,291 per year; a 45% savings in energy costs.

The 5 year savings = $146,455. These savings can be reallocated to purchasing more devices for students and teachers.

Virtualization and Home Access
Virtualization does more than create an opportunity to increase the district's inventory of computers; it also creates the possibility of ubiquitous access by allowing students and teachers to work from anywhere, including the home or any other location with Internet access. Notice that since the software and servers are already in place, access from home is readily available.



In order to make home access easier and more secure all the school needs to do is add a remote access server and a number of client virtualization licenses to manage connecting home users to the network application servers and file storage. Students and teachers log in the same way they would in school and they can access all the applications and files they use in school.

Start Up Costs
Of course, in order to reap the benefits of 'client virtualization' there are startup costs involved in purchasing applications servers, software licenses, installation and support.

See detailed explanation in Appendix E.

Client Virtualization Advances
Although the moniker 'client virtualization' is somewhat new, the underlying technology concept has been around since the dawn of computers. Like most any technology, advances have occurred over the years and, more especially in the last 24 months, the virtualization market has grown and matured. There have been reductions in the cost of servers that coincide with an increase in their power. Thin client devices have done the same (pricing has come down while capability has increased), and the emergence of the sub $500 Netbook has greatly decreased the cost of virtualization. When these decreases are coupled with the savings incurred by having the ability to utilize obsolete computers for extended periods of time, the finances of 1:1 become much more feasible.

The Economic Downturn and Ubiquitous Computing
The economic downturn that began in late 2007 has impacted schools throughout the country. In this economic environment creating a ubiquitous computing environment seems to be nothing but a nice vision and a wonderful concept; but impossible to achieve.

It is important to note that even if ubiquitous computing is not the goal, the underlying methodologies employed in 'client virtualization' are applicable to all schools and can help:

1. Reduce the cost of replacing obsolete computers by 50%
2. Reduce the cost of purchasing new computers by 10%-33%
3. Reduce the growth in the cost of technical support and maintenance by 50%
4. Reduce energy costs by 45%-85%

All of these savings can be achieved while simultaneously increasing access, reliability, and ease of use.

Mobile implementations of Ubiquitous Computing
In many cases ubiquitous computing translates to one device per student. In this scenario it is important to note that in order to efficiently access the network, the virtualized servers, and the Internet, it is most certain that a robust wireless network will be needed. It would be a tremendous technical challenge to have each mobile device have its own hard-wired connection to the network.

Wireless access is shared access. Each device does not have a dedicated connection but connects to a wireless access point that is used by a number of devices. It is recommended that the wireless infrastructure be planned as carefully and as true to 'best wireless practices' as possible to be sure that mobile devices connect properly and have enough bandwidth to meet their needs.

Note: When purchasing end user devices be sure to check that the device can connect to the latest wireless access points.

Appendix E:
Analysis of 1,000 Computer Conversion to Virtualization

This chart represents the cost involved in implementing client virtualization for a 1,000 computer network.

Client Virtualization Component	Description	Cost
Traditional servers • File Storage Server (Data Storage Server) • Domain Controller Server • Back-up Server • Print Queue Server	These servers are used in a traditional client/server network to store of user files, define control access and user groups and to manage other network resources.	These servers already exist in most districts. There are no additional costs. Cost Components: -Storage -Mirroring -Active Directory -Backup Recovery
Terminal Application Servers (Terminal Server or VDI Server)	These servers are added to the network to run the software applications that are being taken off the individual hard drives of the client devices. The user's access to directories and files is still controlled by the File Storage Server. The specification recommended for this server would be appropriate for up to ~50 concurrent users.	In a 1,000 computer network approximately 65% of the computers are in use concurrently. This would require approximately 12-13 servers. Terminal Application Server Dual Quad Core Processors with 16 GB of RAM. Estimated cost per server = $4,500
Microsoft Terminal Server Client Access Licenses (TSCals) for in-school use	These licenses are required by Microsoft to use the Terminal Application Servers. Microsoft offers the option to purchase one TSCal for every individual computer or one TSCal for every individual user.	In a 1,000 computer network where there are more users than computers, one TSCal will be purchased for each computer Estimated unit cost = $22

	It is to the advantage of the district to purchase TSCals based on the lowest aggregate number: the number of computers (per computer mode licensing) or the sum of students & teachers (per user mode licensing).	
Remote Access Server	This server acts as a gateway to the Terminal Application Servers and the File/Storage Server from outside of the district's hardwired or wireless network.	The Remote Access Server can be a desktop. Cost: $600
Microsoft Terminal Server Client Access Licenses (TSCals) for outside of school use	These licenses are required by Microsoft to use the Terminal Application Servers. Microsoft offers the option to purchase one TSCal for every individual computer or one TSCal for every individual user. It is to the advantage of the district to purchase TSCals based on the lowest aggregate number: the number of computers (per computer mode licensing) or the sum of students & teachers (per user mode licensing). Where the district chooses per computer mode licensing, additional TSCals need to be purchased for home computers.	In a 1,000 computer network where there are more users than computers, it is recommended to purchase approximately 50% of the number of TSCals used within the school for home use. Estimated unit cost = $22
Citrix for outside of school use	In order to simplify access for a variety of home	It is recommended to purchase only the number

	computers, it is recommended that the district purchase a number of Citrix licenses for the home. The home user downloads the appropriate Citrix plug-in and connects to the Terminal Application Servers at school and can use all of their applications and files.	of Citrix licenses that may be used concurrently during the evening or weekends. Citrix offers a volume discount at (60) licenses. Estimated unit cost = $200
ClassLink LaunchPad Software Licenses	These licenses provide the instructional desktop that empowers teaching and learning. The built-in management system and management modules enable technical staff to more easily manage and monitor the Terminal Application servers.	It is required that one license be purchased for every computer in school. There is no charge for home computers. Unit Cost = $99
Installation	Estimated (4-6) days of installation.	Estimated per day cost = $1,750
Training	Estimated (3-5) days of training.	Estimated per day cost = $1,450 per day

Appendix F:
Endnotes and Resources:

1. Body of research on one-to-one programs include:

   The Impact of Maine's One-To-One Laptop Program on Middle School Teachers and Students, Maine Education Policy Research Institute, University of Southern Maine

   K-12 One-To-One Handbook, The Center for Digital Education
   www.k12blueprint.com/k12/blueprint/results.php?menu=results

   A Study of One-to-One Computer Use in Mathematics and Science Instruction at the Secondary Level in Henrico County Public Schools - Andrew A. Zucker, Education Development Center, Inc. and Raymond McGhee, SRI International

   Implementation and Effects of One-to-One Computing Initiatives, William Penuel; SRI International

   "Change Takes Time: The Promise of Ubiquitous Computing in Schools: A Report of a Four-Year Evaluation of the Laptop Initiative at Athens Academy," 2004, p. 43 [http://lpsl.coe.uga.edu/Projects/Aalaptop/; retrieved November 10, 2004

   Early Evidence from the Field: The Maine Learning Technology Initiative: What Is the Impact on Teacher Beliefs and Instructional Practices?" Occasional Paper #3, April 2003 Executive Summary, "Evaluation Report – Year 3, Middle School Laptop Program," Beaufort County School District, Beaufort, South Carolina, November 1999, report may be downloaded at
   http://www.beaufort.k12.sc.us/district/evalreport3.htm

   Freedom to Learn studies from the State of Michigan
   http://www.wireless.mivu.org/upload_3/MI_Evaluation_Brief.pdf

   Gulek, J. C. & Demirtas, H. (2005). Learning with technology: The impact of laptop use on student achievement. Journal of Technology, Learning, and Assessment, 3(2). Available from http://www.jtla.org

   Light, McDermott, & Honey, "The Impact of Ubiquitous Portable Technology on an Urban School Project," EDC's Center for Children and Technology, May 2002 Barrios, "Laptops for Learning – Final Report and Recommendations of the Laptops for Learning Task Force," March 22, 2004, available at http://etc.usf.edu/L4L/

Pete Reilly – Ed Tech Journeys

Pete Reilly is President of the New York State Association of Computers and Technology in Education (NYSCATE), the professional organization for technology using educators throughout New York State and an affiliate of the International Society for Technology in Education (ISTE). He is the former Director of the Lower Hudson Regional Information Center, a non-profit technology consortium of 62 school districts just north of NYC. Recently, Pete formed Ed Tech Journeys to promote educational leadership development, student empowerment, and 'One-To-One' computing projects.

Pete's blog, "Ed Tech Journeys" received the 2006 Edublog Award for Best Newcomer. Pete is also a guest blogger on District Administrator Magazine's site, "The Pulse", and "Education Week's" popular "LeaderTalk" blog. Pete has received acclaim for his interactive workshops on transforming teaching and learning with technology at conferences around the country.

His latest essay, "When the Classroom Door Swings Inward", is part of the anthology, "Being Human at Work" published by North Atlantic Press.. Over his career Pete has facilitated more than (40) Long Range Technology Plans for school districts in NY, CT, NJ, PA, and CA. Pete has received many honors, including being recognized as "Outstanding Administrator -2003", by the Hudson Council of School Administrators.