A sustainable future with Citrix/Thin Client Technology - a case study

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iNet, international Networking for educational transformation, is the international arm of the Specialist Schools Trust. The aim of iNet is to develop a global network of schools committed to working together and sharing knowledge.

The online conferences are a vehicle that brings together global knowledge on identified themes. These themes have been identified by Professor David Hargreaves in his book, Personalising Learning: Next Steps in Working Laterally, as key to the transformation agenda. Topics of other conferences in this series were: Student Voice, Leadership, Learning to Learn.

Each conference was of seven days duration and featured a new Focus Paper daily in addition to approximately twenty-five General Papers. Each day participants took the opportunity to debate one of the Focus Papers online, as well as contribute to the General Online Discussion on papers from educators all over the world. As a final process the knowledge shared will be brought together in the form of a publication.

A sustainable future with Citrix/thin client technology

Abstract: *This article provides a case study of the journey that has brought Joseph's College, Mildura to the stage where Citrix/thin client technology constitutes the stable base of the network. The deployment of this model and IP telephony has freed the school from financial shackles. A successful staff laptop program and the benefits of wireless technology have been part of that journey but now we are moving on for the benefit of the whole school community.*

Background

The expanding role of technology in schools has been accompanied by an equally expanding financial commitment. In many instances funding has provided a hardware infrastructure with minimal allowance for ongoing maintenance and upgrading.

St Joseph's College, Mildura is a Mercy Catholic secondary college situated in north-west Victoria, Australia. A Year 7-12 co-educational school, the student enrolment in 2005 of 873 students is supported by 110 teaching and non-teaching staff. Mildura is a reasonably remote regional area, and although a popular tourist destination with a focus on fruit growing and wineries on the majestic Murray River, it is statistically one of the lowest socio-economic areas of the state.

The college has always endeavoured to have a reliable, quality, computer enriched learning and teaching environment. The journey that has lead us to where we are today can be attributed to a number of points of balance, namely:

1) a group of enthusiastic personnel within the school,
2) a series of proactive Principals,
3) good technical support,
4) a desire to overcome the disadvantages of isolation,
5) location within one of the lowest socio-economic regions of Victoria,
6) the commitment of the Sisters of Mercy to provide educational opportunities equally to every individual, and
7) as a traditionally low fee-paying school, the need to work within a firmly constrained budget.

Some of the technology story

In 1999, the college administration initiated the purchase of a laptop computer for every teacher. It was apparent that the range of skills and enthusiasm for embracing technology in the classroom was directly related to teacher access to it. According to Larry S. Anderson (1999), 'a bold technology planning effort, incorporating computer and other technologies, has the potential of building, strengthening, and sustaining learners through networks and events that embody the concept of community'. The laptop program had the desired effect of creating a 'community of learners'.

In 2002, a review of the three year planning cycle of computer hardware development indicated it was not sustainable over a five year projection period. Hardware replacement in line with warranty periods, coupled with increasing student enrolments resulted in failure to keep up with the desired student computer ratio of 6:1. Network expansion was being stifled in favour of reliability.

Not unknown territory

The value of thin client technology in reviving redundant hardware was familiar to us at St Joseph's. Microsoft Terminal Services had been deployed in one computer lab in 1998 on a trial basis with cast-off 486 computers, that were not reliable enough on the general network, being used as the 'client workstations'. While performing satisfactorily, it was not sufficiently reliable to be employed as a general solution.

Teachers were reluctant to use the lab as smooth connectivity couldn't be guaranteed, and multimedia was not available. The release of an upgraded version that supported multimedia was in the offing, nevertheless, the constant issue of unclean logoffs and need for technical 'tweaking' made running Terminal Services a very high maintenance concern. Under the guidance of local firm, Integrating Technologies Pty Ltd who had recently contracted to provide network support, the decision was made to investigate the parent version of Terminal Services, Citrix Solutions.

The Citrix Metaframe/ thin client decision
The Citrix MetaFrame XP Feature Release 3 was trialled in October 2002 and immediately showed promise. The initial high cost of purchase was balanced off against the forecast significant reduction of future developmental costs and the promised reduction in technical support.

In December 2002, the college purchased 150 silver service licences with the intention of converting one student lab as a trial, then rolling the rest out as the bugs were ironed out. Integrating Technologies Pty Ltd technicians commenced Citrix training, and the success of the first installation was so apparent that all available licences were immediately installed.

What is a Citrix Management/ thin client environment?
Citrix Management Server and thin client computing go hand-in-hand. The client connects to the server through the network to run applications, access files, print, and perform services available to ordinary computers. Generally referred to as 'keystrokes across the network', the local computer has minimal memory, no floppy or CD-ROM drives and is simply used to logon. Once logged on, the user is working directly off the server.

More often than not, someone on a thin client device is unaware that they are not working on a standard PC. In fact, the most common response is, 'Hey, this machine is so fast'. While redundant PCs have been employed for this task, at St Joseph's College all new purchases are now true 'thin-clients', i.e. a box half the size of the average laptop computer that works in conjunction with a standard keyboard and screen.

Two thin clients that were deployed in the trial in 1998 are still functioning satisfactorily in 2005. There is nothing to go wrong with them. Many schools would be familiar with the technology through the use of Wyse terminals which have had many applications in school administration departments and libraries. It is robust with a long lifespan.

Advantages of Thin Clients
Wikapedia (2005) summarizes the value of thin-client computing very succinctly as:

1. **'Lower IT admin costs**. Thin clients are managed almost entirely at the server, the hardware has less points of failure, and the local environment is highly restricted (and often stateless), thereby providing protection from malware loading and executing.
2. **Easier to secure**. Thin clients can be designed so that no application data ever resides on the client (it is entirely rendered) so that malware protection is centralized.
3. **Lower hardware costs**. Thin client hardware is generally cheaper because it does not contain a disk, application memory, or a powerful processor. They also generally have a longer period before requiring an upgrade or becoming obsolete.
4. **Worthless to thieves**. Thin client hardware is useless outside a client-server enviroment. Burglars interested in computer equipment have a much harder time fencing thin client hardware (and it is less valuable).'

The backend - Citrix Management
The Citrix Management Presentation Server is the software that manages the thin client network with Microsoft Windows 2003. The corporate level is most familiar with the Citrix/ thin client computing where a single employee usually works at the same desk throughout the day, yet it is an ideal application for schools. A cost effective system is needed to manage

computers in classrooms, labs and libraries that carry a variety of software applications and are accessed by different students all the day. From our experience, Citrix provided that solution.

On the standard school network, each PC has it own operating system, applications, drivers, security and antivirus programs. An upgrade in any of these requires a technician to visit every machine, a time consuming and expensive exercise that invariably leads to delays in the delivery of new software. Prior to the installation of Citrix, the technician at St Joseph's was physically unable to keep up with the workload. As the network grows, the problem compounds.

Our network is a hybrid of both Citrix with local workstations and staff laptops connecting via the wired LAN. The Citrix servers operate in the basic configuration of a 'Farm' consisting of 6 servers ranging between 2.4 to 3.0 GHz Dual Xeon servers with 2 GB RAM. Early trials with various capacity servers indicated the value in using a number of smaller machines in preference to fewer servers of greater capacity. One of the features of the Farm environment is 'server redundancy', i.e. the ability to add or remove servers with no impact on the end users. Load balancing features of Citrix enable a server within the Farm to fail with minimal impact on performance.

Appreciating the Total Cost of Ownership (TCO)

One of the outstanding features of implementing a Citrix Solution is the reduction in demand for technical support. Technical support within schools is typically staffed at a level far lower than is considered acceptable in industry. Jamie McKenzie (2000) refers to this as 'network starvation' stating that in the business world, standards for technician support levels usually call for one technician for every 50-75 users, while in schools, there may be only one technician for every 300-500 desktops. This creates a situation where crisis response becomes the main focus of technician activity.

In the United States, the Consortium of School Networking (CoSN) is working to support schools in their efforts to refine networks in ways that will enhance learning. This has lead to the adoption of an approach common to business organisations called 'The Total Cost of Ownership' (TCO). The main thrust of TCO is to identify all of the primary elements required to make any innovation succeed, the hidden as well as the visible.

Supporting computer technology in schools is often seen as providing computer hardware. Actual operation exposes the hidden costs that include licencing, program upgrades, download costs, network infrastructure, staff and student training, management software, virus protection, and vandalism.

It is when all of these costs are evaluated that the efficiencies of the Citrix/ thin client model become truly apparent. For instance, Citrix licencing is perpetual and, once purchased, is owned by the client for perpetuity. The software works in well balanced perfect harmony with Microsoft products such as Active Directory enabling other non technical staff to relieve account administration from the technician. The library staff at St Joseph's College conduct the day to day management of student user accounts dealing with forgotten passwords and other login issues.

Security is another major consideration as applications are protected against tampering and viruses by being locked down on a server instead of residing on the local machine.

Impacting student achievement
Providing consistent, secure, and simplified access to resources has a direct impact on student achievement. It is easy to agree with John Brydon (2001) when he says, 'The network is the key!' Students are empowered in their learning when they are able to access network programs on any computer in the school or from home.

Mark Liddle, senior Network Administrator of Integrating Technologies stresses the security of built-in 128 bit encryption and SSL Support of Citrix which, unlike other systems, provides data encryption right from moment of connection between client and server, not after login and password have passed between them. The ease of this procedure gives students a true anywhere/anytime learning environment. As Mark says, 'High availability equals high value'.

Easy remote login provides inclusion for students who might not be able to participate in a traditional classroom environment. It also keeps exchange students in touch with their home school when living overseas. We have quickly reached the stage at St Joseph's College, where it's taken for granted that our school community has a seamless continuity of learning between home and school.

Power failure and data loss is less of an issue in a Citrix environment. Providing a student logs back into the same workstation they were on when the power failed, they will find that a server can reboot and will resume the disconnected session where they left off.

The Shadow Taskbar feature that enables selected staff to view and control student workstations it a powerful feature for both student instruction and management. It can be used to assist students with difficulties, keep them on task or otherwise interact with the student's work station.

Since conversion to Citrix, students have developed confidence and store their work more readily in their personal network folders. This is backed up daily and eliminates the problems encountered through transferring work between school and home. Students have adapted to the lack of a floppy drive being strongly encouraged to transfer their files between school and home via email if necessary. The option of USB drive access is being considered with a review of security issues. Presently students transfer files via USB through the library or teacher laptops.

Parental Support and involvement
Complete connectivity has the effect of empowering parents to be partners in their child's education, enabling them to provide the support that is often necessary for individual success. It can be said, without doubt, that student login problems from home are always solved. That's not to say that parents don't complain that their student cannot access the school's resources from home. Investigation of these cases invariably results in the invalidating of an excuse for the non-completion of homework.

Trialling with teachers and the classroom
The success of Citrix Management Server, has lead to a review for other possible areas of efficiency. Maintenance report job logs revealed that the 75 teacher laptops account for approximately 65 percent of technician time being spent on maintenance, repair and teacher instruction on these machines.

Their movement to and from home, back inside the firewall, is a constant source of concern. Theft and accidental physical damage is often not worth claiming on insurance due to policy excess. Furthermore, every laptop needs to be individually configured each time a new application is installed creating the inconsistency issues that have disappeared from the student network.

A teacher survey recently conducted to establish attitudes and practices in the use of laptops revealed that many teachers were not taking their laptops to class, while others who did found it quite a burden. Some were being used simply as expensive desktop computers.

Having successfully deployed thin clients onto a number of non-teaching staff workstations, the decision was made to conduct a trial of the replacement of teacher laptops with thin clients. Volunteer teachers would have their laptops replaced with a thin client installed on their desk in the teacher's staffroom, and in their timetabled classrooms.

Ten weeks into the trial, it is being resoundingly applauded by the teachers as a tremendous success. There are limitations. Some of the personalising of work stations available with PCs is removed with thin clients. Teachers cannot upload their favourite holiday snaps as screen savers or install software. A certain amount of user re-education and planning is necessary, however, teachers on the current trial at St Joseph's College agree that these inconveniences are far outweighed by the performance and convenience of the system. The positive outcomes being stated are:

1. Freedom from the burden of carrying a laptop to class,
2. Faster start to lesson that augers for better classroom management,
3. Teachers who didn't previously take the laptop to class are now taking advantage of network access that's available in the classroom.

This is not to say that any teacher will be asked to forfeit their laptop before they are ready. It simply means that we have established how we are going to move from the crippling maintenance burden of the staff laptop program.

Changing the technology spending priorities

The enormous savings gained from installing Citrix have provided the freedom for expansion. IP Telephony that was installed in 2003 has been rolled out to the whole site. Voice-mail integrates seamlessly with Microsoft Exchange 2003 and Citrix. Staff access a centralised mail store via webmail or Outlook for messages recorded to individual phone numbers. Budgets have been extended through this easy management system that takes advantage of cost saving IP telephony.

Other initiatives such as the introduction of WiMAX to service a remote addition to the college is being investigated as a further plug-in system to the Citrix Management Server. Within two years of using Citrix the network has expanded considerably. Redundant CPUs have been purchased for as little as $6.50 each and deployed for the cost of a screen and keyboard.

Anticipated savings that provided the courage and incentive to initially go with this solution, have been even greater than original estimates as the cost of hardware falls. We now have the freedom to consider other initiatives.

Not totally smooth
Naturally, a major reorganisation of the network such this is not without some issues. The legacy systems that must be maintained during the period of transition have an effect on the smooth running of the network. In the end they make it worth the time and effort to do a complete network rebuild once you know where you are going. Also, there are some parts of the network that it is better not to have on Citrix, eg. the Media lab. These remain as local workstations.

In January 2005, two years after the initial installation of Citrix, the network underwent a total rebuild. Since then, legacy issues have been resolved and new servers are easily deployed into the Farm as required. Technicians take just one hour to rebuild and install a new server onto the Farm.

The experience of setting up the Citrix/ thin client model has also revealed that a number of applications providers servicing the school market have not given consideration to anything other than integration into a PC environment. All difficulties are surmountable, however, have required a revisit to the drawing board for some suppliers.

The future
A number of years ago, after initially introducing it in 1999, St Joseph's College extended to full site wireless coverage. This network will remain in place and be used to connect between the classroom televisions and thin clients to deliver media files. It is also available to the increasing numbers of staff using wireless enabled PDAs and will continue to be used by staff who opt to stay with their current laptops.

To conclude, in the United States, Citrix Management Applications software is typically being installed at district level and is being used to remotely support and manage school networks from a central location. Three instances where it has been successful are Bellingham, Chappel Hill and Lemon Grove School Districts.

The direction of network development at St Joseph's College has evolved through necessity. We simply could not afford to finance our preferred technological future. For us it has been our 'ticket to freedom' and we will watch the trend in other Australian schools with interest.

Bibliography:
Anderson, Larry S. (1999). Technology planning: it's more than computers. http://www.nctp.com/articles/tpmore.pdf [Accessed 14 June 2001]

Brydon, J. (2001) The new literacies: vital for tomorrow's world. *Experiencing Change, Exchanging Experience Virtual Conference, 25 June-13 July 200, Discussion Paper*. http://www.cybertext.net.au/tipd/papers/week2.....htm [Accessed 4 July, 2001].

David, Barrie. (2002). Newburn white paper on thin client benefits. http://www.wyse.com/overview/white_papers/newburn.pdf [Accessed 20 April 2005]

Evilsizor, Douglas E. (2002). Networking Home and School with Thin-Client Technology. *Technology and Learning.* December 1

http://www.techlearning.com/db_area/archives/WCE/archives/dougevil. . [Accessed 17 April 2005].

Citrix. (2005). Citrix Access Platform solutions for K-12 Education: Industry case studies http://www.citrix.com/English/aboutCitrix/caseStudies/industryList.asp?storyIndustry=Education [Accessed 19 April 2005].

McKenzie, J. (2000) Network starvation. *From Now On—The Educational Technology Journal* . **9,** 6, February. http://fno.org/feb2000/starvation.html [Accessed 16 June 2002].

McKenzie, J. (2002). The true cost of ownership. *Multimedia Schools.* November. http://www.infotoday.com/MMSchools/nov02/mckenzie.htm [Accessed 22 March 2005].

Thin client. (2005) Wikipedia. http://www.wikapedia.com [Accessed: 20 April 2005].

About the author:

Camilla Elliott has the dual role of Network Resource Manager and Head Teacher-Librarian at St Joseph's College, Mildura, Victoria, Australia. This provides a broad view of both technical infrastructure and curriculum. She works in close cooperation with the technical development team, contracted technical support, curriculum leaders and students in overseeing the development of an ideal learning and teaching infrastructure. She has a keen interest in technology and the possibilities it presents to engaging students of the 21st century.