



Open Education

<http://www.apoplous.org> | Newsletter # 6 | February 2006 |

In this issue:

- Classroom of Tomorrow (p.2)
- The Rising Cost of IT- Thin Clients for education (p.10)
- The Apple Thin Client (p.20)
- Editor's Notes (p.24)

Disclaimer:

All opinions mentioned here are personal, unless otherwise stated. This newsletter report is not embraced or supported by anyone other than the writer.

All products mentioned here are registered trademarks of their respective companies.

Contact Information:

Alexandros Kofteros
13 Pindou Str., Flat 203,
2035 Strovolos,
Nicosia, Cyprus

alexandros@apoplous.org

www.apoplous.org

'apoplous' newsletter created on a PowerMac G5 using inDesign CS suite.



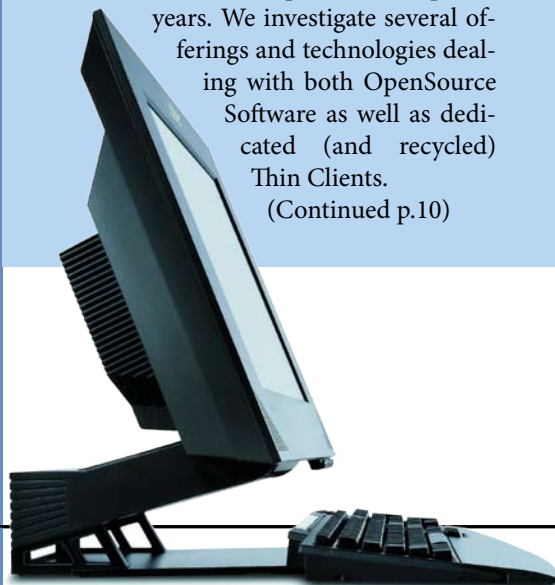
Revolution Begins

Our research has reached escape velocity: we have already taken the Linux Operating System and put it inside the classroom, identifying most of the difficulties and infusing our own expectations and experiences on an already stable system.

We are now ready for the next bold step: to create at least one classroom where every student has immediate access to clients (one for every child) and with curriculum content available -at least for Maths- through a respected Learning Management System. Such a change does not come easy, nor cheap. However, 'apoplous' along with its collaborating partners in the research are boldly moving ahead. (Continued p.2)

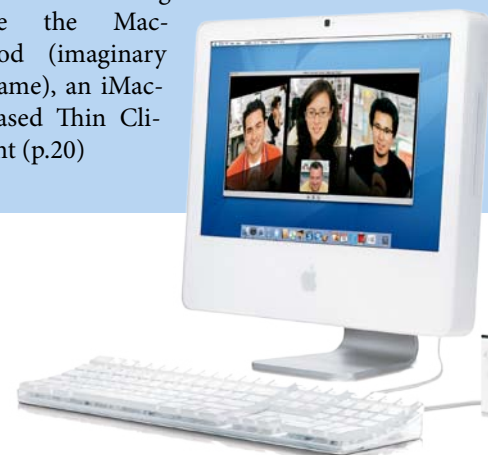
The Cost of IT

The cost of IT in education should not be as high as it is estimated today. The Total Cost of Ownership can come down to strikingly low levels with the right choice of tools and equipment. The move to OpenSource Software and Thin Clients is an intriguing and yet amazing prospect that has been put to work -at full speed- in the past 2 years. We investigate several offerings and technologies dealing with both OpenSource Software as well as dedicated (and recycled) Thin Clients. (Continued p.10)



The MacPod: Is Apple Developing the Ultimate Thin Client?

In the past few years Apple has made some impressive moves that took the entire industry by surprise. Steve Jobs revealed that Apple is actually working on several 'Just in case' projects. One of these was the move from PowerPC to Intel hardware. The other bold move might be the MacPod (imaginary name), an iMac-based Thin Client (p.20)



The Classroom of Tomorrow

In what will eventually be the single most bold step for IT in (Cyprus) education, we are moving to a 1:1 analogy for school year 2006-2007 with the entire Maths curricula turned to Learning Objects



The time is right: we have a strategy for computer recycling through a Linux Terminal Server. We have proven that lower TCO can come from a combined strategy of Thin Clients (hardware), OpenSource Software and a central Learning Management System to put all pieces together. Now we move to the next stage: a truly digital classroom!

A Bold Step Ahead

This is going to be a pilot study- again. In order to turn an entire year-curriculum digital would require hundreds of people, experts in education, computer software, graphic design, 3D graphic arts, sound artists, academics, just to name a few. Our scope is not to do that- even

though we would love to. Our intentions are to use a centralised Learning Management System to de-centralise learning within the classroom. Strange as it might sound, a Learning-Objects Oriented approach on Fifth-grade Maths, with an LMS to provide the linking components, a teacher is free to do what he should do: become a true facilitator of knowledge and especially devote more time in helping children with learning difficulties or even gifted children.

The educational system today has neither the means nor the provisions for either category. In the pages that follow we shall give a brief explanation of the way we plan to take education from here.

Thin Clients Make IT Feasible

Costs are always a consideration when implementing new technologies or new ideas in education. Fortunately, Thin Clients/FOSS can contribute to lowering the TCO and make IT feasible in large numbers



A typical computer lab: far from ideal arrangement for integrating technology IN the classroom

After 2 years of using Thin Clients and Open-Source Software in the classroom, we are ready for the next, even bolder step: to completely replace every single thing in a normal classroom and turn part of the curriculum digital.

A lower TCO makes it possible

It would have little sense -if any- to propose a one client per child initiative, without proving that it is both feasible and financially viable to do just that. By recycling computers or by using dedicated Thin Clients with Open Source Software, the Total Cost of Ownership comes down significantly. Maintenance also becomes far easier and less expensive, adding another plus to the entire Thin Client strategy. As we are approaching the middle of this school year, we have to make plans for the year ahead.

More Clients in one room

Of the four schools that are part of our research, we will move to the 'one client per child' in just one of these schools. For various reasons we decided to upgrade the equipment at Dasoupolis Primary School. For next year we expect to house a classroom of at least 22 children. Each

one of them will have direct and immediate access to a Thin Client. We expect to receive the additional clients -as a donation- within the next few months and delivery, installation and support will come from our collaborating members in this research.

All furniture in the classroom will be replaced- from normal desks, to chairs to computer desks.

Faster, Silent Server

Since we work with Thin Clients, a fast server is needed. Our present Intel server features a Pentium4 CPU running at 3.2GHz. With 22 clients, we fear this server will not be sufficient. A more powerful Dual Processor 1-U server has been considered, but the level of noise prohibits us from using it. We have made some thoughts on replacing our Intel server with another machine with either Dual CPUs (and silent fans) or a single, Dual Core processor. Since our funding no longer supports purchase of additional equipment, we will have to resort to generous donations from private companies for this server. We are, however, examining several alternative solutions.

The Desks & Chairs

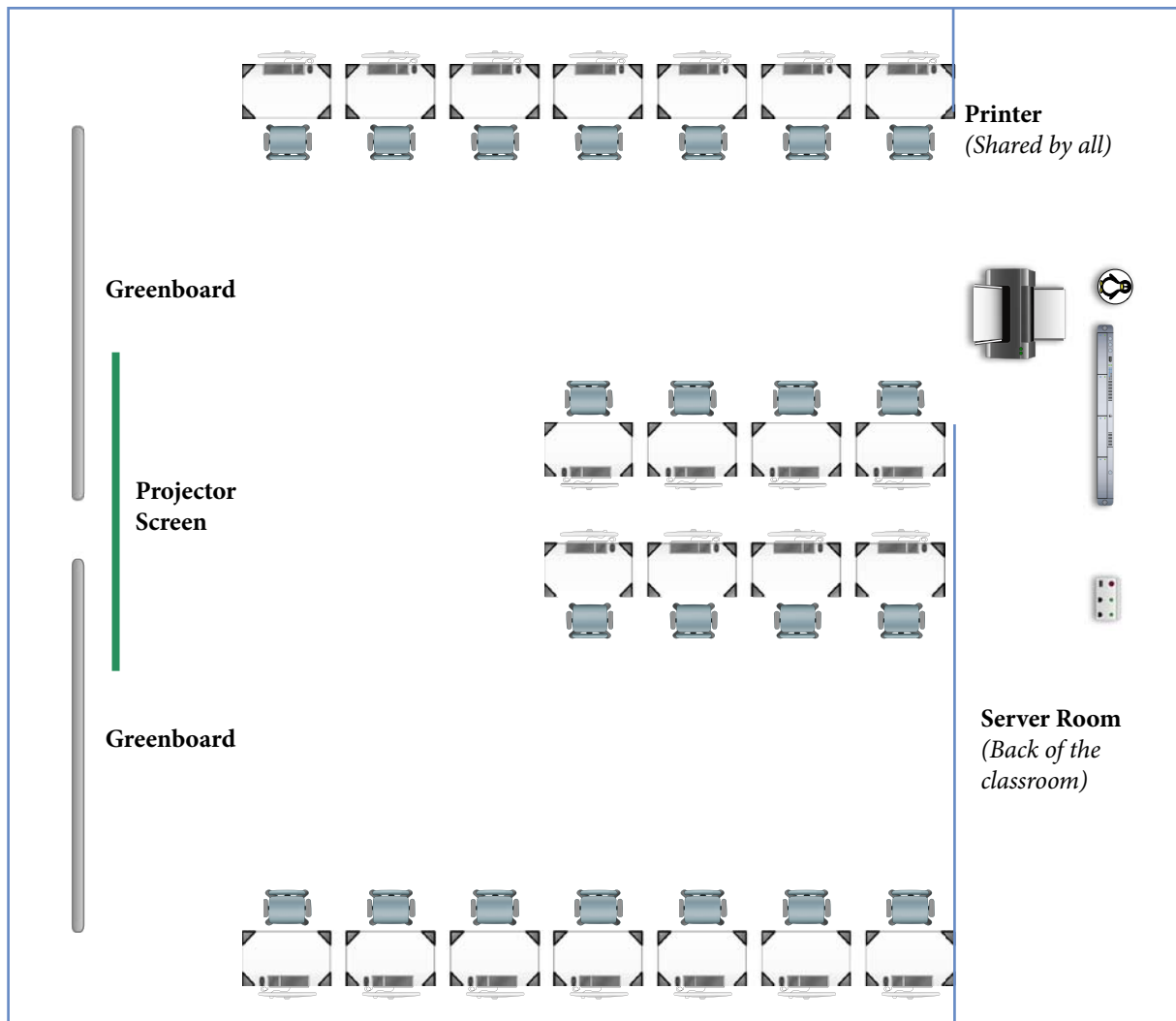
Not all lessons benefit from the use of computer. We need desks that allow our children to work as good (if not better) as they would on their normal desks. Since the SunRays take just a small part of the desk (and the keyboard can rest underneath the Ray when not used), children will be able to work happily with their text books with and without using the computer.

Because children will have to be flexible in their movements (especially when discussions or presentations take place) we need to replace their normal chairs with (ergonomic) computer chairs.



Classroom arrangement

It is obvious that the 'normal' arrangement of classrooms cannot -effectively- support the integration of IT. At least not with the numbers we expect.



Making IT Right

The above diagram shows the proposed arrangement for our pilot classroom. The absence of teacher desk is obvious- after all, our intention is to turn the teacher into a facilitator of knowledge and not the center of it. We do not, at the same time, disregard the importance of presentation of information from the teacher. We just removed the focus from it and we shall attempt to establish new roles for both students and educators.

Every child has his/her own client. This does not necessarily dictate that each client has to sit on a different desk. We

will examine desks that can support two or even three students (and clients) at the same time.

Collaborative work will be encouraged, with and without the use of a computer. The use of rotatable chairs will allow us to be extremely flexible in the way we work with children. The removal of all 'standard' furniture will free more space for the educator to be able to move from student to student. These suggestions mean that the educator will actually be more productive but at the same time require him/her to move more inside the classroom.

Agents of Change

When a team of academics from Europe visited schools in Finland, they asked school principals a simple question: what is the most important ingredient for school success. The answer was simple: Teachers!



You cannot have education without educators. This is the simple most important ingredient for any educational system that needs to have the best possible results. The introduction of the Integrated Computer Classroom is extremely new (at least in Cyprus), and requires a different role for the teacher.

The Teacher Effect

Any innovative idea can only succeed if educators accept it. Otherwise, all innovations are doomed to failure, regardless of how much effort is put by Ministry Officials. The same applies to IT in education. Many educators believe that, since their methods are showing good results, they do not feel the need to move to other methods. Dealing with learning, many educators tend to believe that IT has to offer little-if any-advantages over more traditional methods.

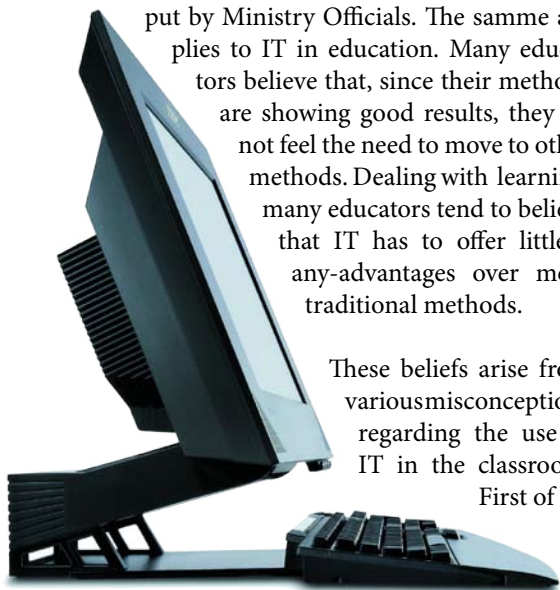
These beliefs arise from various misconceptions regarding the use of IT in the classroom.

First of all,

teacher experience the frustration of not having the right analogy of computers per students. In most Cyprus classrooms we have at least one client for 20-30 children. This number will increase to 3 per classroom by 2007 but is still far from being ideal. Another factor is the absence of digital content. Even though debate suggests teachers have to design their own material, this can only happen when a core of content exists. Otherwise it is like sending a teacher to a classroom and neither he/her nor the children have ANY textbooks.

Another great problem is the Curriculum itself: There is insufficient -if any- integration of IT inside the curriculum itself. Teachers have to face the frustrations of not only having to cover specific curriculum aims and content, but they also have to choose how, when and where to use IT effectively. This is all acceptable when a teacher has enough experience with both teaching, curriculum studies and IT skills, but the vast majority of educators do not have all these skills.

We hope our work within the next school year (and the following) to give us more evidence on how IT can be integrated within the classroom and what are the requirements as far as Curriculum Content is concerned and how to work with educators and help them accept any and all benefits of such an approach.



Maths Headaches

Every time Cyprus participated in International Research on Maths and Science, results put us far below the average. The shock of TIMSS1995 brought with it many changes to our educational system



The TIMSS Website (www.timss.org) gives information on both the Mathematics and Science research as well as the research on Literacy (PIRLS).

Through the home page we can navigate to all the findings across the previous years of research study.

The TIMSS Shock

Up until the TIMSS research of 1995, Cyprus had the mistaken belief that 'all was well' in the Educational System. What the results showed, however, was that Cyprus managed to rank well below the average score. This led to an initial shock, with many 'experts' even suggesting that the methodology of TIMSS was questionable!

Unfortunately, the second time Cyprus participated in this research, results were not much different. This led to a rethinking of how learning in Maths and Science takes place. A team of experts, including educators and academics, was created and the entire Maths curriculum was reconstructed from scratch, giving emphasis to problem-solving skills and creative thinking.

The previous Maths books strongly emphasised the teaching of skills in solving numerical problems- little to no problem-solving skills were required.

What we essentially have now are 4 volumes of books divided in several sec-

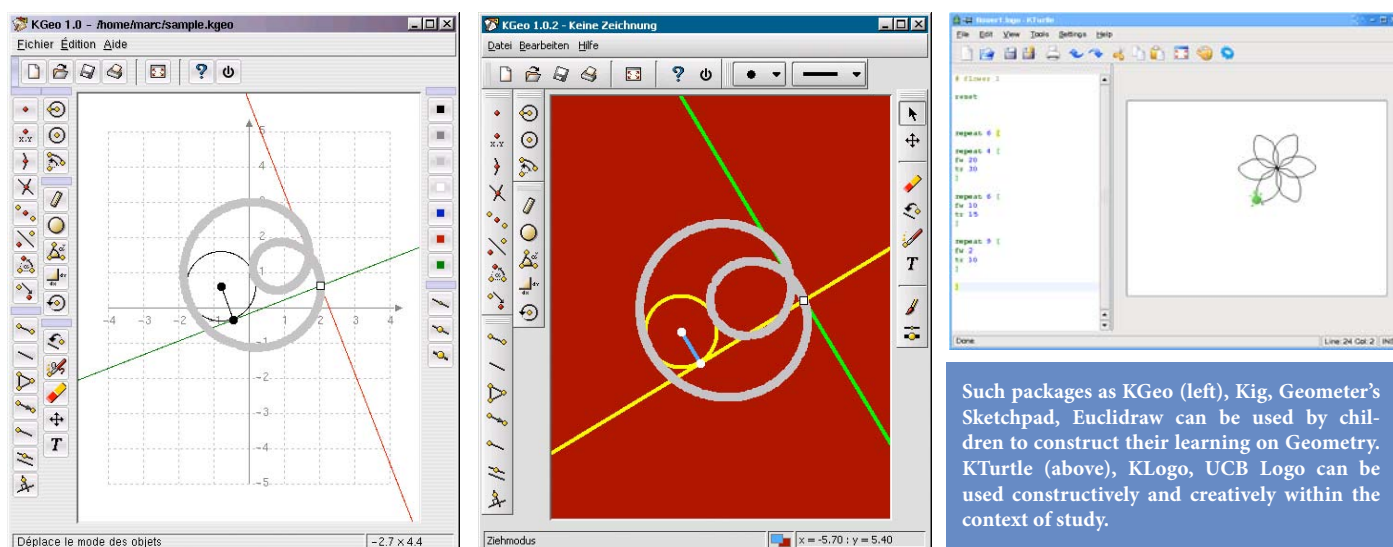
tion/chapters per book, for every single classroom of Primary Education (Grade 1 to 6). There was, however, poor management of the new curriculum and context, with absolutely no training of the educators on how to best use the new concepts found in these books.

In 2003 (school year), Cyprus participated for the third time in the TIMSS research. Results were much better, with Cyprus coming just above the average score. Some consider this to be a success, but given the effort and the resources used for the change in Mathematics, some others dare to question the results as 'too little'.

Simultaneously, the change in Mathematics led to an actual increase in material to be covered by students/teachers for each school year. The official line that 'teachers should do selective work with assigning exercises' is not a very elegant solution. Children (and parents) cannot accept that certain exercises are not to be solved by their children, but instead they CAN and SHALL be solved by other students in the same classroom.

The Time We Do Not Have

We are not suggesting that the use of IT will sufficiently gap the differences between students of varying level of performance. It will allow us to examine the effect in the way children interact with Maths.



Such packages as KGeo (left), Kig, Geometer's Sketchpad, Euclidraw can be used by children to construct their learning on Geometry. Kturtle (above), KLogo, UCB Logo can be used constructively and creatively within the context of study.

Some children, especially those with that require extra help from the teacher, find it extremely difficult and frustrating to deal with Maths. Almost every classroom has a percentage of students that are well behind the expected level of competence.

The Issue of Time

Most schools in other countries deal with children with learning difficulties by using extra time, usually after classroom hours. This is not the case for countries like Cyprus. In most schools, children go home after 13.05 p.m. with no provision for extra lessons to cover gaps. What we do have is usually just one period (40 minutes) per week for personal help by the teacher. This is not the ideal solution, since, during this period, the child has to skip another class (ie History, or Athletics, or English etc). Plus, usually the teacher has at least 2-3 children at the same time, a situation not always beneficial (even though supporters of this method suggest that children tend to learn better in small groups).

During the normal lesson, the teacher has to allocate his/her time to all children. In fifth grade, Maths are taught 6 periods

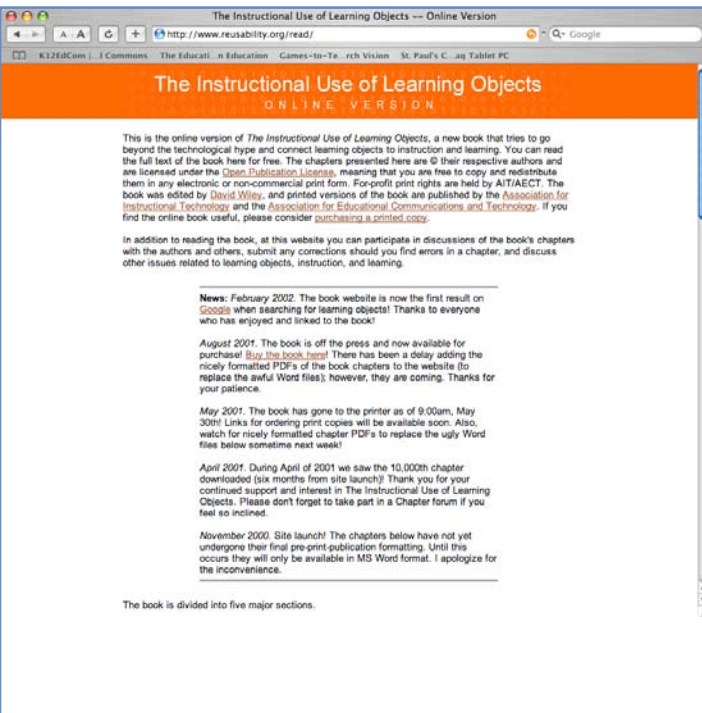
(6x40 minutes) per week. A lot of time is dedicated to correcting assignments or exercises, examining home work, answering questions etc. Very little time remains for actual on-the-spot help to children who need it the most. Students do not usually progress on their own to the various exercises, unless the teacher is asked to inspect the solution they have come up with.

The Issue of IT

The use of technology, and the transfer of Maths curriculum to the computer, will allow us to better use our time within the classroom to the benefit of our students. A blended approach will be used, with 'normal' paper-based exercises taking place whenever needed. At the same time, two types of digital exercises will be used. Those with open-ended software (ie Kig, KGeo, Sketchpad) as well as modules based on the actual book exercises in the form of Learning Objects.

The Move to Learning Objects for Maths

With limited resources, and short of people to recreate material, we decided to move to an object model that ensures both quality of production, reusability, as well as flexibility in the implementation.



The 'Reusability' web site (<http://www.reusability.org>) provides valuable information as well as a complete book on Learning Objects. Needless to say, it has proven to be a very good guideline on our work for the next school year.

Life is not fair. Some children, for various reasons, appear to be failing at school. Research has shown that 10-15% of our school children have severe literacy problems and the situation is not improving

year after year. With most parents having less and less time available to devote to their children, and with an educational system that appears numb in coping with this problem, we turn to technology for a helping hand- this time, we hope to make good use of it. As an (Apple) brochure stated, several

years ago, "Life isn't fair: We are working on it!"

still exists within the same context (as proposed by such researchers as Tom Boyle).

In our situation, we are dividing the entire 5th (and parts of 6th) grade Maths curriculum into modules (Objects). Each module has absolutely no connectivity option to the other, and no hyperlinks to any other information. This ensures the true independence of each module, and allows the educator to use them and re-use them either in grouped activities or stand-alone.

'Contaminated' Design

Our Modules consist of two additional sub-modules. The one is a 'scribbler' - a sub-application that works as a virtual piece of paper. Even though students need (and are allowed) to use paper as well as the computer, the scribbler helps in keeping the information for future use. Also, another sub-module is a calculator, that only becomes enabled for specific exercises or problems. All modules will run full-screen, thus giving students a clear screen to work on.

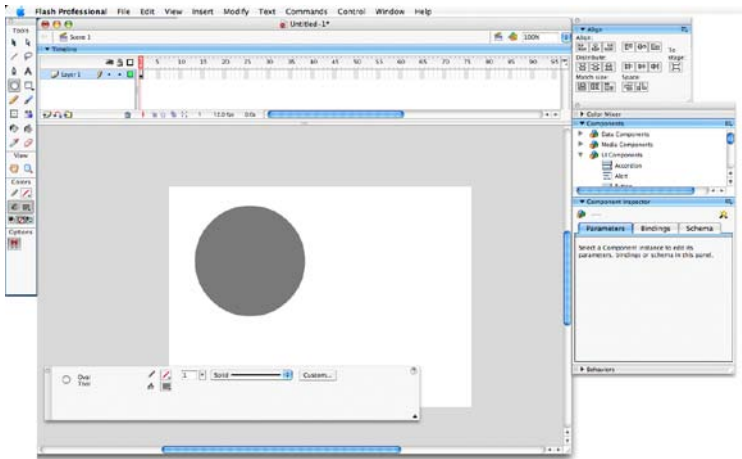
Learning Objects

Almost every issue of this Educational Report mentions Learning Objects. The computer implementation of Learning Objects has many similarities with Object Oriented Programming (Wiley, 2002). As such, the emphasis is on small, independent pieces of information (we call them 'modules') that have little -if any- interoperability with other modules. In some cases, each module is completely independent from all the rest, but

"Life isn't fair; We are working on IT!"
--Apple Computer

An LMS Approach

Having the content is one thing. Applying it to the entire classroom and managing the results is a completely different thing altogether. We are building the future classroom on top of an LMS.



Adobe (former Macromedia) Flash is one of the most respected Multimedia Authoring Tools in the market. It has long replaced the former king, Macromedia Director, as the main authoring environment of choice for both CD/DVD-ROM and the web.

“Hell, there are no rules here. We are trying to accomplish something!”
--Thomas Edison

Just imagine: your child comes home with homework. For various reasons you find some trouble solving specific Maths problems. You log-on the LMS from home and you post a question to the teacher. After a couple of hours you get the answer. Similarly, a parent needs to learn the progress of his/her child. Parent-Teacher Meetings are essential, but what if a parent wants to find out the progress on a daily basis? Log into the system from home, using your child's login details and there you have an entire history of his/her progress. Science Fiction? No. Just what we are doing for next school year!

Lotus Learning Management System

When the research started, we had more modest plans for Lotus LMS. We knew, of course, that success in the first stages of our research would allow us to move forward. That is why, in choosing partners, we decided to go with IBM and Inteliscape (their respective Lotus Business partner) and their LMS.

In bibliography, LMS are hardly (if ever) used in Primary Education. We do not care, at this stage, what bibliography claims regarding this issue. As Edison put it, *“Hell, there are no rules here- we are trying to accomplish something!”*. This does not imply that we are moving blind

on this one. Far from it!

A thorough bibliographic research has shown that Learning Objects have never been tested in primary schools, where the classroom is also a computer-lab, and with an LMS to manage everything and bind all the pieces together. We believe we are making bold steps ahead, and the evaluation of our progress, by the end of next year, will allow us to have a clearer view of both LMS in primary education as well as Learning Objects in general.

Authoring Tools

Most of our Modules will be built using Adobe (Macromedia) Flash. This is the most practical authoring tool for creating content, as it can generate modules that work either stand-alone or through a web site. Flash Modules can also work on all platforms (Linux, Solaris, MacOS X, Windows) offering an advantage over other technologies. RealBasic is a candidate due to its cross-platform nature, however the modules created will not be easily accessible by people with dial-up lines or by most schools today.

Net Access Not For All?

Understandably, not all parents have access to the internet from home. Even though we shall attempt to get (and we are positive on the result) free Web access to all parents, we do not expect everyone to be able to log on the LMS from home. We are moving towards a more open-ended approach that will allow all parents (even those with children in other schools) to be able to access our content and forums. Lotus LMS is licenced-based, so it is not the right solution for supporting every single parent. Instead, we are taking a two-road approach by implementing Lotus LMS alongside Moodle, the OpenSource Learning Managemt System

The rising IT costs

Most countries believe in the added value of IT in education. However, escalating costs cause headaches to financial advisors of governments.

The Cost of IT

Computer today tend to be quite complex machines. The Operating System alone installs hundreds of files on the hard drive, and patches are needed to be applied on regular basis. Graphics and sound cards are usually installed in high-end models, and the entry levels enjoy an all-in-one approach with almost everything on-board.

Almost every country in the developed world understands the significance of computers in schools. In Cyprus, for example. the Ministry of Education has already established at least one PC for every single classroom, from Kindergarden to Sixth Grade. By the year 2007, every classroom will have at least 3 computers (not counting additional equipment for labs), totalling approximately 12 000 computers for the entire government-controlled area of Cyprus. This number, unfortunately, is not accompanied by a strong team of IT people to offer maintenance and instead the Ministry has to rely almost entirely to teacher good-will or to the private sector.

The costs of upgrading the machines have to take into account both hardware and software. The present vulnerabilities of the Windows OS leads to a necessity of constantly upgrading virus and spyware detection software. At the same time, IT personnel have to deal with virus and spyware issues, spending time cleaning infected computers.

This strategy is not entirely different in other countries. Even in places where IT personnel has been hired, the cost



of maintenance and the upgrade circle of the machines create an almost astronomical cost for most governments. With these costs, and with the present model of 'fat' clients, it is too expensive to move to an analogy of 1 client for every child, at least not for a long-term plan.

The Thin Solution

Thin Clients are terminals that require (in some cases) a server to run their software. In most cases, a Thin Client does little more than just give connect the keyboard, mouse and screen to a 'dumb' box that accesses a central computer. Of course, technology and networks today allow us to do things unheard of a few decades ago. That is why a Thin Client today can replace a 'fat' client for most operations and offer an inexpensive solution for implementing large numbers of client in a company, school or organisation.

Thin Clients are not a new concept. Actually, they take us back to the time before personal computers, when university students, scientist, military personnel and others had to use 'dumb' terminals connected to a quite large mainframe computer.

The Personal Computer changed that, starting with the lowly Apple II and going through many known and even forgotten names - Oric Atmos, Commodore Pet, Sinclair Spectrum, Sinclair QL, Amstrad CPC range, Atari ST, Commodore Amiga...

The Personal Computer managed to become accepted in most schools in the developed world. However, Thin Clients are becoming more viable alternatives while delivering the same -if not more- potential as their 'fat' client cousins.

Thin Clients for Education

Is the time right to move back to a thin client model for our schools?

They do look promising, but are there any heavy compromises?

Cost-efficiency

Imagine a traditional primary school of Cyprus with grades 4-6 and at least 120 students. Now, supposing we have at least 3 PCs for every classroom, and excluding a computer lab, that brings us to a number of almost 30 computers- and no IT personnel to handle them! Multiply that number by almost 400 and you get the number of computers in our educational system. Let us suppose, for arguments' sake, that we establish a thin-client network in that school. That means that, with a powerful server we can drive all clients simultaneously over a 100Mb/s network- with the option of moving even to a Gigabit network.

Couple that with an ADSL connection for every school, and the maintenance of the server can even be had without the core Ministry team even leaving their office or hiring private-sector technical support.

With Intel and AMD moving to 64-bit dual-core processors, such a server machine need not be expensive. And, with Data Mirroring, we can be sure that a server can keep running happily even with a hard drive failure.

Our Research Findings

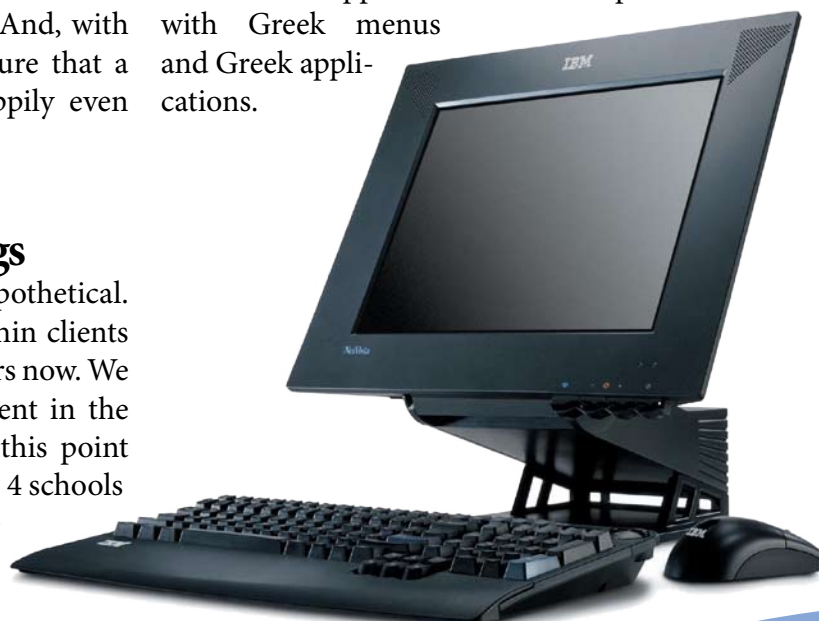
The above scenario is not hypothetical. We have been working with thin clients in primary schools for two years now. We started with recycled equipment in the previous school year, and at this point we have established our labs in 4 schools across Cyprus. Three of these

schools are running under K12OS (Fedora Core 4/LTSP), through a Pentium 4 server (Troulloi Primary School) and through 2 Celeron 2.4GHz servers for another 2 schools (6th Lakatameia School and Mazotos School). Lakatameia and Mazotos are using recycled computers, covering such models as PII, Celerons and PIII.

Dasoupolis Primary School is running Sun Java Desktop 3 and Solaris 10, using dedicated SunRay 170 thin clients.

Server Down, Clients Up

One major problem when working with Thin Clients is what happens when the server goes down. There are many ways to deal with this situation. Some machines can run on their own embedded OS (be it Windows XPe, Windows CE or Linux). With adequate RAM (at least 128MB), our recycled machines that feature CD-ROMs can run Live Linux Distros and connect to the Internet. Our favorite Live Linux Distro is Knoppix, based on Knoppix and comes complete with Greek menus and Greek applications.



K12LTSP For Recycled Thin Clients

Give life to old machines- it is easier than one thinks, and quite inexpensive too, especially with Free/OpenSource Software.

Food for thought...

The Free/OpenSource Community is mistakenly thought of being a privilege of computer geeks- that is no longer the case (if it ever was). StarOffice and OpenOffice are tremendous packages that are aimed at the desktop user -be it student, teacher, work or just the sort that likes to toy with various Office suites. Therefore, all details must be ironed so that both suites can offer Linux/Solaris a more competitive advantage over their proprietary competitors.

Both Microsoft and Apple are taking great steps in improving the UI experience of their users- the same MUST be applied to all Linux applications. We are not saying that Fedora is better than Solaris, or that OpenOffice is better than StarOffice. However, from an end-users point of view, Fedora Core 4 and its OpenOffice 2.0 suite is far far more user friendly than anything else in the Linux world.



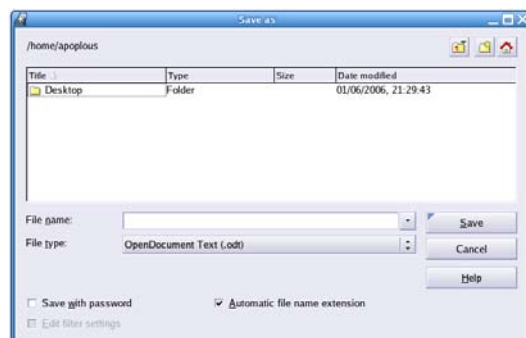
Fedora Core Power

Say what you want about Fedora. The truth is, it has proven to be quite stable and capable of handling 20+ clients running off a Pentium 4 server with 2GB of RAM.

One of the best features of Fedora, is the tight integration of almost all included applications with the Gnome (and in some cases KDE) environment. As you can see from the screenshots (right), most dialogue boxes and windows in various applications (including OpenOffice and Firefox) are completely themeable.

K12OS comes on 5 CDs and can be downloaded from:
<http://www.k12ltsp.org>

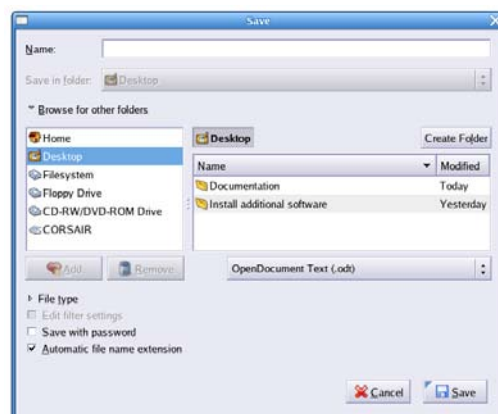
Installation is quite straightforward, even for novice users. The K12LTSP installation includes educational software such as Celesta (Solar System), Kig, KTurtle, GCompris, TuxMath and several others. Not all of these are suitable for Primary Education, but they are of very good quality. OpenOffice 1.9 is included, and can be updated to the latest (OpenOffice 2.01) version using the up2date tool.



The StarOffice Open/Save window. Quite unfriendly, since you have no way of (immediate) access to any removable device, unless you go through several directories.



The Fedora implementation of OpenOffice 2.0. Please notice the enhanced Save/Open window. You have direct access to the Home Directory, the Desktop as well as all the removable devices. And things get better...



Through the click of a button, we get the window divided in columns, each one showing (respectively) the removable devices, working directories plus all the files. Plus, it is completely themeable.

Installing K12LTSP- The Hardware

As mentioned earlier, the installation of a fully-working Linux Terminal Server is quite straightforward, and exceptionally easy.

System Requirements

Before Installation, we have to decide on the hardware to use. For a network of 15 clients, a Celeron 2.4GHz based machine is the minimum we can accept. For up to 20-25 clients, a Pentium 4 at 3.2GHz is adequate for normal use.

The minimum hard drive we can use is 80GB, even though this will run out quite soon. A good practice is to allocate at least 80GB for the OS and then additional 10 GB for every client. Hard drives of 200GB capacity are all too common now and fortunately Fedora Core 4 works perfectly with both ATA and SATA drives. When choosing hard drives, a major consideration is the actual speed of the drive. 10 000 RPM SCSI

drives are quite expensive, and they need more fans to operate at acceptable temperatures. SATA drives are quite inexpensive, and they are quite fast.

Memory Pains

Memory is always a consideration. If the motherboard supports ECC memory then we should use that, even though schools are not mission-critical institutions and a crash during work will definitely not cost lives. At least 256 MB should be left for the system and additional 50MB should be used for every client. In a situation with 10 clients, for example, we need at least 500MB for the clients and another 256MB for the server. The more RAM the better, and since memory is at a record-low, we can fill our RAM banks with as much memory as possible.

Graphics-Sound

The least important component of a Terminal Server is the graphics card. Actually, most terminal servers are running headless- you can control them through one of the clients. It is advisable that they are left alone. The same can be said about their sound cards- most servers don't even include one!

LAN Cards

Even though it is possible to run an LTSP server through one LAN card, it is advisable that two are used, one for the clients and one for internet access. In most cases, the clients will use a 100Mbps connection. We suggest using a Gb LAN card on the server for driving the clients, even if the Switch to be used

Choosing the right chassis

In most cases, the server will be kept running for long hours. In classrooms today, the temperatures can rise quite significantly, especially during the early Summer weeks (in Cyprus). Since airconditioning is just a dream for now, we need to make sure our server is kept as cool as possible. Therefore, a suitable chassis that allow air to flow through it is a necessity. Fans must be placed in areas where air will circulate in and out of the computer, removing the hot air from both hard drives and components.



Servers such as the IBM eSeries are ultra-reliable. However, they do come at a price.

Setting Up the Network

The ingredients of a Linux Terminal Server setup are quite simple: the server, a switch and the clients (along with cabling)!

Setting up the network

Nowadays, it is unthinkable to have a network with no access to the internet (unless there is a tremendously serious reason). Upon installation, K12LTSP informs us that one LAN card (designated as 'eth1') will be used for Internet connection. The other LAN card, (eth0) will be used for the Thin Client Network.

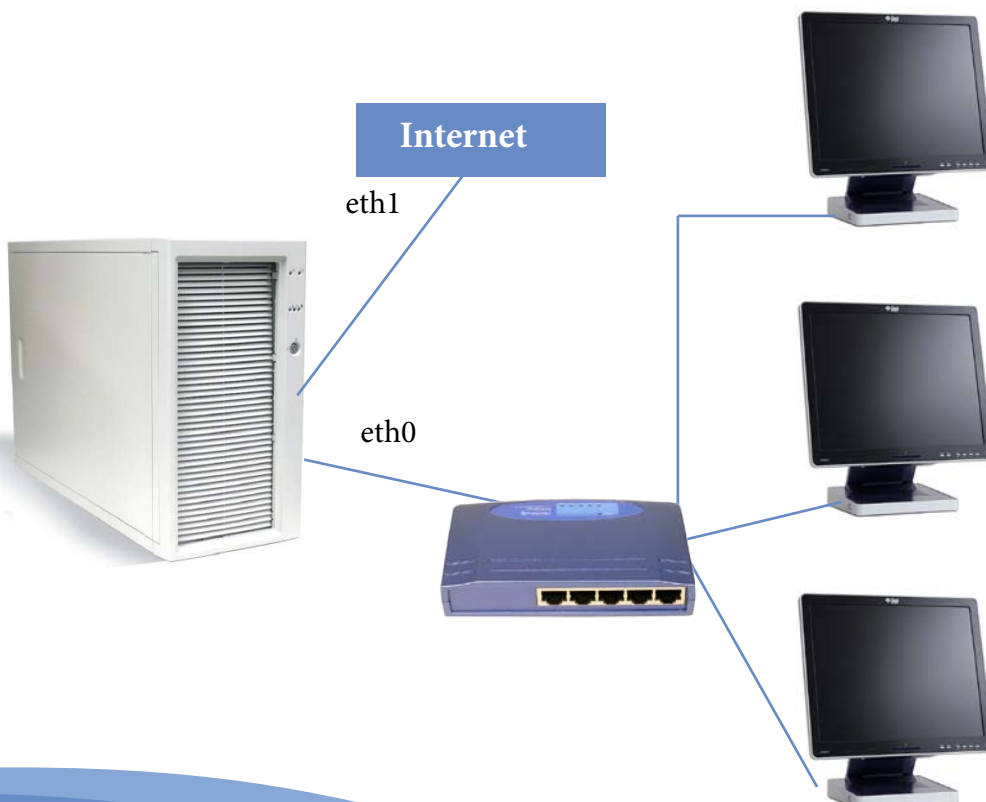
It becomes obvious that, eth0 connects to a switch (preferably 100Mbps or better). All the clients connect to this switch as well.

Even though it is possible to use just one LAN card, it is advisable to use at least 2. Most server motherboards come equipped with two LAN cards. Custom-built servers with standard components can include as many LAN cards as possible, since they are quite inexpensive.

Network settings

Actually no settings are required after installation- the clients will boot up quite happily! However, it is advisable that we change at least the 'lts.conf' file to better suit our hardware (see panel 'Hardware Flexibility' next page).

As the name suggests, K12LTSP is a complete Linux/Thin Client solution for education and is targeted not only towards seasoned IT personnel but to beginners and technology-aware educators as well. This allows networks with Thin Clients to be set even in places with no IT people around, and with only basic systems to work with. Needless to say, even though it doesn't include the tools found in systems like Solaris, K12LTSP is stable enough to be used effectively even in schools with large computer networks. We must admit that we are very impressed with the speed and the features of this solution.



Setting Up The Clients

Many would think that client setup can be quite trivial. That is not entirely true, since we can get the clients running in no time



In one of our schools we used Intel-based Thin Clients with TFT screens. All clients used the same hardware (Celeron 2.4GHz CPU, Intel i845 chipset). Since the server is already configured for these specs, any additional (similar) client only requires a cable connection to be up and running.

PXE Booting

Most motherboards developed by Intel that include a LAN card, give us the ability for PXE Boot. PXE is a protocol that allows the card to receive packages from a remote server through a local network. If we prefer to start our client through a CD-ROM or an internal hard drive, then we have to disable the PXE boot from the BIOS.

In most obsolete computers, we can either use a Boot Floppy (Boot or PXE Boot- <http://k12ltsp.org/clients.html>) or a LAN card with a BootROM. The most elegant solution is to use a LAN card with a PXE BootROM. These are available in the market and they are quite inexpensive (for a package of 32 100Mbps LAN cards with BootROM, the price was 6.5 Cyprus Pounds per card).

Hardware Flexibility

All Clients will boot into the main Log-in screen- no need to setup anything! However, to get the most out of your thin clients, it is a good idea to customize the way the server behaves. To do this, a system administrator must get his/her hands 'dirty', and make changes to at least two files: `lts.conf` and `dhcpd.conf`.

This way we can setup the sound card on the clients (necessary for sound support), as well as VGA support. We can also enable local floppy drive support and CD-ROM access.

Rays of the Sun: No protection required!

It is often said that the life-giving Sun is no longer our friend. The same cannot be said for our ultra-efficient, energy-friendly, noise-free SunRays



Turning on the Rays, with the Server already up and running, it takes less than 5 seconds to get into the login screen. This allows us to save on energy, even though each unit only consumes 45-63w maximum!

Connectivity

Each SunRay 170 features 4 USB slots (albeit, 10Mbps) for connecting Keyboard, mouse and peripherals (CD-ROM or USB stick). Also included are serial ports, as well as a VGA in and a VGA out port. These can come in handy when we want to use the client as an external monitor or for connecting it to an LCD Projector. The unit also features a built-in speaker, but we can also connect external speakers to the unit, thus improving the sound quality (depending on the speakers used).

Beauty Meets Power

The first thing somebody notices upon visiting E3 (fifth grade) in Dasoupolis Primary School, is the absence of noise- SunRays tend to be ultra-quiet. With no moving parts, this machine resembles nothing more than a 17 inch TFT monitor. By choosing an almost completely silent server, we ended up with a complete lab that is as quiet as a sleeping baby.

A slot on the front is used for a personal card, adding an extra level of security. Our students can use these cards to have access to their own accounts without typing their login name and password every time.

2D/3D Performance

Whereas with the LTSP server, we can set the correct drivers for the clients and get acceptable 2D (even 3D) performance, the same is not true for the SunRays. Unfortunately, we only get a basic 2D performance that degrades when the load rises on the network. This is because the SunRays use a very basic 2D driver. This is quite a serious issue for education, since most of our software simulations use animations to better show the effect under observation. We hope the next version of the SunRays includes at least basic 2D/3D acceleration, since this is a must for education (especially primary).

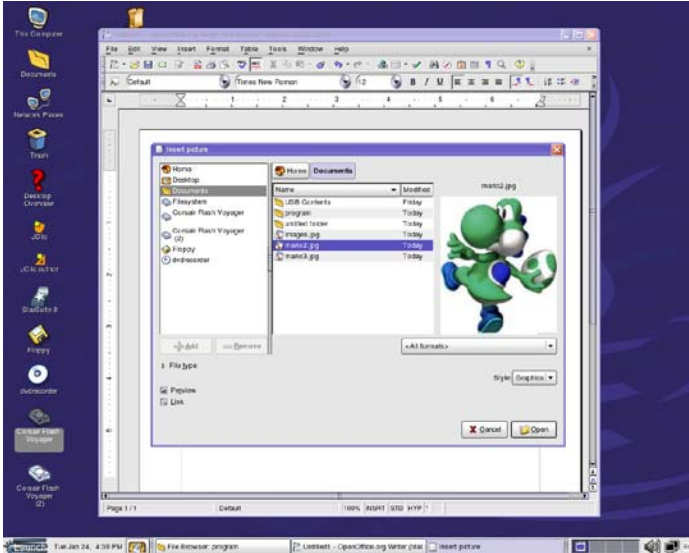
“Our main complain is the inadequate 2D speed of the system. 3D under the Rays is not even considered”



Another minor complain about the SunRays is the inability to turn the unit. This is quite useful when working with 2-3 students at the same time. The unit can be adjusted in height and in vertical viewing angle (the screen), but we could do with a rotating base of some sort.

Solaris 10, Sun Java Desktop 3, Nexenta...

After testing RedHat, SJD3 and Solaris, we believe that -at least for SRSS- the best solution is Solaris 10 for now. However, we have our sights on Nexenta, which looks quite promising.



Sun Java Desktop (as well as Solaris 10) are completely themeable. The screenshot on the left shows SJD 3 with the Gartoon Theme installed. Please notice the Save/Open window- we have used resources from the Fedora Core 4/OpenOffice package to enhance the behavior of StarOffice.

SunRay Server Software

SunRays work over the network using SunRay Server Software (SRSS). Up to a few years ago, SRSS was tied to Solaris 10 and SPARC processors. In a daring (and smart) move, Sun ported its technology to Intel (and AMD) platform, allowing SunRays to run under most distros available today. However, our experience (at least with Greek support) shows that SunRays tend to prefer their Solaris 10 OS over others, including Sun Java Desktop release 3 and RedHat.

A different Gnome

The latest versions of both Solaris 10 and SJD 3 come with Gnome 2.8. However, this is not quite the same Gnome environment you see in other distributions. Sun has obviously tampered

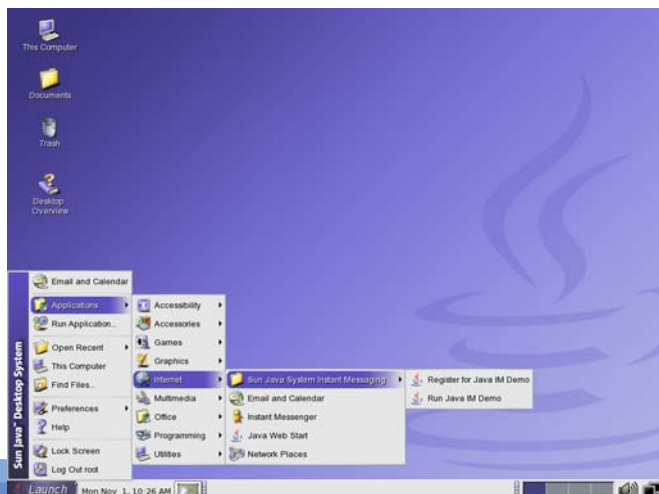
with it, bringing some enhanced flexibility to it. For example, we can easily make changes to all the menu items under the 'Launch' menu. This is a feature found under Gnome 2.12 (even though there we have a more elegant 'Edit Menu' screen).

Solaris Vs SJD

Even though they both use the same Gnome environment, the tools available under Solaris 10 give it an edge for managing the network and new connections. This should not pose a challenge to hardened system administrators, but since we are educators we prefer to focus on what is available right out of the box. For example, it is far easier under Solaris 10 to setup accounts for large groups of students than under SJD. On the other hand, installing and running new software under SJD (based on SUSE) was quite easier.

The Future..

For our SunRays we decided to move to Solaris 10. Either way, OpenSolaris is now OpenSource, and we get to examine yet another OS. Nexenta is a very promising project as it tries to tie together the best of both worlds: the SunOS and the Debian packages. As soon as Nexenta gets into Beta, we shall test it with our SunRays.



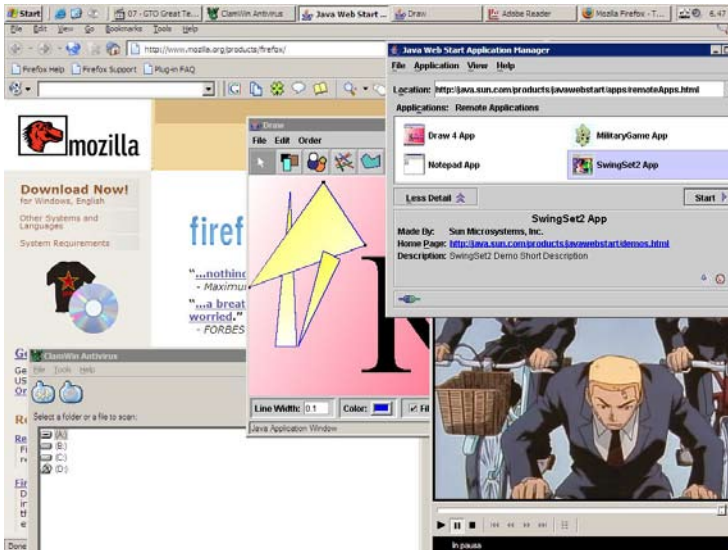
SunOS/Debian

Sun Java Desktop is based on SUSE. For various reasons, Sun is moving away from SJD and instead remains focused on both Solaris 10 and OpenSolaris.

Nexenta is a bold step to integrate SunOS with Debian technologies. The fruits of this initiative can be experienced with the Alpha version of Nexenta that can be downloaded from: www.gnusoSolaris.org

Windows XP embedded

Microsoft is trying to grab the market on embedded Operating Systems. Along with its Windows Terminal Services, Microsoft has a viable alternative to Linux/Solaris Thin Clients.



Like it or not, Microsoft is a major player in the OS scene. Their rising market share in the server world allows them to pose a serious threat to Solaris/Linux thin client solutions.

Microsoft Windows Terminal Server 2003

We are not ashamed to admit that we have used the trial version of Windows 2003 Terminal Server on occasion. Even through our SunRays, it makes sense occasionally to use Windows software directly from the source. However, the true potential of Windows 2003 Terminal Server is with its own Thin Clients.

It is not within the scope of this document to cover the details of either Windows Terminal Services or how a Thin Client connects to it. However, there are a number of dedicated thin clients in the market that are built especially for that specific environment.

Windows XP embedded

Most major companies who deal with Thin Clients are not ignoring the Microsoft giant. Using either Windows CE or Windows XP embedded, these clients offer a basic functionality even when the server is down. Windows XP embedded is based (as the name sug-

gests) on the look and feel as well as core technologies of the professional OS we find on most desktops. By providing the user with a familiar look and feel, as well as basic applications and functionality, a Thin Client can perform basic tasks that might appear to be quite adequate, at least in the short term, when a server is down.

Typical systems come with the familiar look and feel of Windows, accompanied with a basic Media Player, a web browser, as well as some utilities and simple applications. As this is a proprietary operating system, vendors don't have much saying on the customization of it. Plus, the licencing cost is transferred to the end user directly, since Windows XPe does not come cheap or free.

At the end of the day, users of both Linux or Windows XPe can work equally productively, depending on what their aim or task is. Windows XPe is a robust product, and it makes sense in environments where users don't want or can't be retrained to use a different type of system.



The Ultimate Thin Client?

Ever since Larry Ellison was rumored to buy Apple and replace Macs with internet appliances, speculation has been wild about a possible Mac-based Thin Client. Is there a 'just in case' scenario?



A year ago, Steve Jobs did the unthinkable: he announces that Apple was moving away from IBM PowerPC and made friends with Intel Pentium CPUs. What shocked people the most was the fact that MacOS X, based on MacOS and NeXTSTEP, was been developed since the beginning in a 'just in case' scenario (to quote Steve Jobs).

'i' is for Internet

During the mid 90s, Apple was in serious trouble. The market share was shrinking, Michael Spindler, then Apple's CEO, was on the go, MacOS 8 was proving to be a disastrous project eating away resources, and Microsoft Windows had started capturing core Mac markets. Rumors called of Larry Ellison of Oracle moving in to

“Was the original Bondi Blue iMac originally planned to be a network appliance instead of a fat client?”

purchase Apple and replace all Macs with Internet Appliances. In the end, Dr. Gilbert Amelio reorganised Apple and brought Steve Jobs back, only to be kicked out of the company and be replaced with the 'iCEO', a title given to Steve Jobs while he served as Apple's interim CEO.

The original iMac (Bondi Blue) was the machine that really brought Apple back from disaster (along with the launch of the PowerPC G3 Processor). The 'i' in the iMac stood for 'internet'. However, was it included in the name just to show the exceptional ease with which it could connect and browse the internet, or did it start as a project according to Ellison's original idea for a network appliance?

The Educational Ground

Apple has always had a strong foothold in the educational market. In the past few years we have seen Apple making strides into markets it had never had even a single product for years. The Apple XServer range has been proving to be accepted, while offering a dedicated version of MacOS X, named MacOS X Server. The three products that have made it into the educational world in the past few years are the iBooks (with some counties in the US initiating projects of one laptop per child), the eMac and the iMac in the various forms it has taken since the official unveiling of the original model 8 years ago.

All is not rosy for Apple, however. DELL has replaced Apple as the number one supplier of edu-

cational computers for schools. The iBook has been a success in some counties, but at the same time Apple has seen other similar projects been cut down by Mac-unfriendly officials. The iMac is an undisputed champion with strong features, however it is too expensive -even after heavy discounts- to be accepted en mass in most public schools.

The Times are A-Changin'?

Apple made the bold move to Intel. Is the time right for Apple to make another bold move and reclaim the educational market? We examine a possible option (next page).

The Software

K12OS is hardly the only choice regarding Linux and Thin Clients. Even though we use K12OS (www.k12os.org) others might find alternatives like Edubuntu more appealing (www.edubuntu.org) The beauty of OSS is that you can customise it the way it is meant to work. LTSP can be installed on (almost) all major Linux distributions. (www.ltsp.org)

The Apple Thin Client

Imagine an iMac with no hard drive and no DVD. Now, use an embedded version of MacOS X plus an XServer. Couple that with the most user-friendly Unix OS in the market and you have a killer Client



It is no secret that Steve Jobs offered MacOS X as the main OS for the \$100 laptop M.I.T. is developing. How could he offer such a system for a laptop that runs its OS from a flash memory space of under 1GB and in just a short time -it is shipping end of 2006- unless Steve has a special embedded version of the OS ready? Is this just another 'just in case' scenario?

The Best of Both Worlds

Thin clients make a lot of sense for education. They are easy to use and maintenance is a breeze. Plus, in order to upgrade the entire network, all you have to do -in most cases- is upgrade the server.

Apple has lost considerable marketshare to its Windows competitors. With its move to the Intel platform, and the support of Windows applications natively, either through an official Virtual PC or through WINE (it has been already announced), Apple can bridge the gap of compatibility. But, a killer machine to replace the educational eMac might be in the face of a dedicated Apple Thin Client.

Such a client could run off MacOS X Server. It is already a tried-and-tested OS, especially designed for handling multimedia tasks with great ease. Apple has already demonstrated, time

and again, the video streaming capabilities of both the OS Server system and its QuickTime technology. This experience alone could be quite beneficial since education makes good use of digital video, a weak point for most -if not all- Thin Clients.

Because MacOS X, by nature, is a BSD-based OS, it is much more stable and virus-free platform. These are some of the strongest selling points of Linux and Solaris, covering the Thin Client/Educational market.

The Software Edge

Apple has made sure that Macs are equipped with the best possible consumer software around. iLife comes standard with every iMac and Mac Mini and includes such software as iMovie (video editing), iDVD (DVD creation), iTunes (music playback and more), iWeb (flexible web design) and GarageBand (music creation). iWork is also a promising product, offering an alternative to both Word (Pages 2) and PowerPoint (Keynote 3). For those used to Microsoft products, there is a Mac version of MS Office. Of course, there is also the OpenOffice suite along with other third-party suites.

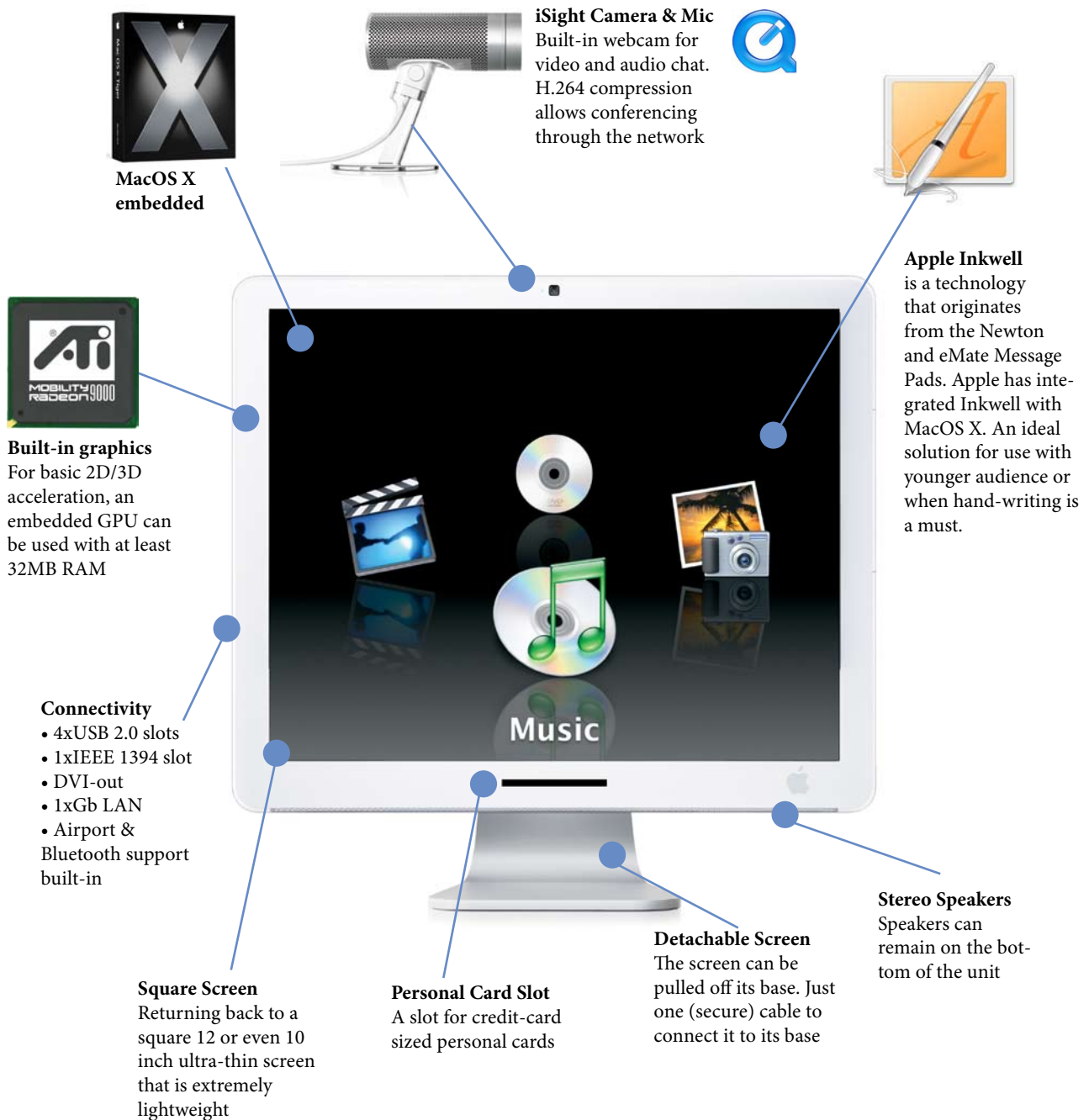
What makes a Mac-based thin client the perfect choice for education is the close ties between hardware and software. QuickTime is a tremendous technology that will never be ported to the Linux platform. Also, some third-party proprietary technologies are supported under MacOS X, like the Shockwave plug-in.

But who would such a move threaten? Microsoft? Probably not. But it would sure give Apple another great boost in the Educational market. And it could cause a headache to Sun Microsystems for sure.

“Steve Jobs offered us MacOS X for our laptop but we refused- we needed a completely OpenSource OS”
--Seymour Papert, One Laptop Per Child

An imaginary model: The MacPod

Based on the present Apple technology, we put together several already available parts of MacOS/ iMac to deliver the ultimate Thin Client- please note, this is mere speculation.



The Technology to Handle IT?

Apple really does have the technology to go with such a concept. It seems as if Steve Jobs already has a version of MacOS X to be used in an embedded environment. Things will become clear in the next year.



All the ingredients to create a 'killer' thin client are already at the disposal of Apple. The question is: should they do it? Or should they invest in a more efficient Intel Mac for education or a (much-rumored) hybrid between an iBook and a tablet-PC?

Wireless is the name

Going completely wireless is an ideal situation for the educational world. Without wires, children can use computers everywhere. With the energy-efficiency of computers using Flash-stored operating systems and software (and no removable devices or hard drives), a laptop can go on working for longer periods than what we are used too. But, a laptop is not always the ideal solution.

A thin client might not be as portable as a laptop or tablet PC. However, it would have several advantages over the laptop. First of all, applications could run from a central server through the network. This will allow almost all types of applications to be installed on the server, thus giving access to almost everything ever released for this specific platform. Performance could increase with a server upgrade, similarly to what we experience today with normal Thin Clients. And with an embedded OS, even when the server is down we can still work with a basic OS and



some embedded applications (ie special versions of AppleWorks or iWork, Safari browser etc).

Detachable Monitor

A detachable monitor (connecting to the main base through a secure cable that houses power for the unit) would make sense. Without a hard drive or DVD drive, this could be made as thin as possible, allowing the complete placement of the unit everywhere. This should make it easier for children to move the screen any angle they prefer to write on the surface using a stylus.

Making it light-weight enough should not be a problem. After all, just a look at the iPod and iPod nano should convince us that this company has both the technology and the know-how to deliver such a thing.

The Server Technology

The XServer line of Apple Servers are already well established in the market. They have been applauded for their ease of use and maintenance. MacOS X Server is a very stable server operating system and can easily accommodate Terminal Services.

Their engineers working with QuickTime streaming should also have enough experience to ensure that their clients have the edge on multimedia content playback using QuickTime and its codecs.

Conclusion

These are just speculations. The only certainty is that Apple is cooking something. They have not announced an iBook or a new consumer model to replace eMac. This is not a sign that they are abandoning the educational market, but rather an attempt to bring out a new revolutionary product. And Dell is the main target here...



XServer & MacOS X Server

A bundle that has proven its worth in the past few years. Can possibly run a network of several Apple Thin Clients with enhanced multimedia support.

Editor's Notes

Research has shown that more than 10% of our students (in Cyprus) are plagued with serious learning difficulties that stem from an inefficient and aging educational system.



Being an educator is a very serious profession. Thousands of families every trust trust us with their children. What we realise, at the end of the day, is that, regardless of how much effort we put, there is just so much that an educator can do to help children with learning problems.

Not Experimenting... But!

Many educators believe that, if a method 'works' then they should not change it. After all, as the saying goes, 'if it isn't broken don't fix it'. But how exactly do we measure success? Is success something we can achieve by keeping our students performing within the boundaries set by us or by the Ministry? When we have children left behind (to quote on G.W. Bush's Educational Act), how can we talk about success in our methods? Maybe it is time we took some more drastic measures and try countering the problem.

The Parent Factor

Sadly, in many cases, the family poses an extremely negative factor in a child's progress. Unfortunately, we can do from little to nothing to change the family environment. What we can do, however, is make sure that every single moment a child stays at school, he/she receives the best possible care and support. Support does not come easy in most cases. Every single child in the classroom demands his/her teacher attention (and rightly so), leaving less and less time to actually work with the (usually) small minority of children that are either left behind or are too advanced for what they are expected to cope with.

Proper Use of Technology

The word 'proper' is the correct term here. I have

participated time and again in endless debates on how and why should technology be implemented in education. A thorough bibliographic search even brings up contradicting information on the 'ifs' and 'hows' of IT.

Ministry Works

Sadly, even though the Ministry of Education has a small core of dedicated and very productive educators creating strategies and content, they alone are plagued with bureaucratic responsibilities that seriously hinder their -otherwise great- work. As such, even though the Ministry could, it will not be able to create content, at least not in the next few years.

apoplous misconceptions?

We are not to say that we 'get it'. Far from it. What we do have, is first-hand experience on the only classrooms to ever have a truly integrated lab. What first started in 2002 with 1 client for every 4 children is now turning into a fully-digital experience.

Of course, critics are always at the Gates and we thank God for that- otherwise we might become obnoxious and short sighted. We are always open for well-meant criticism. Which brings to mind an old Dave Mustaine song:

"If there's a new way, Ill be the first in line- so it better work this time!"

Again, Possibilities are endless!

- Alexandros Kofteros
B.A. Education
Post-Graduate student, Univercity of Cyprus,
Curriculum Content Development

For all your comments please feel free to email me alexandros@apoplous.org

If you found this newsletter interesting please forward it to other people. Thanks!