

Thin Computing Proposal - 2009

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Detailed Project Description:

This proposal represents a pragmatic first step toward improving the energy efficiency of campus computing by using a combination of thin client hardware and infrastructure, energy conservation software for traditional computer labs, and sharing these resources across administrative entities (Swanlund and FAA) to provide the campus with a view of the next phase in our computing infrastructure. It builds on previous pilot studies in FAA and Swanlund (also funded by the SSC) on the issues surrounding thin client use for administrative tasks. This proposal uses those critical experiences to both increase the number and the range and depth of the user group. This work will directly affect campus-wide computing processes; lessons learned will lead directly to a more redundant and scalable campus-wide Windows Terminal Server environment.

Building on the past successes with a thin client pilot in the Fall '08 (SSC grant supported the purchase of 24 Chip PC thin clients), Swanlund, the College of Fine and Applied Arts (FAA), Webstore, CITES and other campus departments to scale up the effort in order to make thin clients available to a wider campus audience (with the SSC monies and CDW/ChipPC bulk purchasing discounts already applied).

Our logic for this scale up follows. A new desktop computer (Dell Vostro) can be had for as little as \$260, and the last job for old, slow, power hungry computers is typically e-mail and self-service kiosks (essentially free in up-front costs, but consume a lot of electricity ¹ as they typically run 24/7 since they're in public locations). It would be ideal to get the price-to-the-department (after discounts and grant) of thin client hardware to as low as possible to encourage adoption by making it cost-competitive with the Dell Vostro as well as compete with the "free" computers from surplus. The purchasing unit would be responsible for providing the keyboard/mouse and monitors but we would offer the lesser of \$200 or 50% of cost incentives for thin client purchases for at least 200 thin clients (with 100 of those vouched for by FAA.)

¹ A PC using 0.10 kilowatt-hours for one hour (100 watts,) run for 24 hours a day (2.4 kwh used per day) for one year uses 876 kwh. At 10-cents a kwh, that's \$87.60 to run the "free" computer from campus surplus as a kiosk for a year. Note that that University pays less than \$0.10 per kwh, but on the other side modern PC's use anywhere between 90-150 watts depending on how they're being used. Round numbers make the calculations easier to understand. Regardless, the payback period is within the 3 year warranty period for the device.

Re-using computers

Reusing existing computers does not actually require any additional funding, (campus already has computers in use and available at surplus.) We mention this here to address the potential e-waste created by computers replaced with thin clients. We believe that [Thinstation](#), [openThinClient](#) or similar software can be used in certain instances to re-purpose older computers utilizing network bootable software-based thin client solutions. Once properly setup and booting over the network, the internal hard drive, CD-ROM and possibly video card can be unplugged to reduce power consumption. Otherwise, this setup would work like a thin client, having the user log into a remote system and do all of their work there, with the intention of replacing the system with a real thin client when the hardware completely fails or when funding is available for the thin client purchase.

We will provide detailed, campus-specific instructions to setup and use traditional desktops to re-use existing/old computer hardware with the eventual goal of completely replacing the old computers with thin clients to save energy, although we realize that may not be possible in all cases.

Energy Management on existing Windows PCs

Since not all computers can be replaced with thin clients and some standard desktop computers will continue to be in use for the foreseeable future, FAA (Swanlund does not have any computer labs) wants software to better manage energy savings on these systems. The normal software controls available within Windows are not suited to a fully managed lab environment where a computer may be running software even if no user is actually logged into the system. The current built-in software/hardware power management on Windows PCs require certain computers to be on all the time to have them not go into power save modes when long running jobs are being performed in the background, such as is the case while rendering output for FAA students in the college labs. The Verdiem Surveyor software allows very fine grained control of power management on such systems such as only going into power save modes when specific software programs are not running, which is exactly what is needed in this case. Seeing as these systems are left on 24/7 currently, there is great potential for saving energy.

Thin Clients

Thin clients work by providing just an output (display) and input (keyboard and mouse) interface to a user session running on a server elsewhere. The Chip PC thin clients we are currently using (Xtreme PC 6500NG and 6600NG devices from Chip PC Technologies) reduce power consumption as much as 95% over a traditional desktop computer and can significantly reduce energy costs for campus. Thin clients also typically have no moving parts and due to being just a client to a larger server elsewhere, have a longer life span than a typical desktop computer, estimated to be around 10 years instead of the typical 3-4 years of a traditional desktop. The model tested last year is no longer available for purchase, but has been replaced with a similar model, the 7500NG. This new model provides updated functionality in the same power envelope as the older 6500NG. There are also some newer model thin clients that might be useful for specific purposes and also integrate into the existing infrastructure.

We would like to make thin clients available at a reduced cost for other units in addition to about half of the grant (100 units) going to the College of Fine and Applied Arts (FAA.) FAA has had several users using thin clients that Swanlund has loaned them from the previous project and would like to expand to around 100 users on thin clients, as per the original intention of the previous year's ChipPC proposal.

We would literally swap out a desktop computer and directly connect a thin client in its place. The computer would use the same monitor, keyboard, mouse and speakers whenever possible, or new ones (purchased at the department's expense) where required.

FAA sees that using the same brand of thin clients that Swanlund has previously purchased in order to further reduce costs by utilizing existing campus infrastructure as specified below. While there is no official policy yet from CITES on campus recommendations on thin clients, we will work on coming up with some vendors with devices that function in the campus environment and use the previously setup infrastructure to encourage buy in with Chip PC whenever possible.

Thin Computing infrastructure

We've been working with CITES to setup and maintain virtual machines to provide at least the initial needed infrastructure for thin clients. The Chip PC Xcalibur Global management server (CITES-XCALIBUR) has been successfully running on a VMWare virtual machine hosted at the CITES data center for many months. We saved money as well as electricity & reduced e-waste by not purchasing a physical server for this last year. We are aware that increased usage means the service might need to be moved to a larger server in the near future and we will make plans to do so when justified.

We are also working with CITES on setting up an actual redundant and scalable campus-wide Windows Terminal Server environment. As imagined, this is a rather time consuming process and it will take several months to get this ready for end users and implement a cost recovery plan for long-term usage with the possibility of the CITES Webstore managing the day to day operations of such a service.

Budget & Fund Raising:

Detailed budget

Since these devices would be replacing normal desktop computers, the costs associated with their maintenance and upkeep are at most the same as the normal desktops and no funding is required beyond the initial hardware / license purchase. In fact, it is hoped that thin clients will reduce IT support costs after the initial costs of learning how to maintain this new technology. The units utilizing the technologies can also help maintain the centralized servers where ever possible and cover at times when those named in this proposal are not available.

Fund Raising

Thin Client costs

cost	QTY	description	subtotal
\$250	200	Chip PC Xtreme PC 6500NG	\$50000
\$33	200	XG client license	\$6600
\$41	200	XG domain authenticator	\$8200
\$9	200	Customized Screen Saver	\$1800
\$6	200	USB power cable	\$1200
\$17.03	200	Terminal Server CALs	\$3406

Total cost: \$71206

Verdiem software costs

cost	QTY	description	subtotal
\$13.00	334	Verdiem Surveyor software	\$4329
\$1.95	334	Verdiem 1yr maintenance (required)	\$651.30

Total cost: \$4993.30

CITES virtual machines

CITES virtual machine costs are detailed on the CITES web page at:
<http://www.cites.illinois.edu/vmware/>

The exact costs will be determined by user load on the systems during the course of the project but will be in excess of remaining **\$5000** that we are requesting to help cover some of CITES costs. CITES has graciously donated the virtual machines in use for this project so far.

Requested funding

Thin Clients - \$40,000

We request **\$40,000** for partial funding of thin client devices, licenses, and associated Terminal Server client access licenses (CALs) at a rate of up to \$200 or 50% of cost, whichever is lower, for each thin client purchased. Depending upon the actual model purchased, some people will get the whole \$200 discount (higher-end Xtreme PC 6600 device, dual-monitor support) and some would not (lower cost Plug PC devices, single monitor support.) This would fund at least 200 thin clients at the \$200 rate and since certain models are less expensive, we are hoping for more than 200 to be available at discounted rates for campus units.

As this just covers part of the costs, we will seek additional funding directly from the various campus units where these thin clients would be installed as they are allocating money for replacement computer hardware. This previous project proved that the technology works and it is in use today.

Verdiem software - \$5000

We are requesting **\$5000** to purchase the Verdiem energy management software (enough for 334 desktop computers) for FAA. There is no enterprise or site-license offered by the company, but we will work towards sharing a single management server for multiple campus departments instead of having each group setup their own Verdiem server. FAA will also continue to monitor this software during the grant period and see if our initial estimates work out and justify its initial expense. Several licenses can be loaned to other departments for initial testing in their own environments as well to determine if those departments should also purchase the software.

FAA will contribute the needed staff time and initial server for testing the Verdiem software in their lab environment and hopefully be able to provide some data on cost savings by the end of the year, with the hopes of a recommended campus solution for those with similar energy management needs where the built-in solutions do not function well.

CITES virtual machines - \$5000

We have cost estimates from CITES for the four virtual machines that we are currently running in support of this proposal. The total is over \$5000 and that does not include all the years of use and of course these virtual machines will need to keep running year after year to support users. We are asking for just **\$5000** to help repay some of CITES's investments to host these virtual machines until a more long-term cost-recovery pricing structure can be determined (which is one of things we intend to do with this proposal.)

Time-line

Thin Clients

Once funding is approved, we can order, test, and deploy thin clients to willing participants as soon as we can get in a shipment and get the needed Terminal Server infrastructure configured. There is no real set time when devices need to be deployed, as replacing single desktops at a time as well as entire computer labs is possible. (Obviously computer labs may need to wait until classes are out though.) Requests from other departments will be handled on a case by case basis and we hope to enlist the help of the Webstore for order processing for non FAA departments.

However, we're aware that certain key infrastructure components are not yet in place and we will work with other units, including CITES, to create and maintain the needed infrastructure to host thin clients with a Windows Terminal Server back-end as soon as possible.

Verdiem software

FAA has already tested and is ready to deploy the Verdiem software as soon as staffing time and computer usage permits. (This might need to wait until computers are less used, possibly between semesters in August or December.)

CITES virtual machines

We've been in contact with CITES and four test virtual machines are already up and running. The Chip PC Xcalibur Global management software has been up and running since our last proposal in 2008 and we have 3 additional virtual machines for actually testing and managing the Windows Terminal Server environment itself. So the initial virtual machines that we need for initial testing of the campus-wide Windows Terminal Server service are already up and running and we will continue to prepare the environment as time permits.

Energy, Environmental, Social and Economic Impact

Energy Efficiency

For the thin client devices, we've already outlined energy savings in last year's proposal: http://sustainability.illinois.edu/ssc/downloads/projects/2008/chippc/ChipPC_ThinClient.pdf

By our previous rough estimate of costs over \$80 per year for electricity single a single desktop on 24/7, spending \$15 per computer on the Verdiem software to save more than that in energy costs seems very reasonable. Even if electricity is really cheaper and we can only use power saving modes one third of the time, it is still cost effective to spend \$15 to save \$20, especially since we can keep running the software for several years. (There is an additional per-year cost for the software however, but that is not covered for future years by this proposal.) In initial testing there was over 50% power savings, but of course that depends on real-world usage patterns of the computers.

While newer operating systems such as Windows 7 have better power management, the current University financial situation means that many departments cannot afford even \$50 (and it will cost more than that) to upgrade to them plus new versions of software that will also need to be purchased and staff time to perform the upgrades. It is very likely that Windows XP will remain the common desktop computing platform on campus for at least the next few years, making \$15 a reasonable cost to use what we have now more efficiently. Besides, Windows 7 probably still does not solve the problem of the background task needing to run while no user is logged on.

Environmental Impact

For the thin client devices and infrastructure, we've already outlined details in last year's proposal: http://sustainability.illinois.edu/ssc/downloads/projects/2008/chippc/ChipPC_ThinClient.pdf

Obviously replacing desktops with thin clients leaves the old desktop around as e-waste. We are addressing this by providing help for units without the ability to purchase new thin clients to turn their existing (or computers from surplus) by trimming it down as addressed elsewhere in this proposal. While not saving as much power as a true thin client, using an existing computer as a diskless remote client allows end-users to have the same thin computing experience, prepares them for an eventual move to real thin clients when additional funding is available, still saves some power where possible and saves lots of IT Professional computer support time.

A pure software solution is very efficient as it extends the life of existing computer equipment and saves energy in the process. Please ask if the committee would like exact numbers, but I think it follows that if just installing software can reduce emissions from electricity production it has positive environmental impact.

Social Impact

For the thin client devices and infrastructure, we've already outlined details in last year's proposal: http://sustainability.illinois.edu/ssc/downloads/projects/2008/chippc/ChipPC_ThinClient.pdf

At some level the Verdiem software will reduce awareness of saving energy as the computer system administrator will manage all of the settings for the user instead of needing the user to be aware of their own energy usage and carbon footprint. However, the additional savings from an automated computer program that never forgets to shutdown a computer are very beneficial and outweigh this risk.

Economic Impact

In addition to being priced at 1/2 to 1/4 the cost of a traditional business class desktop computer (such as a Dell Optiplex,) the electric power savings alone (ignoring the management server cost) pays for the devices over their estimated lifespan. And this is a low estimate as most computer are always left on.

Verdiem will save on electric costs and allow re-use of existing computers thus reducing e-waste and providing better value to purchased computers.

Outreach and Education

Thin Clients

OAR (4), FinAid (6) and Siebel (2) have thin client kiosks setup in their lobbies that are used by many students. These kiosks have high visibility and combined with addition new locations, possibly including ARC and the Illini Union, more and more places on campus will have thin clients visible to students. We have added informational links to websites on the thin clients themselves as well as put up information saying how these devices save energy.

As more and more units throughout campus see the benefits of thin computing, more and more locations will use the technology and students throughout campus will realize the benefits of thin computing. Entire classroom labs and staff offices could be replaced with thin clients, although there is a significant need to prove that the technology can work before large numbers of labs can be completely converted. Students are welcome to stop in and use the thin clients at various public places. We arranged to have the email kiosks setup in Siebel Center and we think that a similar setup can be used to replace all of the email kiosks in the Illini Union, provided the additional 50% funding can be secured.

Verdiem software

We will help other campus units deploy Verdiem software when our help is requested. Unfortunately there is no enterprise or site licensing so possible cost reductions do not seem possible at this point in time. There is hope that a single server can manage the software for all of campus and we will work with that goal in mind.