



COST-BENEFIT STUDY
PowerMAX Zero Client
Solution for Education
20 Workstations
Useful Multiplatform &
Atrust m320 Zero Clients

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OVERVIEW

The following proposal will outline a low-cost, easy to deploy, manage and secure solution that meets all business computing needs using Virtual Desktop Infrastructure (VDI) with zero client devices. This proposal will include hardware, software and licenses to implement twenty (20) workstations that will be able to run the day-to-day applications, such as Microsoft Office, Google Chrome, Peachtree, etc. The workstations (clients) will be outfitted with Atrust m320 Zero Client devices which will access virtual machines (VM) over a standard network infrastructure to deliver a Windows 7 Pro desktop for the end-user to use. .

Features

- **Low initial cost:** Up to 60% less than traditional implementation. When you're ready, you only need to upgrade the host computer/server.
- **Supports up to 30 simultaneous users:** Each users with their own desktop.
- **High energy efficiency:** Up to 90% less on energy cost compared to traditional implementation.
- **Host computer/server redundancy:** Real-time hard drive mirroring of host server
- **Centralized management and maintenance:** System administrator manages all aspects of administration directly from the host computers.
- **Multiple options for End-user operating systems:** You can choose between Windows 7, Windows 8 or any Linux Distro or any combination.
- **Uninterruptable Power Supply system:** automatic switching to battery power supply should there be any power lost or low voltage.
- **Low maintenance cost and environmental heating:** As there are no moving parts, the zero client devices produces no heat and less likely to breakdown due to wear and tear over time.
- **Classroom Manager:** The Useful Classroom Manager tool is a software that integrates teachers and students in a learning system. The teacher can command the students' computers connected to your classroom, defining how students develop their activities.



SPECIFICATIONS *Hardware Overview*



Atrust M320 Zero Client

Atrust m320 is a zero client designed as an endpoint of a shared resource system, such as a MultiPoint Server or Useful Multiplatform system. The solution enables a host server to power multiple and independent stations. Each station only consists of one station hub (zero client) with a keyboard, mouse, and monitor connected, allowing multiple users to

share the computing power of one single server. Simply through an Ethernet connection, the server provides each station user with a familiar and independent Windows experience.

Atrust m320 Zero Client Benefit	
Low total cost of ownership (TCO)	Additional computing access is as simple as adding more I/O devices. The total cost of ownership is then drastically reduced.
Slim and quiet design	m320 is feather light weighing only 158g (approximate). The slim design allows it to be mounted to the back of a monitor with a VESA mount. Together with its fanless design, m320 helps create a simple and noiseless workplace environment.
LAN-based connection	m320 connects to the host server with an Ethernet cable. This connection type exceeds the length limit of a USB connection and provides more flexibility in the layout of a MultiPoint Server system.
Simple plug and play setup	Just attach a keyboard, mouse, and monitor to your m320, and then connect it to the host server. A station is set up easily and ready for use right away.
Easy management and maintenance	Since all computing tasks are performed on a server, all hardware and software issues are gone on the client side. All user management, software installations, system management, and upgrades are done on a single server.



- 1. Power LED:** Indicates the status of electricity supply.
- 2. Microphone Port:** Connects to a microphone or a digital musical instrument such as a MIDI keyboard
- 3. Headphone Port:** Connects to a headphone or a speaker system.
- 4. USB Port:** Connects to a USB device.
- 5. DC IN:** Connects to an AC adaptor.

- 6. Power Switch:** Press to turn on/off the client.
- 7. LAN Port:** Connects to a host server or Gigabit switch.
- 8. USB Port:** Connects to a mouse.
- 9. USB Port:** Connects to a keyboard.
- 10. VGA Port:** Connects to a monitor.
- 11. Kensington Lock Slot:** Secure the device with a Kensington Lock or similar locking systems with a security cable.

SPECIFICATIONS *Hardware Overview*



Atrust st110A Server

Atrust st110A is an Intel Ivy Bridge platform tower server that designed to meet the needs of many IT environments with comprehensive enterprise-class manageability. With stable-enhanced ECC memory support, rich I/O interfaces, easy accessibility of varied storage media, st110A is reliable, multipurpose, and especially suitable for small and medium enterprises. It is also designed as a key element of Microsoft MultiPoint server or Useful Multiplatform solution and best choice for client/server computing and remote desktop capable environment.



For this implementation, five (5) host computers will be deployed that will host twenty (20) workstations (zero clients) each.

Atrust st110A Server Specifications

Brand & Model	Artust st110A Server	
Processors (2x CPUs)	Intel® Xeon® E3-1245v2 3.40GHz, 8M Cache, 5GT/s DMI, Quad-Cores, 77W	
Chipset	Intel C216	
Memory	16GB (2x8GB) Unbuffered ECC DDR3, 1600MHz	
Graphics	Integrated in main chipset	
Storage Controller	Onboard RAID 0, 1, 5	
Storage	1TB 7200RPM SATA Drive, 3½"	
Optical Storage	24x DVD RW	
Networking	On-Board Dual 10/100/1000 Mb Ports	
Slots	1x low-profile PCIe x16 1x low-profile PCIe x4 1x low-profile PCIe x1	
I/O Ports	Front: 4x USB 2.0 for device connection 1x Microphone in 1x Headphone	Rear: 2x Gigabit LAN 1x Serial 2x USB 2.0 for keyboard & mouse 4x USB 3.0 for device connection 4x USB 2.0 for device connection 1x Audio out (Stereo) 1x Audio in 1x VGA
Power Supplies	250W, 100~240 VAC, 50~60Hz	
Form Factor	Tower Server	
Dimension	(w) 330mm x (h) 96mm x (d) 400mm	
Weight	8.35kg (approximate; 2x HDD & 1x DVD included)	

SPECIFICATIONS *Recommended Infrastructure Components*

This proposal will not outline hardware, software or deployment information and costs for the technologies outlined in this section. The information here is recommended for the optimal performance of centralized computing with zero clients.

	MINIMUM REQUIREMENTS	RECOMMENDED REQUIREMENTS
Network Cabling	Category 5e EIA/TIA 568B Specifications Tidy cabling work Proper cable management	Category 6 EIA/TIA 568B Specifications Tidy cabling work Proper cable management
Storage	Network Access Storage (NAS) 4TB (<i>depending on storage needs</i>) 7200RPM SATA Hard Drives	Network Access Storage (NAS) 8TB (<i>depending on storage needs</i>) 10000RPM SAS HDD or SATA SSD
Network Switch	10/100 RJ45 Ports with 2x Gigabit Uplink RJ45 Ports. Unmanaged	Gigabit RJ45 Ports with 2x Uplink SFP Ports Jumbo Frames, 9Kb at least Managed
Uninterrupted Power	2000VA for each host server & their 20 workstations Surge Protection	3000VA for each host server & their 20 workstations Surge Protection Volt Regulator Power Factor Correction

SPECIFICATIONS *Software & Licensing*



Power Many Displays, From Desktops to Digital Signs, with One Solution

Userful Multiplatform desktop virtualization software is the simplest solution to streamline and manage PC deployments to power many displays, from desktops to digital signs. Replacing the many physical computers traditionally needed to power many displays with low-cost, low-wattage zero client devices and a low-cost server appliance, Userful Multiplatform is the lowest cost VDI solution that makes it possible for any organization to afford. The most flexible virtual desktop solution, Userful Multiplatform software delivers a choice of customized Microsoft™ Windows, Linux and a free, integrated cloud desktop to multiple displays within a local area network, all managed from a browser. Userful Multiplatform software is half the cost of other desktop virtualization solutions and a fraction the cost of one computer per person.

Centralize all PCs, Operating Systems and Desktops

Efficiently centralize all stand-alone PCs, independent operating systems and desktops into a low-cost, server appliance. Set up is easy with plug and play simplicity, even with limited IT skills. The simplified approach to VDI in Userful Multiplatform software creates a visibly better performance than complex virtualization solutions that encode and decode data from a data center. Userful Multiplatform offers the high performance of a stand-alone PC that users expect with even the most demanding applications like playing multiple full HD videos.

Virtualize Multiple Operating Systems from One Server

Deploy one or many customized desktops to each desktop display, touch screen, digital sign, interactive whiteboard or large interactive display. Including Microsoft Windows, Linux and a free, integrated cloud desktop, ideal for organizations that rely on web apps like Google Drive, administrators can deploy a single solution to everyone or provide a simultaneous choice for users to switch between with a click. Only in-use Microsoft Windows desktops require a license, which saves on costly software licensing.

Power Many Types of Low-Cost Displays From desktops to digital signs, Userful Multiplatform is a single solution to power and manage many displays throughout an organization. Userful Multiplatform not only reduces the cost of desktops, it enables organizations to also afford low-cost touch monitors or TVs and turn them into self-serve kiosks and single or multi-panel digital signs. To enhance communication and collaboration in meeting and learning spaces, organizations can also add a SMART Board interactive whiteboard or SMART LightRaise interactive projector. The desktops and content are all easily customizable from the central server, including a basic digital signage player.

Centrally Manage from Any Device

Seamlessly manage the entire solution using a browser accessible control center from a desktop, tablet or smart phone, even with limited IT skills. Managing just one image on the server to instantly deploy new applications and updates to all desktops makes it easy to reduce IT management time and resources.

Note: Clicking the video images below will open up your default web browser and you will be taken to YouTube to watch the videos.

Say hello to Userful Multiplatform



Watch a software demonstration



Feature

Centralize Desktops	Centralize all PCs, operating systems and desktops into a low-cost, server appliance that replaces stand-alone physical PCs, independent operating systems and desktops.
Server Appliance	Using a local server appliance simplifies desktop virtualization and eliminates latency to create a visibly better performance than complex virtualization products that encode and decode data sent from a data center.
Virtualize Desktops	Deploy one or many customized desktops to each computer station, touch screen or large interactive display. Administrators can deploy a range of desktops, including a mix of Microsoft Windows, Linux and cloud-clients, or deploy the one desktop to everyone.
Welcome Screen	At each desktop, users can get started quickly by selecting from the range of desktops presented to them, and switch between them with a click.
Simplify PC Deployment	Setup a network of virtual desktops in just hours and easily maintain it with even limited IT skills. Scale deployments by adding additional servers.
Deliver Secure Access	Reduce security risks by working on a local server appliance inside the local area network instead of a data center or the cloud.
Ensure High Availability	Reliably provide high availability via fail-over redundancy from another server that can take over in the unlikely event that the original server is down.
Broadcast Alert	Send a message from the control center to all connected displays to instantly broadcast messages. Messages are distinguished by color and alert level ranging from green announcements to red emergency notices.
Virtual Microsoft Windows Machines	Create virtual Microsoft Windows XP, 7 or 8 machines once and map to any number of computers. Customers can use a cost effective Microsoft Windows Diskless COA licenses instead of VDA licenses.
Shared File Storage	Store and share content between multiple desktops by saving files to a shared folder on the host PC. Saved files can be downloaded through a simplified list in a web browser and saved on the desktop to edit locally.
Reduce Ongoing Costs	zero client devices have an extended lifespan since they have no moving parts that can fail and no local processing power. They consume only 3 watts of power compared to 120 watts of power per PC.
Cloud Transition	Shift to cloud apps by deploying any mix of cloud-client and Linux desktops plus Microsoft Windows desktops, as needed. Only the number of Microsoft Windows desktops in use at one time requires a license which saves on expensive software licensing.
System Operations	Centralizes all host PC administration, including check and install updates to review software updates that are available and monitor installation progress until complete or perform system diagnostics to check the summary overview of system health and instantly understand which updates and upgrades will improve overall performance.
SMART Board interactive whiteboard Integration	Enhance communication and collaboration by adding a SMART Board 600 or 800 interactive whiteboard or a SMART LightRaise 60wi interactive projector to the solution.
Touch Screen Support	Add a touch screen including PHiStek and other monitors. PowerMAX also carries PHiStek touch screen monitor brands.

Useful Multiplatform License *for Education*

LICENSES	DESCRIPTIONS	LICENSING MODEL
General	Userful Multiplatform Software License	Perpetual per seat
General Support	Userful Multiplatform Software support and updates subscription (<i>includes access to Automated Failover feature</i>).	Annual per seat
Academic	Userful Multiplatform Software License education	Perpetual per seat
Academic Support	Userful Multiplatform Software support and updates subscription for education (<i>includes access to Automated Failover feature</i>).	Annual per seat
v-Class	vClass is a classroom management add-on that allows teachers to use either PC to monitor & control their students' desktops.	Perpetual per seat
v-Class Support	vClass add-on support and updates subscription	Annual per seat

vClass Addon *Classroom Management*

vClass is a classroom management and educational content management tool that is compatible with Useful Multiplatform. This software allows teachers to monitor students' PCs in a classroom, exchange messages with students, and even "take over" student workstations for demonstrations. In addition, teachers can create and manage curriculum, including quizzes, displaying content and applications.

vClass has two components: vClass Student (*for the students*) and vClass Teacher (*for the teacher*). The teacher, through commands, can display their screen on the student computers, monitor student screens and relay it to others in the class, open and close applications, execute commands remotely, monitor internet usage, create conversation groups (chat), apply tests and exams in the classroom, control student access to classes, and also block access to the internet or computers in order to avoid distractions.

vClass is also available for Microsoft Windows.

Features

Student to teacher connection: The student connects to an available teacher in the school network and with the teacher authorization he can join the class. If he was previously accepted, teacher authorization is no longer needed.

Class Model management: The Class Model is basically a list of students. The teacher can manage these lists and if he locks the Class Model, the connected students cannot leave class until the teacher releases them.

Silence the student: The teacher can silence a student's computer by sending a command that blocks the mouse, keyboard and blanks the monitor with a specified message. Some of the other functions can also be executed with block, which means that the students won't be able to access their mouse and keyboard while the function is being executed, to avoid distractions.

Share screens: The teacher can display his screen in the students' computer screens, allowing, for example, to show a presentation, a website or an application. The teacher can also view all students' screen in a smaller size, or monitor them with or without taking control of the student's machine. He can also share one student's screen with the other students.

Internet access control: The teacher can apply created Internet policies in the student's machine. These policies can allow or restrict Internet sites. The block mechanism can filter domains by a white list, a black list and/or filter web pages by their content.

Execute remote commands: The teacher can open and close applications in the students' workstations, execute pre-defined commands or enter the desired command to run in the student's computer.

Apply tests: The teacher can elaborate tests, that may contain images, videos and sounds, and apply them in the student's computers. After completing the tests the students can send their answers to the teacher. Multiple choice questions are automatically evaluated by v-Class. After the conclusion of the test's correction, the teacher can make the results available for the students.

Text messages and Chat groups: Text messages can be exchanged between teacher and students. The teacher can also setup Chat Groups in class and monitor each group's conversation. Through the Chat Groups function, the students can also talk with each other in class.

File transfer: Teachers can send files to the students computers, and students can send files to the teacher after his/her approval.

View real time videos: Students and teachers can enjoy the cutting-edge technology watching videos transmitted from the teacher's computer in real time.

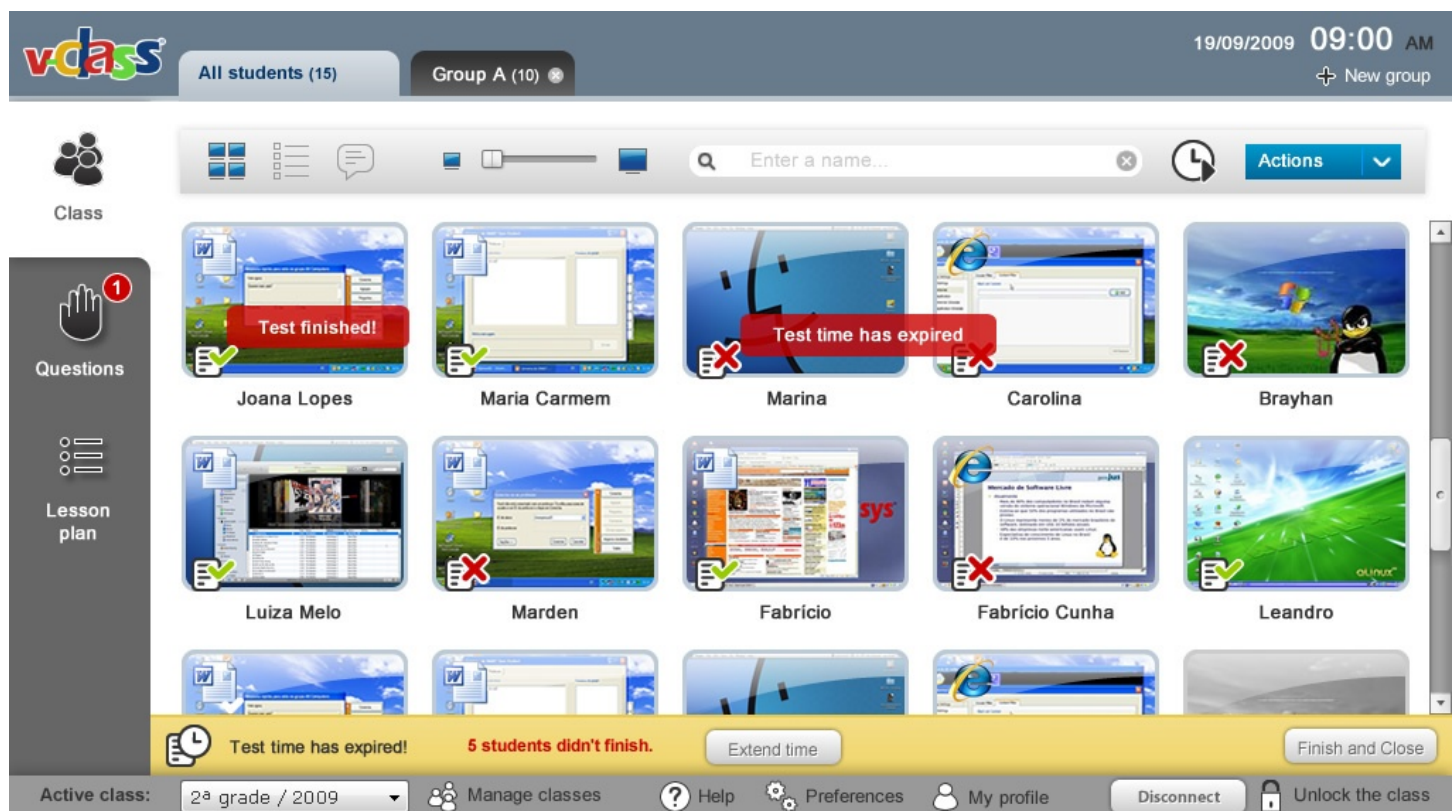
Test with multimedia content: Teachers can insert pictures, sounds and videos in tests and exercises.

Grade book: The teacher has a virtual grade book where he/she can write the student's scores obtained in tests and homework.

Check the wireless network: The teacher can easy check the network connection status, analyzing the network traffic of each student connected in his/her class.

Develop lesson plan: The teacher can create his/her classes in advance. He/she will define a timeline by entering the desired content in a sequence and the system runs automatically.

Select part of the screen: The teacher can zoom in and zoom out into part of his/her screen, emphasizing subjects that require students' attention.



The screenshot displays the vclass software interface. At the top, a status bar shows the date and time as 19/09/2009 09:00 AM, along with options for 'All students (15)' and 'Group A (10)'. A sidebar on the left contains icons for 'Class', 'Questions' (with a red notification bubble), and 'Lesson plan'. The main area shows a grid of 10 student computer monitors. Each monitor displays a desktop environment with a test window. The status of each student's test is indicated by a green checkmark (finished) or a red X (expired). The students listed are Joana Lopes, Maria Carmem, Marina, Carolina, Brayhan, Luiza Melo, Marden, Fabrício, Fabrício Cunha, and Leandro. A red banner across the middle of the grid reads 'Test time has expired'. At the bottom, a yellow bar contains a clock icon, the text 'Test time has expired!', a red notification '5 students didn't finish.', and buttons for 'Extend time' and 'Finish and Close'. The bottom status bar includes 'Active class: 2ª grade / 2009', 'Manage classes', 'Help', 'Preferences', 'My profile', 'Disconnect', and 'Unlock the class'.

Operating Systems: Linux *for the End-Users/Clients (recommended)*

Linux are Unix-like operating systems (OS) that are offered free of cost under the Free and Open Source Software licensing model. There are many different distributions (distro) of Linux – each a uniquely designed to they target users, from day-to-day users to computer geeks. Linux offers all, if not more that the popular Windows operating systems with greater security, greater speed and usability.

Like Windows, Linux offers software for any application you could need and most of which are also under the Free and Open Source licensing model. This cuts the costs for software and licenses needed for day-to-day applications, such as word processing, spreadsheets with calculations, presentations, graphic designing, email management and many more.

Below are 2 Linus distros and office suite that we would like to recommend for use on your computers.

Ubuntu 14.04.1 LTS



Ubuntu is a Debian-based Linux operating system, with Unity as its default desktop environment (GNOME was the previous desktop environment). It is based on free software and named after the Southern African philosophy of ubuntu (literally, "human-ness"), which often is translated as "humanity towards others" or "the belief in a universal bond of sharing that connects all humanity".

Features: A default installation of Ubuntu contains a wide range of software that includes LibreOffice, Firefox, ThunderBird, Transmission, and several lightweight games such as Sudoku and chess. Many additional software packages are accessible from the built in Ubuntu Software Center as well as any other APT based package management tool. Execution of Microsoft Office and other Microsoft Windows applications can be facilitated via the Wine compatibility package or through the use of a virtual machine such as VirtualBox or VMware Workstation.

Security: Ubuntu's goal is to be secure "out-of-the box". By default user's programs run with low privileges and cannot corrupt the operating system or other user's files. For increased security, the sudo tool is used to assign temporary privileges for performing administrative tasks, which allows the root account to remain locked and helps prevent inexperienced users from inadvertently making catastrophic system changes or opening security holes. PolicyKit is also being widely implemented into the desktop to further harden the system. Most network ports are closed by default to prevent hacking. A built-in firewall allows end-users who install network servers to control access. A GUI (GUI for Uncomplicated Firewall) is available to configure it. Ubuntu compiles its packages using GCC features such as PIE and buffer overflow protection to harden its software. These extra features greatly increase security at the performance expense of 1% in 32 bit and 0.01% in 64 bit.

The home and Private directories can be encrypted.

Linux Mint 17 Quiana (*Cinnamon*)



Linux Mint is a 32- and 64-bit Linux distribution for desktop computers, based on either Ubuntu or Debian. Its stated aim is to be a "modern, elegant and comfortable operating system which is both powerful and easy to use." Mint provides full out-of-the-box multimedia support by including some proprietary software such as Adobe Flash. Mint's motto is "from freedom came elegance"

Linux Mint 17, code name Qiana is a long term support release which will be supported until 2019. It comes with updated software and brings refinements and many new features to make your desktop even more comfortable to use.

Features: Linux Mint primarily utilizes free and open-source software, making exceptions for some proprietary software, such as plug-ins and codecs that provide Adobe Flash, MP3, and DVD playback. Linux Mint's inclusion of proprietary software is a bit unusual; many Linux distributions do not include proprietary software by default, as a common goal for Linux distributions is to adhere to the model of free and open-source software.

Linux Mint comes with a wide range of software installed that includes LibreOffice, Firefox, Thunderbird, XChat, Pidgin, Transmission, GIMP, and Cheese. Additional software that is not installed by default can be downloaded using the package manager. Linux Mint allows networking ports to be closed using its firewall, with customized port selection available. The default Linux Mint desktop environments, MATE and Cinnamon, support many languages. Linux Mint can also run many programs designed for Microsoft Windows (such as Microsoft

Office), using the Wine Windows compatibility layer software for Linux, or virtualization software, including VMware Workstation and VirtualBox. As of version 16 there is an issue with multi-monitor support and Wine.

Linux Mint is available with a number of desktop environments to choose from, including the default Cinnamon desktop, MATE, KDE, and Xfce. Other desktop environments can be installed via APT, Synaptic, or via the custom Mint Software Manager. For users that have grown accustomed to Windows' GUI, Cinnamon offers a very familiar and comfortable user experience.

LibreOffice Fresh 4.3



LibreOffice
The Document Foundation

LibreOffice is a powerful office suite; Its clean interface and its powerful tools let you unleash your creativity and grow your productivity. LibreOffice embeds several applications that make it the most powerful Free & Open Source Office suite on the market

LibreOffice is a free and open source office suite, developed by The Document Foundation. It was forked from OpenOffice.org in 2010, which was an open-sourced version of the earlier StarOffice. The LibreOffice suite comprises programs to do word processing, spreadsheets, slideshows, diagrams and drawings, maintain databases, and compose mathematical formulae.

LibreOffice uses the international ISO/IEC standard OpenDocument file format as its native format to save documents for all of its applications (as do its OpenOffice.org cousins Apache OpenOffice and NeoOffice). The OpenDocument file format is now also supported by all major competing office suite applications (proprietary and open source). LibreOffice is also compatible with other major office suites, including Microsoft Office, through a variety of import/export filters. The file formats of Microsoft Office are well supported, though some layout features and formatting attributes are handled differently in the application or are not entirely supported in the filters. LibreOffice is available in over 110 languages and for a variety of computing platforms, including Microsoft Windows, Mac OS X 10.6 Snow Leopard or newer, and Linux. It is the default office suite of most popular Linux distributions.

Features



Writer: A word processor with similar functionality and file support to Microsoft Word or WordPerfect. It has extensive WYSIWYG word processing capabilities, but can also be used as a basic text editor.



Calc: A spreadsheet program, similar to Microsoft Excel or Lotus 1-2-3. It has a number of unique features, including a system which automatically defines series of graphs, based on information available to the user.



Impress: A presentation program resembling Microsoft PowerPoint. Presentations can be exported as SWF files, allowing them to be viewed on any computer with Adobe Flash installed.



Draw: A vector graphics editor and diagramming tool similar to Microsoft Visio and comparable in features to early versions of CorelDRAW. It provides connectors between shapes, which are available in a range of line styles and facilitate building drawings such as flowcharts. It also includes features similar to desktop publishing software such as Scribus and Microsoft Publisher.



Math: An application designed for creating and editing mathematical formulae. The application uses a variant of XML for creating formulas, as defined in the OpenDocument specification. These formulas can be incorporated into other documents in the LibreOffice suite, such as those created by Writer or Calc, by embedding the formulas into the document.



Base: A database management program, similar to Microsoft Access. LibreOffice Base allows the creation and management of databases, preparation of forms and reports that provide end users easy access to data. Like Access, it can be used to create small embedded databases that are stored with the document files (using Java-based HSQLDB as its storage engine), and for more demanding tasks it can also be used as a front-end for various database systems, including Access databases (JET), ODBC/JDBC data sources, and MySQL, MariaDB, PostgreSQL or Microsoft Access.

Windows 7 or 8 Professional *for the End-Users/Clients*

The familiar made better

The desktop you're used to—with its familiar folders and icons—is still here. And not just still here, it's actually better than before, with a new task manager and streamlined file management. And you can always get to your desktop—and back to your Start screen again—with a tap or click.

Programs: Use them the way you always have. Word, Excel, PowerPoint, and other programs you count on work the way you're used to. Use a mouse and keyboard and organize your stuff in folders on the desktop.

Security: Windows Defender and Windows SmartScreen can help guard your PC against viruses, spyware, and other malicious software in real time. Family Safety gives your kids some independence while still keeping tabs on them.

Mouse and keyboard: You can use a mouse and keyboard to work on your Windows desktop the way you always have. And things you do with touch, like using apps from the Windows Store and getting around on your Start screen, can also be done with a mouse and keyboard.

One view of everything: When you're working on the familiar desktop, all apps you've opened will appear in your taskbar at the bottom of the screen. This includes both apps you opened from the desktop and apps from the Windows Store you opened from your Start screen.

Microsoft Windows Virtual Desktop Access (VDA) License

Windows VDA is a device-based subscription that has been designed to help organizations license devices that do not qualify for Windows Client SA (such as zero clients, contractor PCs, tablets, laptops, etc.) to be able to access a virtual desktop.

For each zero client running Windows 7 or 8 as the end-user operating system, one (1) Windows VDA License needed.

Purchasing the Microsoft Licenses

Microsoft offer great discounts for educational institutions as much as half the regular costs. For you to get these academic editions, it may be necessary for you to purchase the licenses yourself from a Microsoft dealer. If you would like, we are able to assist you with the purchasing.

COSTINGS *Hardware*

Qty	Product Name	Unit Price	Cost	GCT	Total
20	ATR-ZCDVDI320 Atrust m320 Zero Client for VDI, Ethernet, 3.6W	\$20,000.00	\$400,000.00	\$0.00	\$400,000.00
1	ATR-SERS4CT16 Atrust st110A Server, Xeon E5-1245v2, 4C, 16GB, 1TB	\$178,200.00	\$178,200.00	\$0.00	\$178,200.00
20	AOC e1660Sw , LED Monitor, 15.6". Black	\$12,455.12	\$249,102.36	\$0.00	\$249,102.36
20	USB Keyboard & Optical Mouse , Black	\$1,283.78	\$25,675.60	\$0.00	\$25,675.60
1	PME-INSSOFUMV Useful Multiplatform Installation & Setup	\$50,000.00	\$50,000.00	\$0.00	\$50,000.00
20	PME-INSSUNZCS Zero Client Station Setup	\$1,500.00	\$30,000.00	\$0.00	\$30,000.00
			\$932,977.96	\$0.00	\$932,977.96
			Sub-Total	GCT Total	Total

COSTINGS *Software & Licenses*

Qty	Product Name	Unit Price	Cost	GCT	Total
20	USE-LICMULEDU Useful Multiplatform Academic Licenses	\$5,300.00	\$106,000.00	\$0.00	\$106,000.00
20	USE-SUPMULEDU Useful Multiplatform Academic Support (Incl. FailOver & Updates)	\$1,320.00	\$26,400.00	\$0.00	\$26,400.00
20	USE-LICMULCLA Useful Multiplatform v-Class addon Licenses	\$1,050.00	\$21,000.00	\$0.00	\$21,000.00
20	USE-SUPMULCLA Useful Multiplatform v-Class addon Support (Incl. Updates)	\$350.00	\$7,000.00	\$0.00	\$7,000.00
20	Windows Enterprise User License	\$15,930.00	\$318,600.00	\$0.00	\$318,600.00
20	Windows VDA License - 1 Yr (Annually per device)	\$10,800.00	\$216,000.00	\$0.00	\$216,000.00
			\$695,000.00	\$0.00	\$695,000.00
			Sub-Total	GCT Total	Total

* Please be advised that the costing for the Microsoft products are estimated based on March, 2014 prices and may be different from the current prices.

COSTINGS *Total*

	Sub Totals	GCT Totals	Grand Totals
Hardware Total	\$932,977.96	\$0.00	\$932,977.96
Software & Licenses Total	\$695,000.00	\$0.00	\$695,000.00
	\$1,627,977.96	\$0.00	\$1,627,977.96

Prices are subject to change without prior notice or permission. Prices are valid only for a period of fourteen (14) days. GCT zero rating documents are required.

COSTINGS *Total with Linux Mint or Ubuntu*

	Sub Totals	GCT Totals	Grand Totals
Hardware Total	\$932,977.96	\$0.00	\$932,977.96
Software & Licenses Total	\$160,400.00	\$0.00	\$160,400.00
	\$1,093,377.96	\$0.00	\$1,093,377.96

Prices are subject to change without prior notice or permission. Prices are valid only for a period of fourteen (14) days. GCT zero rating documents are required.

As you can see, using Linux Mint and/or Ubuntu OS can reduce your purchasing cost tremendously. Not to mention that the cost of the office suite is not yet included. Microsoft Office Academic Edition will attract an additional cost per workstation while LibreOffice may be added at no extra cost.

COST-BENEFIT ANALYSIS *Synopsis*

As an educational institution that requires the use of technology, this study is evaluating options for your institution to implement traditional personal computers (PCs) or zero client solution.

Computer Usage

Typical usage for day to day computing operations running a general set of productivity applications, such as word processing, spread sheets, accounts, project management, client management, and web browsing applications.

Assumptions *(based of typical usage)*

- Number of Desktops: 20
- Usage per Desktop *(approx.)*: 30% *(the usage of a desktop throughout the work day)*
- Concurrent Usage *(approx.)*: 80% *(the number of desktops are being used at any given time)*
- Number of Work Days: 5 days
- Hours in a Work Day: 8 hours

This study will explore the initial costs and maintenance and operational costs over the lifespan of a zero client which will be compared to the traditional desktop PCs costs.

COST-BENEFIT ANALYSIS *Hardware & Software Costs*

This cost-benefit comparison analysis will outline the acquisition and support of zero client workstations versus traditional PCs. The analysis will determine that the optimal cost efficient model is the installation of “true” zero client workstations over the purchasing of new desktop PCs. Furthermore, the ultimate cost-benefit solution would be the application of zero client workstations with centralized management of the servers across the LAN when possible.

Acquisition and Installation Cost

Below is the cost comparison of equipping the institution with 100 workstations, including monitor, keyboard, mouse, the installations, setting up & licensing for host servers OS, management software, Windows 7 Pro VMs, and one year of technical support.

Traditional Personal Computers (PCs)

DESCRIPTION	QTY	UNIT COST	LINE SUB TOTAL
Dell OptiPlex 3020 Desktop Computers	20	\$119,025.00	\$2,380,500.00
<i>Note: This price is based on a basic computer from Dell. The specifications sheet this computer is available upon request. US\$80/PC was added for shipping and an exchange rate of JM\$115.00 to US\$1.00 was applied. No duty taxes were added to the sum.</i>			SUBTOTAL \$2,380,500.00
			GCT \$0.00
			TOTAL \$2,380,500.00

Microsoft Windows	COST	GCT	TOTAL COST	COST/ COMPUTER
Traditional PCs	\$2,380,500.00	\$0.00	\$2,380,500.00	\$119,025.00
Zero Clients	\$1,627,977.96	\$0.00	\$1,627,977.96	\$81,398.90
Cost Difference	\$752,522.04	\$ 0.00	\$752,522.04	\$37,626.10

Linux Mint / Ubuntu	COST	GCT	TOTAL COST	COST/ COMPUTER
Traditional PCs	\$2,380,500.00	\$0.00	\$2,380,500.00	\$119,025.00
Zero Clients	\$1,093,377.96	\$0.00	\$1,093,377.96	\$54,668.90
Cost Difference	\$1,287,122.04	\$ 0.00	\$1,287,122.04	\$64,356.10

Although some dollars are saved merely through the initial acquisition of zero client workstations, the full Total Cost of Ownership (TCO) savings will be realized through operational savings over the lifespan of the zero clients.

The zero client workstations will not need memory or disk upgrades to run the newest software, nor will they need utilities like desktop security software. Multi-user software and volume licensed software; such as Microsoft Office would need an end-user license for each PC it is installed on even if only about twenty-five to thirty per cent (25-30%, typically) of the software is used at any given time. With the zero client system, you can purchase as you need. If the institution’s average usage is around thirty (30) persons using the Microsoft Office software, you only need to purchase enough user licenses to cover the thirty (30) concurrent users.

In addition to actual dollar savings, the use of a zero client model will allow staff members and teachers to spend more time working and teaching rather than tending to machines. In general, the technical support demands and software costs will decrease.

Maintenance Costs

The general lifespan of a desktop PC diminishes over two (2) to three (3) years with regards to processing power and hardware. The costs of replacing a single desktop computer exceeds \$100,000.00 for a desktop PC, which, in the business world, can result in increased variable

overhead and ultimately lower the company's bottom line. Furthermore, the cost of upgrading PCs in terms of man-hours is high, as it is a labour intensive task to install new software on each workstation every time a new update, change, or component replacement is required.

With zero clients, maintenance is reduced to centric VM management and location reassignments of the workstations (if there are any at all). As there are no moving parts, there's no chance of a workstation downtime due to wear & tear.

COST-BENEFIT ANALYSIS *Energy Costs*

The traditional PC consumes an average of 120 watts while idles and up to 240 watts when in use. As this may be true for the office desktop computers, the workstations for the engineering department would consume between 120 watts and 450 watts. Our zero clients consumes between 0.2 watts to 3.6 watts, which will prove significant savings on energy costs.

Traditional Desktop PCs Energy Consumption Projection

Year	Rates	Office Workstations	Year Total
2014	\$44.17	\$146,997.76	\$146,997.76
2015	\$45.50	\$151,407.69	\$151,407.69
2016	\$46.86	\$155,949.92	\$155,949.92
2017	\$48.27	\$160,628.42	\$160,628.42
2018	\$49.71	\$165,447.27	\$165,447.27
2019	\$51.21	\$170,410.69	\$170,410.69
2020	\$52.74	\$175,523.01	\$175,523.01
2021	\$54.32	\$180,788.70	\$180,788.70
		\$1,307,153.48	\$1,307,153.48

Zero Client Energy Consumption Projection

Year	Rates	Office Workstations	Office Server	Year Total
2014	\$44.17	\$1,724.40	\$15,487.77	\$17,212.17
2015	\$45.50	\$1,776.13	\$15,952.40	\$17,728.53
2016	\$46.86	\$1,829.41	\$16,430.97	\$18,260.39
2017	\$48.27	\$1,884.29	\$16,923.90	\$18,808.20
2018	\$49.71	\$1,940.82	\$17,431.62	\$19,372.44
2019	\$51.21	\$1,999.05	\$17,954.57	\$19,953.62
2020	\$52.74	\$2,059.02	\$18,493.21	\$20,552.23
2021	\$54.32	\$2,120.79	\$19,048.00	\$21,168.79
		\$15,333.92	\$137,722.44	\$153,056.36

Energy Consumption Projection Comparison

	AVERAGE/YEAR	TOTAL OVER 8YRS
Traditional PCs	\$163,394.19	\$1,307,153.48
Zero Clients Solution	\$19,132.05	\$153,056.36
Cost Difference	\$144,262.14	\$1,154,097.12

Note: The rate used is an average of a Rate-20 JPS customer. An annual 3% inflation is adding to the rate.

COST-BENEFIT ANALYSIS *Systems Life Cost Profile*

Traditional Desktop PCs 2014 to 2021 Projections

Note: An annual 3% inflation is added. Although our zero clients' lifespan is up to 10 years, we have taken a more conservative approach to show only 8 years.

COST CATEGORY	YEAR 1 2014-15	YEAR 2 2015-16	YEAR 3 2016-17	YEAR 4 2017-18	YEAR 5 2018-19	YEAR 6 2019-20	YEAR 7 2020-21	YEAR 8 2021-22	System Life Total
Purchasing Costs	\$2,380,500.00			\$2,601,236.62			\$2,842,441.49		\$7,824,178.11
Installation Costs	\$116,500.00			\$127,302.70			\$139,107.10		\$382,909.80
Maintenance Costs	\$69,900.00	\$71,997.00	\$74,156.91	\$76,381.62	\$78,673.07	\$81,033.26	\$83,464.26	\$85,968.19	\$621,574.31
Repairs/Replacements Costs			\$142,381.27			\$155,583.86			\$297,965.13
Upgrades Costs									
Energy Costs	\$146,997.76	\$151,407.69	\$155,949.92	\$160,628.42	\$165,447.27	\$170,410.69	\$175,523.01	\$180,788.70	\$1,307,153.46
Licenses Costs									
Total Projected Cost	\$2,713,897.76	\$223,404.69	\$372,488.10	\$2,965,549.36	\$244,120.34	\$407,027.81	\$3,240,535.86	\$266,756.89	\$10,433,780.81

Zero Client Workstations 2014 to 2021 Projections with Microsoft Windows

COST CATEGORY	YEAR 1 2014-15	YEAR 2 2015-16	YEAR 3 2016-17	YEAR 4 2017-18	YEAR 5 2018-19	YEAR 6 2019-20	YEAR 7 2020-21	YEAR 8 2021-22	System Life Total
Purchasing Costs	\$932,977.96								\$932,977.96
Installation Costs	\$93,200.00			\$3,278.00			\$3,581.96		\$100,059.96
Maintenance Costs	\$2,330.00	\$2,399.90	\$2,471.90	\$2,546.06	\$2,622.44	\$2,701.11	\$2,782.14	\$2,865.60	\$20,719.15
Repairs/Replacements Costs									
Upgrades Costs				\$21,436.00			\$23,423.70		\$44,859.70
Energy Costs	\$17,212.17	\$17,728.53	\$18,260.39	\$18,808.20	\$19,372.44	\$19,953.62	\$20,552.23	\$21,168.79	\$153,056.37
Licenses Costs	\$695,000.00	\$256,882.00	\$264,588.46	\$272,526.11	\$280,701.89	\$289,122.95	\$297,796.64	\$306,730.54	\$2,663,348.59
Total Projected Cost	\$1,740,720.13	\$277,010.43	\$285,320.75	\$318,594.37	\$302,696.77	\$311,777.68	\$348,136.67	\$330,764.93	\$3,915,021.73

Zero Client Workstations 2014 to 2021 Projections with Linux Mint and/or Ubuntu

COST CATEGORY	YEAR 1 2014-15	YEAR 2 2015-16	YEAR 3 2016-17	YEAR 4 2017-18	YEAR 5 2018-19	YEAR 6 2019-20	YEAR 7 2020-21	YEAR 8 2021-22	System Life Total
Purchasing Costs	\$932,977.96								\$932,977.96
Installation Costs	\$93,200.00			\$3,278.00			\$3,581.96		\$100,059.96
Maintenance Costs	\$2,330.00	\$2,399.90	\$2,471.90	\$2,546.06	\$2,622.44	\$2,701.11	\$2,782.14	\$2,865.60	\$20,719.15
Repairs/Replacements Costs									
Upgrades Costs				\$21,436.00			\$23,423.70		\$44,859.70
Energy Costs	\$17,212.17	\$17,728.53	\$18,260.39	\$18,808.20	\$19,372.44	\$19,953.62	\$20,552.23	\$21,168.79	\$153,056.37
Licenses Costs	\$160,400.00	\$34,402.00	\$35,434.06	\$36,497.08	\$37,591.99	\$38,719.75	\$39,881.34	\$41,077.78	\$424,004.00
Total Projected Cost	\$1,206,120.13	\$54,530.43	\$56,166.35	\$82,565.34	\$59,586.87	\$61,374.48	\$90,221.37	\$65,112.17	\$1,675,677.14