

Green Office Computer Workstations using Thin Client Systems

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ABSTRACT

This study was undertaken to configure a convenient thin client computer workstation to various offices leading to a green earth friendly computing environment. Thin client systems are intended for office computing task such as the use of office productivity tools, internet surfing and the likes that does not require powerful/high performance computer workstations.

Using the feasibility research methodology in the conduct of the study, finding shows that using the thin client technology, the power consumption and cost of hardware is lesser than the existing systems used by various offices. It is recommended that thin client systems be used for light application such as productivity tools, web browsing, and other light applications common to offices.

INTRODUCTION

In our present economy, if we make a list of gadgets/equipment that is very important in our everyday lives, computers will no doubt be on top of the list. It is almost impossible to think that one can survive without computers. They have become a gadget of almost daily use for people of every age. Computer industry is growing very fast and computer technology has also brought about a revolution. Laptops and palmtops have replaced the desktops, which are still popular in many industries.

Another technology introduced in the field of computing is thin client systems. It is based on the client/server concept, providing block mode transmission between the windows and the UNIX components. Therefore, the utilization of the thin client eliminates the key strokes transmission between the windows application and the host. Most emulation programs that perform such processing are highly noticeable on dial-up connections (Baratto *et al.*, 2005).

One benefit using thin client systems is its contribution to green computing. Green computing is the study and practice of efficient and eco-friendly computing resources, which is now under the attention of not only environmental organizations, but also businesses from other industries (Hooper, 2008). In recent years, companies in the computer industry have come to realize that going green is in their best interest, both in terms of public relations and reduced costs.

There are several benefits of thin client technology to organizations or institutions such as minimize power consumption, minimize upgrading cost of computer hardware, minimize the time consumed in hardware and software maintenance, and to promote file security, the proponent proposed this design to help the university reap the benefits of thin client technology.

The main objective of this research is to design and pilot test a thin client-based office workstation to promote green computing in Nueva Vizcaya State University. Specifically, to reduce the power consumption

incurred by computer workstations, minimize the amount of time and money consumed in hardware and software maintenance, and to maximize the use of computer equipment at a lesser cost.

MATERIALS AND METHODS

The feasibility research methodology, which aim to objectively and rationally uncover the strengths and weaknesses of the existing business or proposed venture, opportunities and threats as presented by the environment, the resources required to carry through, and ultimately the prospects for success is used in this project. In its simplest term, the two criteria to judge feasibility are cost required and value to be attained. In general, feasibility studies precede technical development and project implementation. (Murugesan, 2008).

Figure 1 shows the conceptual model in creating the study. The input contains the observation of the proponent with regards to the problems encountered in software and hardware maintenance, power consumption, file security and cost of hardware and software. The process used in the study is System Development Life Cycle, a method used by system analysts to develop an information system, including requirements, validation, and training and user ownership, and the output is a green computing workstations in offices using thin client system.

During the conduct of the testing phase, the current computer laboratory setup of the College of Industrial Technology served as the pilot area. The amount of consumed energy was completed using an energy logger (Figure 2), a power consumption measuring tool. It was used greatly in the determination of the actual power consumption of various electronic devices.

RESULTS AND DISCUSSIONS

A thin client system is a network-based workstation as shown in Figure 3. It is a client-server based architecture utilizing distributed computing architecture that allows the central server to do all of the actual processing. The word “thin” describes a small boot image (operating system) the thin-clients uses. The small boot image is generally just enough to start up either a web browser or a remote desktop connection with a Microsoft terminal server.



Figure 2. Voltcraft Energy Logger 4000 (Photo Credit: Voltcraft.com)

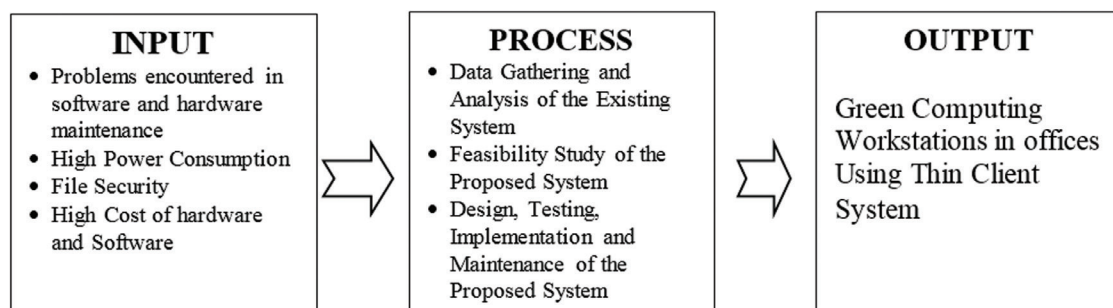


Figure 1. Input – Process – Output Model

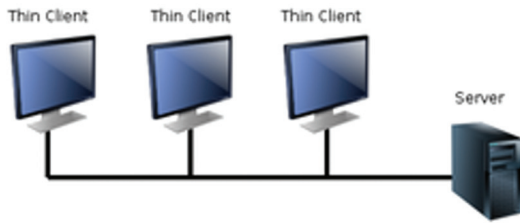


Figure 3. Network Architecture

The configuration of the system are as follows: The fat client system consists of a 19 inches LED monitor, Core i3 Processor 2.8 Ghz., 250 GB hard disk drive, 4 GB of memory, mouse, keyboard, and automatic voltage regulator (AVR). While the thin client system consist of the following specifications: 19 inches LED monitor, a diskless thin client device with dual core atom CPU, 512 MB of RAM, mouse, keyboard, and AVR.

Table 1 shows the comparative energy consumption in W/h and corresponding cost by thin client and fat client and the corresponding cost. The fat client computer system has a higher specification which consumes a greater amount of electricity as manifested by a higher reading of 260 W/h with a corresponding costs of PhP 3.90/hour. On the other hand, thin client computer system has lower specification and consumes 35 W/h with a corresponding cost of PhP 0.525. Based on the findings presented above, it is proven that the power consumption of thin client computer system is lower than the fat client system, cheaper and cost efficient.

The evaluation made by the respondents as to the overall reaction to the green computer workstations in offices using thin client system in Table 2, which was previously performed in the studies of Gamponia *et al.* (2013) revealed the computed mean of 4.30 as very satisfactory.

In terms of efficiency, a computed weighted mean of 4.25 was realized with a qualitative interpretation of very satisfactory. The respondents' evaluation as to the speed of the thin client system, results revealed that

Table 1. Power consumption and cost / hour of one unit thin and fat client

Configuration	Watts/hour	Cost (PhP15/kW)
Fat Client	260	3.90
Thin Client	35	0.525

the loading of the applications installed on the server system is fast, proven by the computed weighted mean of 4.30. The overall reaction of end users on their experience in using the thin client-based system is Very Satisfactory. This impression is supported by the overall grand total mean rating of 4.28.

It can be gleaned in Table 3 the consumption and cost incurred by 45 fat client workstations presently installed in different offices in the campus as against the 45 units of thin client workstations.

The cost is computed using the prevailing rate of PhP 15.00 per kW by the Nueva Vizcaya Electric Cooperative at the time of the conduct of the study multiplied by 22 days and eight hours a day.

The comparison on the acquisition cost is presented in Table 4 which shows that a fat client computer having a specification as stated above would cost at PhP 25,000.00 while a thin client computer system with the same specification as stated above will only cost the end user around PhP 8,000.00. Thus, savings of PhP 17,000.00 per workstation can be realized. In addition to the thin client systems will be a thin client server which cost at PhP 40,000.00.

In a thin client technology, all software are installed on the server side thus, the operating system and third party software are all installed in one system unit. Most of the maintenance activities resides on the server. The applications and operating systems are loaded over the network.

Table 2. Respondents evaluation on the use of thin client-based computer

Overall reaction to the green computer workstations in offices using Thin client system	Mean	Verbal Description
Reliability	4.30	Very Satisfactory
Efficiency	4.25	Very Satisfactory
Speed	4.30	Very Satisfactory
GRAND MEAN	4.28	Very Satisfactory
<i>Mean Perception</i>	<i>Qualitative Description of the Mean Perception</i>	
4.5-5.0	Excellent	
3.5-4.4	Very Satisfactory	
2.5-3.4	Satisfactory	
1.5-2.4	Fair	
1.0-1.4	Poor	

Table 3. Computation of 45 units of computer workstation in offices

45 workstations	Fat Client	Thin Client	Difference
Consumption in kilowatts per day	93.60 kW	1.40 kW	92.20 kW
Cost per day	PhP 1,404.00	PhP 21.06	PhP 1,382.94
Consumption in kilowatts per month	2,059.20 kW	30.89 kW	2,028.312 kW
Cost per month	PhP 30,888.00	PhP 463.32	PhP 30,424.68

CONCLUSION AND RECOMMENDATION

Conclusion

This study was undertaken to design and configure a green computer workstations for offices using thin client system. The following conclusions were derived.

1. Based on the findings, using thin client system technology, the power consumption incurred is lesser as compared to the existing fat client system being used in various offices of the university.
2. The total cost of acquisition is also cheaper as compared to fat client system.
3. Thin client systems used the programs installed on the server thus, maintenance and installation activities are confined on the server side only, minimizing time and effort consumed as compared to the individual installation and maintenance being performed on individual fat client systems.

Recommendation

Table 4. Comparative acquisition cost per unit

Unit	Acquisition Cost
Fat Client	PhP 25,000.00
Thin Client	PhP 8,000.00
Difference	PhP 17,000.00

Based on the conclusions, it is recommended that thin client systems be used for light application such as productivity tools, web browsing, and other light applications common to offices. It is highly recommended that the university adopt such technology to lower consumption on office workstations and eventually produce savings.

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