

Computer Building Seminar for Engineering Students

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Abstract

When comparing today's first-year computer engineering student with one of five to ten years ago a troublesome trend can be observed. Although today's students have used Personal Computers (PCs) longer, by and large, they have never touched (or even seen) the inside of a PC. This is a reflection of the changing role of the PC from a hobby item for the technically inclined, to a household appliance not to be broken. Based on that premise a seminar was developed to familiarize students with the inner workings of a standard desktop PC, while also offering the opportunity for them to walk away with a new computer system that they have built themselves. The systems are designed to suit the needs of an engineering student. These features include but are certainly not limited to power, flexibility, expandability and ease of upgrade. In the process of this seminar the student is led through the process of assembling a computer from scratch. During this time the functionality and features of each component are discussed. Once the hardware is assembled we introduce the operating system and installation procedure. The function of an operating system is discussed along with benefits and drawbacks of the various options. Students are allowed to pick their operating systems and the seminar continues with each student configuring his or her own computer. The outcome is that students end up with a high performance, upgradable computer without the mystique or apprehension that they may have felt about family computers. Furthermore, this exercise helps students understand the roles of the various components, hardware and software, and allows them to make informed decisions in the future.

I. Introduction

Our goal in this seminar was to offer students in our engineering department an opportunity to assemble their own high performance PC from parts. The computer constructed was to be adequate enough to be a single machine solution for the average student but also be easily upgraded and fine-tuned for the specific needs of each student in their field.

In the construction process of this computer the students learn what each component does and how it contributes to the operation of the whole machine. This additional working knowledge of computers will allow the students to identify and perform upgrades to this computer in the future as technology changes, as well as be able to build additional computers in the future.

II. Course Structure

The manner in which this material is presented is based on the functionality of the components and how they contribute to the entire machines' function. As we work the student from an empty case to a fully operational computer, emphasis will be placed on what each piece does for the computer as a whole, and the history of the component. This will allow the students to get a feel for how computers developed into the tools they are so accustomed to working with today.

The hope is that upon exiting the course, students will have a computer that they are very familiar with, and an overall understanding of how all computers work. This will allow them to continue to upgrade and maintain their own computer as well as the computers of others. This also present a culmination of ideas that may provide a link between what is learned in their engineering class and how it applies in their own desktop computer.

For the primary reason that all computer hardware is generally made obsolete shortly after its production, an effort to make the information in this course and hardware selected suitable for the time it is to be presented will be made in future sessions.

III. Computer Specifications

When deciding what type of computer to offer in this seminar consideration towards the specific needs of an engineering student must be taken. The configuration that we settled on focused on both power and versatility.

Amongst students at the university level engineering students generally have a need for computing power. No matter what their field of engineering; no matter whether it is CAD drawings, development software, or high end mathematical analysis software computing power is key. Another factor contributing to the need for power is the often over looked "after hours" engineering student. This student will from time to time feel the need to step away from he exhaustive work and play a game, watch a movie or perhaps listen to some music. These things simply will not fly on an under-powered or poorly configured computer and were therefore considered.

The versatility of the computer is also at the heart of engineering students needs. When selecting the hardware for this machine we took notice of not only what the students would be using the machine for but also that they may not be using the Microsoft Windows™ environment. All equipment in our computer was specifically checked for compatibility in the latest Red Hat Linux and dual boot situations.

Overall, we diligently sought to provide the most powerful and versatile machine while keeping cost fairly low. This was the machine for gamers, workers, researchers and designers alike. But to accomplish this very specific hardware would have to be found.

IV. Hardware Selected

AMD Athlon Thunderbird 800Mhz processor⁶ – While not the fastest chip on the block the 800Mhz offered better than average performance for a less than average price. We also saved, without a loss in performance, by going with an AMD alternative over an Intel chip.

Asus A7V Motherboard² – At the heart of all computers is the motherboard. It is the one place where every thing that occurs in the computer crosses. We selected this board because (1) it supported our choice of processors, (2) had the available expansion slots for the cards we wanted to add, (3) offers “Jumper-less” configuration through its BIOS, and (4) allows for future upgrade to 1Ghz processor with no advanced configuration.

128MB 133Mhz Synchronous DRAM (Generic) – While not a large amount of memory by today’s standards it is the fastest combination for our mother board application. 128MB installed in a system that has separate video and sound processing cards will do just fine and will be dedicated to crucial system processes, causing no overall performance issues.

20.5GB Western Digital Caviar Hard Drive⁷ – Once again we did not get the largest drive on the market but instead an appropriate size for the application at hand. Here again we take the slightly-higher-than-middle of the road approach, the drive is medium sized, but high performance. It offers the higher 7200 RPM performance in conjunction with the Ultra ATA/66 EIDE control interface supported by our motherboard. This results in quicker, error-free drive operation and high reliability.

Toshiba 4x4x4x24 CDRW/DVD Combination Drive⁵ – This drive was absolutely perfect for this project. It offers (1) the multimedia capability of a CD-ROM drive for standard software applications, (2) the high end software capability of DVD-ROM, and (3) a removable storage media. Whether the student wants to run a program, watch a movie, backup information or make their own CD’s, this drive suits them all.

3dfx Voodoo3 3000 Video Card³ – With the added capability of DVD and after hours gaming in mind, this was an easy choice for video card. Once again this card has features that are not “top of the line”, but it does support 3D gaming very well, and offers TV output for gaming on the big screen or watching a DVD movie. Also the card does hardware DVD decoding assistance, loosening the burden on the processor and allowing a smoother theater quality picture. The Voodoo3 Chipset was chosen over other 3D chipsets with similar features due to its high compatibility in Linux, allowing 3d rendering and high-resolution operation in this alternate environment. The monitor supplied with this system was a generic and inexpensive 17” display capable of handling up to 1280x1024 resolution.

Sound Blaster Live! Value Sound Card⁴ – In making this a complete package for the engineering student it became evident that beyond the workhorse mentality of the computer, it was also going to play the role of an entertainment center. With the CD/DVD drive and mid range video card implemented, what was needed was a decent form of sound generation that was Linux compatible as well. The answer was the Sound Blaster Live! Value. It does non-digital 4 channel surround sound as well as real-time environmental audio synthesizing (for an encompassing effect in non-surround encoded software). Though capable of drive four channels of sound output the seminar system only included two amplified stereo speakers.

56K V.90 Modem and 10/100Mbs Network Card (Both Generic) – These cards are included for communication in either an on campus or home LAN Ethernet environment or an off campus or

away dial-up service, either way access to the internet and other computers is possible. There is certainly no discounting the importance of this capability; the only issue was getting a set that would work in a Linux platform as well. Finding inexpensive, generic cards with reliable name brand chipsets for which a driver base existed in both environments solved this problem.

Standard 104-key Keyboard and Scroll Mouse – Once again these item we chosen due to their low cost and ease of implementation in dual operating system. The scroll mouse is minor luxury though it is quite standard on computers as of late.

Windows 98 Second Edition⁸ and Red Hat Linux 7.0⁹ – The last piece of any computer is it's operating system. OEM copies of Windows SE and copies of Red Hat were provided with the seminar systems, offering installation of either or both on the computer once assembled.

V. Conclusion

While the theory of the seminar promised to be quite interesting and rewarding for all those involved, the execution was not so seamless. While we were able to offer an excellent educational experience, the final cost of the seminar ended up being non-competitive with store bought packaged computers. This drove interest and perspective participation down to a very small handful of students and faculty. In fact others¹ who have attempted the do-it-yourself approach to PC purchasing find this commonly be the case; when configuring and building your own computer you can not expect to be financially competitive with large computer manufacturers that get pieces far below wholesale price. Similarly, you can not get as highly reliable or powerful of a machine in a mass-produced computer as you can with an well-assembled custom PC.

Another contributing factor was the timing; being offered in winter term when most students are consumed in the holidays away from school further limited interest in the program. Perhaps re-attempting this seminar in a mid to late summer session will be more successful due to the abundance of summer money and incoming first year students needing a college computer, apart from their home computers. Overall the setup and preparatory actions taken will be applied and executed in the near future.

Bibliography

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