AC 2009-1698: FACILITY MANAGEMENT IN INFORMATION TECHNOLOGY AND ITS IMPACTS ON ENGINEERING AND TECHNOLOGY EDUCATION

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Facility Management in Information Technology and Its Impacts on Engineering and Technology Education

Abstract

As information technology (IT) rapidly changes, the role that IT plays in the academic arena has also evolved drastically. From a typical scientific calculator to a PDA to an Ultra light PC to an "Integrated-all device", the impact of this evolution has changed the landscape of the educational environment to an unprecedented level. This rapid change has driven educational institutions to consistently adapt these new trends and renew their services to their communities.

In this project, the IT infrastructures, policies, facility requirements, and management strategies of some renowned engineering and technology schools and colleges throughout the U.S. were studied. Through the numerous related parameters in IT, few key parameters were selected as identifiers that were used to collect the sample data. Examples of these parameters are bandwidth allocation, student laptop programs, software ownership, software deployment, OS platforms, and correlation were carried out in relation to engineering and technology education. This paper presents all the findings in this study together with some impacts of this evolution on engineering technology education.

Introduction

Information technology (IT) is a driving force in engineering and technology education. Incorporating technology while overcoming its challenges and avoiding its pitfalls is a difficult but necessary task for engineering and technology schools and facilities managers. Understanding where and how to allocate resources, generate polices, and establish and control IT parameters are difficult responsibilities. These can include requiring students to own laptops or providing them, controlling device requirements and usage on campus, and regulating software deployment in addition to obtaining and complying with the correct licensing agreement. The goal of this paper is to enlighten members of the engineering and technology fields as to the current technology trends in engineering and technology education, in addition to outlining how some schools are adapting the current information technologies. The research used for this paper consists of several documented articles, information compiled from several prominent universities IT programs, and an indiscriminate survey of one hundred engineering and technology schools.

Information

Facilities Management in Information Technology, like most aspects of facilities management is concerned with organizing and integrating people, buildings, and technology. To do this effectively they must know and understand current and future technology trends. Understanding what is occurring will be the only effective strategy to develop the support infrastructure necessary to adequately provide for their communities.

It is clear that laptops have become part of the technology revolution occurring across university campuses nationwide. Some schools have been requiring students to own laptops while others provide them. However, most do not require them at all and are in the mode of trying to provide all possible computing resources to their communities. Rose-Hulman Institute of Technology for example, has required incoming freshmen to purchase laptop computers since 1995 (http://www.rose-hulman.edu/TSC/policies/). While in 2000, the Massachusetts board of higher education implemented a plan to provide all students attending publicly funded colleges their own laptop, including the renowned Massachusetts Institute of Technology (MIT) (Olsen, 2000[6]). Conversely, the survey concluded that only five out of one hundred schools required students to own laptops. Clearly illustrating that while laptops are common in educational facilities, most engineering and technology schools still do not require laptops. There may be many reasons for this including, cost, security, and other regulatory and control issues, but the benefits of freeing up precious floor space and financial resources by reducing the number of computer labs are important considerations. Additionally there is much data that supports other positive benefits of laptops in education, see (Chompu-inwai & Doolen, 1998;[2] Deden, 1998;[3] and Read, 2003[7]).

Of the schools that do require laptops each has their own strategy for procuring the laptops and regulating their hardware. The survey indicated that when laptops were required by schools the school either provided them, or had arrangements made with manufactures where students could purchase the required equipment at a discounted rate. In the case of Massachusetts board of higher education, they elected to have their program publically funded (Olsen, 2000[6]). Other examples include the University of Oklahoma, which based their program on a successful model developed by Wake Forest University. The university tied laptop requirements to specific courses, in turn allowing students to acquire funds for laptops through financial aid (Shirley, Pierson, Trytten, Rhoads, & Court, 2002[8]).

Hardware requirements are specific to each universities laptop program. They are based on the intended use of the laptop and the software programs it must run. In instances where students are required to purchase from vendors the selection available for purchase is based on the schools requirements. If students are to purchase a laptop on their own they are provided with a list of minimum system requirements. What was discovered is that most schools with laptop programs require Microsoft Windows as the primary operating system. A very small percentage required

or made use of Apple's Macintosh operating systems, and no school required or supported Linux.

Because the proliferation of laptops on university campuses is not only a concern for universities with laptop programs, all universities will need to provide network access and regulate that access. Laptop users at MIT are required to use the MIT wireless network. For security reasons laptops are not able to plug into the wired network. Students wishing to have their laptops connected to the wireless network are required to use MIT's web- based wireless network set up utility. Once they initially connect to the wireless network and start up a web browser, they can register their laptop for network access (http://web.mit.edu/ist/topics/network/). They also do not support printing from laptops. If a student needs to print, they should transfer their file(s) to a school owned machine with student account access and print it from there. Rose-Hulman uses a similar system in which all network devices must be capable of obtaining an IP address via DHCP. It is additionally required that the device be registered with their IT department via the devices MAC address. If the device has the capability of browsing the web, it can utilize their auto registration system. To do this, a student attaches the device to the wireless network, open a web browser, and follow the instructions on their page (http://www.rose-hulman.edu/TSC/policies/). If not it will have to be brought to the IT department and manually have the MAC address registered. Again, these two examples do not represent all universities registration programs. Based on data from the survey thirty-six percent of schools allow wireless only access, while fifty-nine percent allow students access to wired and wireless networks. In all cases the school requires registration of the devices MAC address.

What students use their laptops for varies with each institution. The survey found seventy-eight percent of schools allowed laptops in class rooms for lectures only. While twenty percent allowed them for use during lectures and exams and two percent did not allow laptops in classrooms at all. It is worth noting that some schools alternated this policy based on the content of the course. Important considerations for the allowance of laptops into the class room are the physical requirements of space and resources and the course's content. Shirley et al., (2002[8]) stated there must be large flat tables to support the laptops and allow for room to work. Numerous power outlets and the required network connections must be located near each students work area. Additionally, the course must be structured in a way that includes and benefits from the use of laptops. This includes training instructors to effectively use and present technology to their students (p. 3)

Educational network security and controls are concerns for all universities. This is especially true for engineering and technology schools based on the nature of their educational process and the abilities of their students. Secure access both on and off campus being the most primary concern. This is accomplished through typical IT methods, VPN (virtual Private Networks) and secure login pages. Rose-Hulman uses a Kerberos password (aka their Rose-Hulman password) that is used to access most services on campus. Kerberos can also be used in personal WebPages to authenticate users and in various other services. VPN access for on-campus users is limited to use on the wireless network. The VPN is only required for users connected to the RHIT (Rose-

Hulman IT) wireless network to enhance the security of the traffic sent via a wireless connection (http://www.rose-hulman.edu/TSC/policies/). The VPN is their preferred method to access servers and services while off campus. Virginia Tech uses similar systems like CAS (Central Authentication System), which is a central logon service that enables users to access multiple applications by typing their PID and password. Their Communications Network Services (CNS) offers Virtual Private Network (VPN) remote access as a bundled service with the Virginia Tech Wireless Network Service or the Virginia Tech Modem Pool. VPN provides members with an IP address as if they are on-campus, providing access to campus services that are typically restricted from off-campus access (http://www.cns.vt.edu/). These methods were found to be the standard security measures with which most universities regulate network access.

Based on information from the study about half of the schools surveyed also employ polices regulating what students access, view, or download on the Internet. While this may not seem an important consideration, bandwidth is expensive and so are lawsuits for illegal downloading. MIT for example has their IS&T department record a variety of information about both the operation and/or use of its IT network services. When used in conjunction with IS&T's host registration database, records contained in logs showing the use of dynamic IP addresses on MITnet allow IS&T staff to follow up on problems, incidents, and inquiries. These logs are retained for 30 days after their creation date. All of these logs are considered confidential and as such IS&T takes active measures to prevent unauthorized access during the retention period (http://web.mit.edu/ist/topics/network/). Policies of this type are desirable measures to prevent abuse of network resources and influence student behaviors while accessing the Internet.

Software deployment is the pinnacle of discussion when universities decide how to equip students and computer labs with "real world" experience through software. Most schools offer a couple of options. Either they offer software through download or for purchase, in some cases it may be a combination of the both. This is based on the licensing structure that the school subscribes too. Again using MIT as a model, their IS&T department provides services to help students and staff get and use software. Many applications are available at no cost on their private network, and there are brokered volume license agreements for other essential programs. Their IS&T department has signed a Campus Agreement with Microsoft. The Microsoft Campus Agreement grants members of the educational institution the right to use various Microsoft products. IS&T has also negotiated specific agreements for Windows Operating System, Client Access Licenses, Windows Server, and Microsoft Office Professional product suite. Software is available to MIT faculty, staff and students. Access is limited to those with a valid MIT certificate http://web.mit.edu/ist/topics/network/). Much of the software is either site-licensed for MIT use only, or subject to export controls. It is illegal to redistribute this software without permission. This system was found to be the typical model used by most universities. The research supported this trend, concluding that one hundred percent of the schools surveyed did use a system similar to this one. Providing software for students to purchase or download through licensing agreements with various vendors.

E-mail is quickly becoming the communication medium of choice. Ninety-six percent of the schools surveyed provide e-mail service for students. Out of those, ninety percent used e-mail as the official communication medium for the university. According to Jones & Johnson, (2005[5]) "the vast majority of college students surveyed (84%) are using the Internet to communicate with professors, a number similar to the 2002 figure (87%). Email is the most popular method for doing so, with 79% of college students using it to reach their instructors". Reinforcing research that e-mail is the preferred method of communication for students, faculty, and staff concluding that e-mail should be implemented as the official method of communication for all universities.

E-mail services typically include or consist of account maintenance, management of outgoing and incoming mail servers, email quotas, email security, and more. In addition to help desk support for email and other mail clients. To help faculty and staff in organizing and maintaining schedules and calendars, many schools offer centralized support for calendaring through Outlook with Exchange, or similar programs. The Exchange server is one of the most popular e-mail and calendaring solutions for faculty and staff. The Exchange server provides a complete groupware environment, including integrated e-mail, tasks, appointments, contacts, and public folders. Students and faculty can use a variety of client applications to access an Exchange account. Microsoft Outlook for Windows, Entourage or Outlook via Citrix for Mac OS, and the online WebOutlook interface provide the most functionality and seem to be the most popular.

The final section of this paper is centered around online courses and their impact on engineering and technology education. With the consistent growth of laptop usage, both from laptop programs adopted by various schools and individual student purchases. The development of a flexible twenty four hour-a-day, seven day-a-week learning environment is an inevitable trend for today's educational institutions. It was estimated that in 2004 at least two million higher education students in the U.S. were engaged in distance education (Hiltz & Turoff, 2005[4]). These classes range from totally online virtual classrooms to hybrid classes where students use technology to achieve educational goals, supplemented by some face-to-face interaction with instructors. It is suspected that with the growing use of online courses, the parameters of this trend will change with technology. In turn, incorporating an individual research based approach to education. The challenges in developing online courses can be numerous. Hiltz & Turoff, (2005[4]) dicuss these challenegs and site, integration of the courses into more comprehensive computer driven communication environments can be difficult and cumbersome. Concluding that some schools may find it more beneficial to use a third party service to provide the necessary online course and IT support if the school does not have an IT department, does not have a large enough IT department, or has an insufficient IT budget. Research showed that this is the case for about twenty percent of the schools surveyed.

Recommendations

Comprehensive understanding of current and future trends of these parameters not only strategically aligns universities for long-term survival. It also helps universities navigate through the tough economic times everyone is currently experiencing. Watching the trends and understanding what is coming, what is useful, and how to contain it within a limited budget are challenges all schools face. Furthermore, the inclination that future education will be based more on research, points clearly to a proliferation of technology at higher education institutes. Ironically, most engineering and technology schools are among the first to encounter the impact of this rapidly changing technology because of the nature of their disciplines. This study clearly reveals that laptops or some other computing device, regardless of their being required or not are a key element in the educational process. Properly adopting related policies and establishing effective service infrastructure based on the decision made from the identified trends will certainly provide a better strategic position for the future of engineering and technology education.

Conclusion

In conclusion, the current trends and demands for engineering and technology education are centered around IT. Online courses, software deployment, laptop polices, and network security and control are clearly the concerns for most. With growing competitiveness in higher education, in addition to the ultimate need to provide quality instruction, these trends become the most important parameters in facility management of information technology for higher education institutions.

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