# 2006-1875: LESSONS LEARNED CREATING A LAPTOP POLICY FOR COMPUTING PROGRAMS

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# Lessons Learned Creating a Laptop Policy for Computing Programs


## Abstract

The Division of Computing Studies at Arizona State University at the Polytechnic campus is in the process of instituting a laptop requirement policy for undergraduate and graduate students. The paper describes the motivation and rationale for this policy, the information gathered during the feasibility study, and finally the policy itself as well as a rationale for the decisions. The paper provides others considering similar requirements the experience gained by this organization. The study also considered a campus-wide laptop policy, but concluded there were too many unanswered questions and risks which are both discussed in the paper.


## 1 Introduction

The Division of Computing Studies Arizona State University (ASU) at the Polytechnic campus offers Computer Science programs at both baccalaureate and masters levels. It distinguishes itself from the traditional Computer Science programs on the Tempe campus in two respects. First, the predominance of courses are problem-based, hands-on, and utilize computing best-practice tools, methods and languages. Second, upper-division and graduate offerings earn their place in the curriculum by representing concepts and technologies widely used in the computing profession. The primary bachelor's program is the BS Applied Computer Science and the primary graduate program is the Master of Computing Studies. The Division has roughly 120 undergraduate students and 60 masters students, as opposed to over 1200 students in the traditional Computer Science programs offered at the Tempe campus. The Polytechnic campus of Arizona State University is located in East Mesa and enrolls nearly 5000 students, whereas the university totals over 60,000 students. The campus is less than 10 years old and is rapidly growing at a rate of roughly 20% per year. Many services, including most IT, administrative computing support, admissions, financial, as well as degree analysis and awarding are provided by Arizona State University at the Tempe campus.

Like all ASU students, students at the Polytechnic Campus are given 200 megabytes of network-accessible disk space to perform and save work. In addition, IT staff installs more than 100 software products as requested by academic departments on ASU computers which students can access during supported hours. As is typical in any IT environment, computer users have restricted access to computing systems and cannot perform certain functions, including the installation of new software and the configuration of most installed software applications. Such restrictions are standard practice for any IT organization, academic or otherwise, to ensure that one user does not break or corrupt a computer for another user. Further, IT asks departments to provide them software five months before the semester begins.

Due to the nature of Division courses, faculty members have issues with these restrictions, notably the space for student work, the ability to configure software, and the advance notice for software installation. This paper discusses the Division's motivation and steps to create a 1:1 laptop policy. The next section briefly details the Division's motivation for the policy. Section 3

discusses the study performed by the Division to understand options for the policy. Section 4 presents the Division's policy and rationale for the decisions made.

## 2 Laptop policy motivation

The Division had several discussions surrounding the motivation for a laptop policy. The discussions are categorized in this section and provide the motivation for the laptop proposal.

- The laptop policy helps ensure students are proficient with the use of computers. It provides them continuous, 24/7 access to explore and discover computing and also requires them to use the computer in a directed, educational manner that supports course activities and research.

- Engineers and technologists are expected to become experts at the tools of their trade. The laptop policy enables students to manage their own computing/information environment, including software installation, configuration, and integration, which cannot be accomplished using resources directly available from ASU.

- The laptop policy addresses the Division's unique computing demands and provides access to the latest industry standard software at no cost to the student. Appendix A lists the current software requirements for Division courses.

- A laptop policy permits faculty and instructors to make more immediate decisions on software selection for their courses, both software products and versions of those products. Students in group projects are also not constrained to software already installed on the campus builds.

- The laptop policy increases the opportunity and impact of student mentoring. Division faculty members have found that assisting students with laptops provides optimum mentoring experience as students bring their work and issues directly to the faculty member for help. Students using their home computers or even ASU computing environments must instead bring execution snapshots describing errors and issues which provide less realistic mentoring scenarios between student and faculty member.

- Finally the laptop policy provides unique pedagogical opportunities to the curriculum including in-class projects and the taking of on-line quizzes and tests and presenting solutions to projects.

## 3 Laptop study

To formulate a policy, the Division wanted to understand what decisions needed to be made and what options there were for those decisions. The Division conducted surveys of other universities and programs with laptop requirements as well as it's own IT organization. Several universities and programs were consulted in the creation of the Laptop Policy. Some were contacted directly while others were reviewed on line. This section summarizes the results of those discussions. The universities and programs reviewed were Arizona State University Carey School of Business, Arizona State University College of Law, Clemson University (Laurie

Sherrod manager of their pilot laptop program), Longwood University, Minnesota-Crookston, Northern Michigan University, Rensselaer Polytechnic Institute, University of Connecticut, University of Minnesota Law School, Virginia Tech College of Engineering, and Wake Forest.

### 3.1 Student and Parent Response

When asked about negative response from students and parents to a laptop policy, most programs and universities stated the response several years ago was extremely negative, almost hostile. Some spoke of "red-faced, jaw-clinched parent back in 1998" complaining about the cost of education. However, in recent years, all agreed the attitude has reversed with parents of incoming students encouraged by a laptop initiative. Having a laptop policy has become a selling point for many programs as potential students and their parents assume such programs provide a more advanced, technical educational experience. Some programs also cited reduced laptop costs as a factor in reduced complaints.

### 3.2 Vendors

While most programs and universities partner with a vendor, they were split on their vendor selection. Of those program reviewed, there was an even split between Dell and IBM and no programs partnered with any other vendor. IBM and Dell both provide comprehensive programs for higher education so it is not surprising they were the leading vendors. In addition, most programs strongly recommended their vendor so it appears both Dell and IBM have strong followings from their customers.

Programs and universities were also split over mandating a specific vendor versus letting students choose a laptop vendor. Those that mandate a specific vendor typically collected laptop money directly from students and then distributed the laptops to students (section 3.4, discusses purchasing options in more detail). Programs that did not mandate a laptop vendor found that a majority of students select the campus recommendation.

### 3.3 Imaging

Through their campus programs, laptop vendors offer the ability to deliver laptops pre-built with an image provided by the university. Several programs and universities strongly recommend the pre-image option to save student frustration with installation and configuration as well as to reduce service and help desk calls. Some programs preload separate partitions for system files and user data, allowing the system files to be more easily re-imaged in the event of security problems.

Several programs also mentioned the fact that there will be small problems with the image. Delivering laptops to students incrementally over the summer, as opposed to all at once the week before classes, allows early feedback on the image and the opportunity to update it. Despite imaging problems, the modifications required to fix image errors is significantly less effort than the installation and configuration of a raw laptop for students.

### 3.4 Laptop Purchase Options

The study revealed many pricing options. The two general pricing categories have the students pay either the university or the vendor directly. In the simplest model, students purchase laptops directly from the vendor. Students own their laptop and are responsible for support and insurance (theft, loss, damage) costs. The student has a relationship with the vendor, not the university, with respect to selection, purchase, shipping, warranty, etc. This option allows students to use their own laptop or one provided by their employer. It also allows students the freedom to choose the type of laptop and accessories (additional batteries, DVD vs. CD) appropriate for their particular usage.

Many programs issue the laptops themselves at the beginning of the semester. The university may choose to absorb the cost or add some form of technology fees. With fee-based programs, full-time students are typically required to pay the fee and part-time students may or may not pay the full fee or in some cases pay a reduced fee. By purchasing directly, the university can retain ownership of the laptop and acquire bulk coverage for support, damage, and theft. Students are usually responsible for a deductible in the case of neglect or theft. Finally, some programs and universities choose to lease laptops for two, three, or four years instead of purchasing them.

Leased-based programs where the university or program retains ownership adds institutional responsibilities, but simplifies student burden in planning the acquisition. Policies must be in place to distribute and then retrieve laptops as students move in and out of enrollment across semesters and in the summer. For example, some programs require students to return laptops if they are not enrolled in classes, including summer sessions. Facilities must exist to store and distribute laptops and other peripheral items (power supplies, cables, documentation, restore disks, etc.) and ensure they are available. In addition, the university or program becomes the responsible party for support and assistance with the laptop. Finally, distributing laptops to students when they arrive the week before classes is a logistical problem. It also creates a huge spike in service problems and does allow problems with a standard image to be revealed earlier.

### 3.5 Support and Service

Many programs and universities provide on-campus support. Support among programs and universities included student orientations, a help desk that answers simple questions, and a full, on-site service center. Vendors provide certification that allows on-site servicing of laptops (that have appropriate support contracts from the vendor) with reimbursement on a per-incident basis. Reimbursement is typically $45-$55 for each incident. No program was able to cover the service center operational costs from reimbursement alone and supplemented with money from the university or through student fees. All programs recommend students purchase complete coverage from the laptop vendor and some mandate complete coverage. Bad disk drives were by far the largest service item self-supporting programs encountered so encouraging students to perform backups was also strongly recommended.

### 3.6 Software Licensing

The only bulk license purchased by universities was the Microsoft Campus Agreement to provide Office, Visio, .NET and other common software products. Individual programs with

university-wide laptop programs also have additional software requirements and fees for students. For example one engineering program requires students purchase the 'Engineering software bundle' for $500 which contains Microsoft Office, Microsoft Visio, and other engineering software products. The fee is automatically added at student registration and students can download the software or purchase a CD (to support extended campus students).

## 4 ASU Division of Computing Studies Laptop Policy

The study results discussed above provided valuable information to create a laptop policy. The Division policy requires students beginning in Sophomore-level classes to have a Windows-based laptop. Students are expected to install and configure software, develop applications, present results and problems both in-class and during office hours. Each spring the Division of Computing Studies provides a minimum hardware specification (CPU speed, memory, disk and required peripheral (CD or DVD)) that ensure laptops meeting this specification will be sufficient for the Sophomore student's remaining three years in the program. Students must ensure they have a laptop available by purchasing a next-day, on-site service contract and performing appropriate backups.

The remainder of this section provides the rationale for this policy, including the academic motivation, other considerations regarding brands and purchase options, and available support.

### 4.1 Academic Motivation

To understand the academic motivation, the Division needed to assess how it would leverage a laptop policy. Initially the Division faculty created a Software Course Requirements table listing software applications used within Division courses (see Appendix A). Many courses have significant software requirements. Campus IT requires that requests for software to be installed on their build be made several months prior to the start of the semester. Portions of cost for expensive packages are charged to the unit. IT supported workstations prohibit students to configure applications and access to administrative functions. Both of these are important to computing programs. Many problems exist with this constrained approach, such as computing faculty do not plan courses sufficiently far in advance, software package versions change rapidly and computing faculty commonly track those changes and utilize new features each semester, some faculty may not know which courses they are teaching far enough in advance, and even new permanent or temporary faculty may be unable to adhere to such schedules.

The laptop policy also allows students and the various student mentors, be they faculty, teaching assistants, tutors, or other students, to more easily collaborate on student problems in an appropriate contextual environment. Without a laptop policy, students and mentors discuss problems and issues using paper listings of code and errors. This does not address problems that arise from installation, configuration, and integration inconsistencies among software components installed in the system. Configuration and integration problems are common in practice and experiencing them in an academic environment has great educational value.

The final academic motivation, and perhaps the strongest, is the educational benefits students receive administering their personalized computing environment. Computing and technology professionals spend significant time working with computers and the software applications that

run on them. The laptop policy provides a necessary vehicle for the practical computing experiences and a contextual computing education.

### 4.2 Laptop Brand, Form Factor, and Cost

The policy requires a laptop running the latest Windows operating system with specified minimum performance requirements (disk, memory, CPU, and peripherals), but does not mandate a specific vendor or product. Macintosh (Mac) computers and other form factors (e.g., tablet PCs) were considered, but the Division faculty raised concerns about the Mac's ability to support all Division software and the computing power available in tablets. Windows computers dominate the Division's computing resources and it is the platform on which faculty have installed the software applications and will demonstrate them to students in class. Other form factors, including tablets, were discarded for their limited computing power and their price point for computing power.

The Division's Laptop Policy intentionally permits students to purchase a laptop that does not meet specifications. The minimum specifications are designed to guide a purchase in the sophomore year that ensures that laptop's features will be adequate until graduation three years later. The policy is flexible and permits students to purchase cheaper laptops early in their college careers with the expectation the computer will likely need to be upgraded before graduation.

Another reason for the explicit flexibility is enforcement. The Division will not enforce the policy and will not remove students from the program or specific classes if they cannot show evidence of a laptop. Instead, the policy's goal is to set expectations on the computing resources available to students for success in Division classes. One can view the policy as being similar to a required textbook. Students may choose not to purchase the book, but understand they are limiting their ability to be successful in the course.

### 4.3 Laptop Purchase and Support

The policy states students will purchase support through vendors and must select the 3-year, next-day, on-site service contract. These contracts are relatively cheap ($100-$150) and provide students with the ability to quickly return to a working environment in the event of a failure. As in industry, students are responsible for meeting deadlines and next-day service contracts are a very cost effective hedge for ensuring they can meet such obligations. The Division will also provide, on its web site, a Laptop Help Page with information about computing at ASU, information about software within the Division, and some best practices for owning and maintaining a laptop. The best practices information will include administration, backup and restore policies and procedures, and laptop security.

### 4.4 Software Licensing and Distribution

Many of the Division's software products are available through the Internet. Other software is obtained through the Division's laptop coordinator who loans CD's to students for the licensed software. Many software products, both open-source and commercial, do not require license keys and can simply be installed on student computers. There are two options for the remaining, licensed, software products, a 'node locked' license and a license server. For some products, the

Division uses node locked licenses that are obtained from the vendor, usually through a web site, and assigned to a specific machine. For other products, the Division has placed license files on IT's license server machines. With a license server, faculty do not need to obtain and manage licenses given to students, however students must be connected to the Internet to use the product. With node locked, faculty members are burdened with obtaining licenses individually for student machines.

### 4.5 Campus Infrastructure Impact

Several items must be considered with respect to the university impact for the laptop policy. While some Polytechnic students already have laptop computers on campus, adding more laptops through a policy could strain the campus infrastructure, particularly the demand for wireless connectivity and power.

It is expected the additional laptops from the Division's policy will not significantly impact the campus infrastructure as Division students represent less than 3% of the students at ASU's Polytechnic campus and many Division students already bring laptops to campus. However, in certain concentrations, wireless access could be a concern. Concentrations of students in classrooms may overwhelm individual access points during class periods. Power is also a concern. Adding laptops to classrooms will add a strain on available outlets. One option is to put power strips in rooms hosting the most Division courses.

## 5 Results and conclusions

The Division considers itself well positioned to execute the laptop initiative described in this paper. The policy is currently moving forward within the ASU campus infrastructure and the Division hopes to have the policy in place for Fall 2006. The Division has defined clear goals for their Laptop Policy and produced a policy that has little impact on Division and Campuses resources. The Division has addressed the technical issues including software licensing, purchasing and support, and financial aid. The remaining issues are procedural in nature and include producing the Laptop Help Page for Division students and determining a strategy for non-CST majors who take CST courses without a laptop. This may include not requiring laptops for non-major courses.

### 5.1 Polytechnic Campus

The study also considered a laptop policy for the entire Polytechnic campus. A laptop policy for the campus is compelling. Many technology-based programs and campuses are adding laptop initiatives to provide better educational opportunities for their students. In reviewing these programs, several of them have complex infrastructure that support their initiatives, adding costs to the delivery of the laptop program. The study concluded there were many unanswered questions and risks that must be resolved for a campus-wide laptop initiative and they are listed below.

- What are other programs needs and objective for a campus-wide laptop initiative?
- Will the policy specify a specific type of computer (Windows, Mac, Tablets, etc.)?

- Will the policy recommend a specific laptop vendor? If so, are students required to purchase the selected vendor models?
- Will the policy create laptop images with installed and configured software? If so, who will create it, will there be images for different programs, and how will licensing costs reimbursement be handled?
- How will payment and distribution be handled? Will students or the university purchase and own laptops? If the university directly purchases laptops, what are the policies for distribution and student possession across summer sessions or semester in which they are not enrolled? What is the strategy for keep adequate supply of laptops and associated peripherals (power supplies, cables, etc.) to support late enrolling students?
- Can students use their own or a work-provided laptop? Would any technology fees be waived for these students?
- Will ASU Polytechnic provide laptop support and services? To what level? At what expense and how will the costs be covered? Several options include:
    - Online tutorials on laptop support and maintenance best practices
    - Laptop orientation sessions
    - On-campus help such as a help desk or on-call residents in the dorms
    - Vendor-certified support center
- How will software be licensed? Since current licenses may not allow installation on student-owned computers, how will those licenses be re-worked and who will pay any additional costs? Are there opportunities to purchase volume licenses with programs across the all ASU campuses?
- How will classrooms be reconfigured to accommodate laptops? Will all computers be removed and the cabling reconfigured to better serve laptop users?
- What additional wireless and power infrastructure is required to support the added laptops? Where are the important "hot spots" – classrooms, meeting areas, etc.?

## 5.2 Results

While the Division is well positioned to execute the Division's 1:1 Laptop Policy, implementing a campus-wide policy has several open questions and risks to address. To mitigate some of those risks, the Division of Computing Studies Laptop Policy is being used as a pilot for a campus wide laptop initiative for the Polytechnic campus. The pilot would assess campus infrastructure including wireless connectivity, support services, and access to resources including shared drives, email, and printers. A pilot would also assess other risks including software distribution and support. Division students serve as excellent pilot subjects are they are expected to be more proficient at computing and managing a computing environment and were a significant motivation for the Division's laptop initiative.

## Appendix A: Division Software Course Requirements

| Software | License | Courses |
|---|---|---|
| General Software Development | | |
| JDK | open source | All |

| | | |
|---|---|---|
| Ant | open source | All |
| Eclipse and various plugins | open source | All |
| Cygwin | open source | All |
| SSH | free | All |
| MSOffice | by purchase @ ASU bookstore | All |
| PDF generator | Adobe or open source | All |
| | | |
| Enterprise Computing | | |
| Tomcat | open source | 420, 425, 428, 533 |
| Apache Web Services – Security, Reliable Messaging | open source | 420, 425, 428 |
| ServiceMix Enterprise Service Bus | open source | 420, 425 |
| OpenJMS | open source | 420, 425 |
| JBoss | open source | 425, 428 |
| Hibernate | open source | 425, 533 |
| postgres | open source | 433, 533 |
| JFaceDBC/SQLExpolrer | open source | 433, 533 |
| Jmeter | open source | 425, 533, (420) |
| OptimalJ | campus license | 425 |
| JProbe | 15-day trial | 425 |
| Visual Studio .NET | MSDN | 326, 427, 556 |
| Axis Java Web Services | open source | 420, 427, 428 |
| Rational Software Architect | IBM Academic Alliance | 425 |
| | | |
| Software Engineering | | |
| Rational Rose | IBM Academic Alliance | Research (XMI generation) |
| Visio | MSDN | 315, 316, 415, 416 |
| MS Project | MSDN | 315, 316, 415, 416 |
| Dia | open source | 315, 316, 415, 416 |
| Omondo (UML) | open source | 315, 316, 415, 416, 383 |
| Tool-in-a-box | | 315, 316, 415, 416 |
| Checkclipse | | 315, 316, 415, 416 |
| Junit | open source | 315, 316, 415, 416 |
| jfcUnit | open source | 315, 316, 415, 416 |
| CVS Client (CVSGui) | open source | 315, 316, 415, 416, 383 |
| Instant Messenger | open source | 315, 316, 415, 416 |
| | | |
| Hardware/Embedded Systems | | |
| Rational Rose Realtime | IBM Academic Alliance | 540 |
| LogicWorks | provided with textbook | 150 |
| Altera Quartus II | provided with textbook | 350 |
| PCSpim | open source | 364 |
| Silos, Verilog HDL Simulator | provided with textbook | 452 |
| sdcc | open source | 486 |
| teraterm/hyperterm | open source | 486 |
| Palm OS Emulator | open source | 441 |
| IBM WSDD | 60 day trial | 441 |
| Palm Garnet OS | open source | 441 |

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|---|---|---|
| Network and system monitors | open source | 448, 489 |