Trends in Computer Science Laboratories

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Abstract

Not too many years ago, computer labs formed the heart of CS departments. Our labs provided high end computers and software that were not readily available elsewhere. Recent economic and technical developments have dramatically changed the way our labs are utilized. The current reality for many colleges and universities is one of dramatically shrinking resources, and finding dollars to refurbish computer labs is challenging. This lack of resources is occurring simultaneously with an exploding number of student laptops on campus, and new technologies like remote desktops and system virtualization. Together, these are having a profound effect on how our students work, and departments need to carefully think through how to best develop labs and other spaces to meet current and future needs. This panel will explore the issues and tradeoffs.

1 Paul Wagner

We have evolved our labs in several ways in the Department of Computer Science at UW-Eau Claire, including:

- creating a laptop-only lab with comfortable furniture in several group configurations to encourage mobile group work;
- added support for laptop computers in our other labs, by adding extra video cables (to hook laptops to larger monitors), power, and wireless connectivity;
- increasing our use of virtualization technology, both replacing physical servers with virtual VMWare servers, and allowing students to work with virtual systems in courses like Computer Security (for tool exercises), Database Systems (for database creation, administration and tuning), and Web Frameworks (for having students configure and manage their own web servers); and
- adding large group "conference" space within one lab to promote a professional group environment.

We see a number of issues with our labs and their technology, including:

- how best to support new mobile devices such as table computers and smart phones;
- how to maintain positive work environments in our more "informal" labs;
- whether we can and should move toward a more "studio"-oriented environment where faculty/student interaction in labs is the norm rather than one day out of the week; and
- whether we can maintain control of our labs in a university environment where space and resources are becoming more scarce.

2 Kent Lee

Luther College Computer Science is fortunate to be housed in the Olin Building on campus which was built in 1994 and serves Mathematics, Computer Science, and Business. Our main lab has 35 computer seats running the Linux operating system. We are in the middle of planning a renovation of our main computer lab. Currently the lab is set up so that teaching within the space is less than ideal. Forty feet or more separate the white board and projection screen from some of the seats in the lab.

As part of the renovation, six computer seats will be removed leaving 29 seats in the room. This will open up part of one wall on the short end of the room. In addition, the projection will be on a Team Board IR with a 110" diagonal making the projection ideal for interactive demonstration and teaching. A short throw projector will be installed to allow teachers and students to stand in front of the board without casting a shadow. There will also be a whiteboard installed next to the Team Board. A podium will be switchable from either a Linux machine or a laptop.

It seems over the last few years that more and more students bring their laptops to class. When a programming environment does not require Linux, this seems perfectly

acceptable, but much of what we care to do in Computer Science is free or easier on Linux and I have no interest in configuring Linux or solving Linux installation issues on student's laptops.

Our CS1 and CS2 classes do not require Linux since we use Python as our introductory language and Wing IDE 101 from wingware.com provides a very nice Python development platform. Students who do not have their own laptops can use Linux and other students can use their own laptops in our interactive laboratory environment. Our third class is an introduction to both Java and Linux so students all get some experience using Linux by this third course in the major. But of course, Java can be developed anywhere, so requiring students to use the lab does not seem to make sense.

One concern I have is the lack of a centralized place that all computer science students must work. I believe that sense of community drove many students to participate in computer science programs that might not have otherwise participated. I wonder sometimes if the advent of personal computers and the corresponding decline of lab usage, might have had some impact on the declining numbers of female students choosing to study computer science over the last couple of decades. At Luther we have seen some recent increase in the number of female majors, but certainly not enough. I do believe that laboratory space and a sense of community are vital to the strength of any computer science program.

As you can see I have many questions about the future and not many answers. In general, I think the word is getting out that computer science is a great discipline especially when things like the Watson Jeopardy Tournament are in the news. What will the future hold for us as teachers and students in computer science? I would never try to predict too far into the future, but I think the future will definitely be exciting and bring lots of surprises.

3 Terrence Mason

UW-Stout is a laptop campus meaning that all students (not just CS) have a laptop. This supports the pedagogy of active learning by immediately practicing what you have learned. The boundaries of lecture and lab can be crossed quickly to gain hands on experience with new concepts. Many current technologies including Eclipse with Android Emulator, Visual Studio Express, and Virtual Appliances support common development environments directly on the student laptops. This keeps the students actively engaged in the course by implementing and experiencing code based on the current topics. Students with laptops prefer to program on their own computer versus using a lab computer.

Why do we have a computer lab when students have laptops? Students still require high end computers with special software (game development and graphics) beyond laptop capabilities. Pairs can share a single high performance lab computer and it supports team project work to build relations through group projects, pairs, and common hang out (not a

lab but common space with wireless). It is important to provide a common location for students to complete assignments and work on programming. Ideally, some saved funds on fewer computers could be used to create a Supplemental Instructor position to extend office hours in commons area to complete assignment and help new students. Attempting pairs programming on student laptops seem to require stronger enforcement as students tend to type side-by-side instead of as a driver/navigator team. Thought should be given to creating a mechanism to share jointly developed code.

4 Stuart Hansen

The number of laptops on our campus is growing exponentially. It is not unusual to walk into a CS class and find over half the students with laptops open and in use. Some students use them for passive activities like taking notes or following PowerPoint presentations, but laptops also serve to create a very dynamic classroom climate. For example, when presenting code examples, students download and run the code at the same time the instructor is demonstrating it. They lookup online documentation and love to point out corrections and improvements to the instructor's approach. These types of learning activities are not new, but are now happening in almost every class, not just labs.

There are also social issues presented by the laptop phenomenon. In years past, late night sessions implementing some obscure dynamic programming algorithm created camaraderie amongst the students, that help carry them through their studies. It is still important to encourage our students to make these social connections. To this end, we have established a laptop area within our lab, containing a Gigabit Ethernet switch and power for up to ten laptops. A recent visit to the lab found ten students working on their laptops and only one student working at a higher end workstation.

An additional technology that affects the way students work in our labs is remote desktops. These allow us to easily give students 24/7 access to lab resources. They can be a great service for students with work and family obligations.

Virtual machines add still another level to the dynamic restructuring of our labs. We have started creating virtual servers and workstations for individual course needs, such as in database, web development and security courses. Besides the obvious cost saving in having fewer physical servers, additional advantages are that we can easily create a base image and rollback to that image whenever necessary, and that we can create custom environments for each student that can be readily configured and deployed based on various course goals.