

Living on the Bleeding Edge: Creating and Managing Highly Specialized Student Labs

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ABSTRACT

As use of technology increases in the curriculum, more faculty want to use increasingly specialized hardware and software to meet their educational goals and keep their students on the leading edge of the technology used in their fields. The support needs of these highly specialized uses are usually well beyond those of general labs that central computing groups may maintain. Many individual academic departments do not have the expertise or resources to maintain lab facilities for a large number of users. Especially in the growing multimedia field, multiple departments may have similar or overlapping needs, making single department facilities an inefficient use of resources.

This paper will compare the issues involved to create and support two such highly specialized facilities, one at Carnegie Mellon University (CMU), and one at the University of California at Los Angeles (UCLA). Although the facilities presented are multimedia based, many of the issues are the same for any facility designed to meet highly specialized needs.

Keywords

Labs, specialty, high-end, multimedia, video, audio, digital media.

1 INTRODUCTION

As technology emerges, faculty want to use the best tools available to aid in their pedagogical approaches. Faculty also recognize that students want experience with technology used in professional practice for their resumes and portfolios. Technology once reserved for dedicated professionals in their respective fields, is now expected to work in the hands of even the most novice user. There is an expectation that all of these tools will be as readily available to today's college student as easily as word

processing software was in the past. The reality is that brand new technology, and more "advanced" features present unique support issues in any environment, but especially in public labs used by large and varied student communities for a wide range of purposes. This paper will look at two high-end/specialized facilities at different Universities from their creation several years ago to future plans. Both have struggled to provide access to the latest digital technology to their student constituents in a manageable, public lab environment. These facilities are managed by different functional groups at each university. At CMU, the College of Fine Arts Multimedia Studio is operated by Computing Services, which provides central computing support and infrastructure for the campus as well public labs, called Clusters, for general student use and instruction. At UCLA, the Center for Digital Arts is operated by the School of Arts and Architecture without direct support from a central computing infrastructure.

2 CARNEGIE MELLON UNIVERSITY (CMU)

CMU is a private, national research university of about 7,500 students (4,700 undergraduates) and 3,000 faculty, research and administrative staff located in Pittsburgh, Pennsylvania. Sitting on 103 acres, the fifteen academic buildings house the university's seven colleges and schools, one of which is the College of Fine Arts (CFA).

2.1 Computing Services

The Computing Services division is a support unit immediately under the university Provost. Computing Services provides network infrastructure, central computing, such as e-mail, and other general computing support. Two separate departments within the division work together to maintain the general computing labs, called "Clusters". The Cluster Services group [1] is responsible for operating nine permanent clusters and one virtual cluster (laptop checkout) of various sizes (14-110 machines/site). The sites contain approximately 400 machines across three platforms in approximately equal numbers overall: Macintosh, Windows NT/2000, Andrew. The Applications Software Group [2] within the division purchases and coordinates university-wide site and volume software licenses, and works closely with Cluster Services to make available over 200 software titles on the Cluster machines, most of which are commercial packages. In addition, many academic departments maintain their

own computing facilities to meet the specific needs of their constituents and/or provide additional access to computing for their constituents' exclusive use.

The Cluster Services group has 4.5-5 FTE (Full-time Employee), and approximately 50-60 students who provide cluster staffing, management, and other related projects. The Applications Software Group has 4 FTE: 1 manager and 1 software specialist for each platform: Mac, Windows, UNIX, and 1-2 Student Software Assistants.

Cluster Services' constituency is primarily undergraduate classes (teaching and assignments), with a handful of graduate level classes. They support four types of activity, in the following priority:

1. Academic Teaching: Credit bearing courses
2. Student Support: Academic assignments
3. Internal Support: Productivity software training, product testing, etc
4. University-sponsored functions

2.2 CFA Multimedia Studio (CMS)

2.2.1 Overview

Opened in the Fall of 1997, the College of Fine Arts (CFA) Multimedia Studio [3] is located on the third floor of the College of Fine Arts building. The facility is co-managed by Computing Services and the five schools of CFA: Architecture, Art, Design, Drama, and Music. Although most of the schools have small graduate programs, the population served is vastly undergraduate. The primary audience of the CMS is classes in CFA, and other academic classes that need to utilize the multimedia applications and hardware available there. As a public Cluster operated by Computing Services, it is available to all members of the campus community. The total space is approximately 2,500 square feet. It includes:

2.2.1.1 Labs:

- 21 Macintoshes in a semi-classroom configuration with resident projection connected to the Instructor podium. 10 machines configured for use with basic MIDI keyboards. Software includes general productivity, desktop publishing, graphics, multimedia, sound, video, MIDI, and 3D modeling. 645 square feet.
- 20 Windows PCs in a lab-style configuration with resident projection (originally each half was a separate platform/classroom with no divider: Windows NT and SGI Octanes). Software includes general productivity, desktop publishing, graphics, multimedia, sound, video, 3D modeling and animation. 590 square feet.
- Seven Macintoshes in Advanced Sound and Video Lab (individual workstations and peripherals): four for Digital Video, three for Digital Sound and MIDI. This room also contains two linear editing workstations. 470 square feet
- One Macintosh in a Sound Isolation Booth that includes a further insulated sound room with connections into sound system for audio capture. Includes ProTools Project and Sample Cell cards for advanced digital audio editing, as well as CD-R and DAT deck. 100 square feet.

2.2.1.2 Other Facilities

In addition, a black and white printer (including 11"x17") is available in the hallway (530 square feet). The student Computer Consultant's office (140 square feet) contains a large format 36"-wide color inkjet for printouts on a cost-recovery basis, manuals, cables, and other items for checkout.

The public hallway is also used for pin-ups, small displays, etc, as well as storage cabinets for some printer supplies and less valuable lending items such as tripods.

No server space or guaranteed hard drive space is provided by Computing Services. Students may use personal removable media or servers operated by individual departments to store their files.

2.2.1.3 Current Staffing

Currently, 1 FTE CMS Administrator, whose salary is paid for by the CFA Dean's office, manages the facility. Cluster student consultants staff the Cluster during the academic year, along with many of the other Clusters. Student Cluster Managers supervise overall operation of the Cluster related to general computing, as they do in Computing Services' other Clusters. The CMS Administrator is there to handle incidents and situations that are beyond the scope of general computing. Hardware and Software support is handled by Computing Services staff, in coordination with the CMS Administrator, who serves as the front-line technical support for the facility.

2.2.2 History and Initial Vision

The impetus for this facility came from the need to have a "multimedia" facility in the University as a means to unify the five schools of the College of Fine Arts in a joint participation effort. Other concerns were to foster inter-disciplinary curriculum among the five schools and to provide specialty equipment for student use and borrowing. The project was put on a fast track schedule for completion by the start of Fall semester 1997. Committee meetings to plan the facility began in January 1997. An existing small Computing Services' Cluster, the School of Art's Cluster, and assorted offices needed to be demolished to create the space, but these rooms were in use until the end of the Spring semester. The area was gutted and completely renovated during the Summer of 1997.

We needed to work with all the groups to develop a single vision, to learn each groups' needs and end goal. What we had was a foundation of a vision: to develop a Multimedia facility designed to build high-end multimedia specific skills to CFA students, and to establish or strengthen working relationships among all groups involved. As our experience indicates, this was too general to provide proper direction.

2.2.3 Evolution

Although the physical layout hasn't significantly changed since inception, the functions of each room have been muddled, except for the advanced rooms where the machines were focused into very specific specialties. The is basically operated by Computing Services, with a CFA advisory board for planning and enhanced communication. For the first two years of creation and operation, the budget for the CMS was funded by a special

presidential grant. At the end of the two years, financial responsibility for the CMS was added to the overall Clusters budget, with little increase in the overall amount allocated to Clusters.

2.2.3.1 *Vision*

Although we have only begun the process of developing a formal Vision Statement, the lab is to provide a facility for teaching and student work that goes beyond general public computing labs.

2.2.3.2 *General Layout*

As originally envisioned, the facility was to consist of multi-purpose machines in each room, with each room being geared to a different level of experience. The large Macintosh classroom would be for introductory classes, the Windows/SGI lab for mid-level classes, and the Advanced Lab & Sound Booth for advanced classes/work in video, sound, multimedia, CAD, and 3D modeling. All machines within a room would be configured for all functions in that room, i.e. all eight Macs in the advanced lab and sound booth were configured with all available multimedia applications, CAD, 3D modeling, Digital Video, analog video, digital sound, and MIDI applications.

The original designation of the rooms as entry-level, etc. has proved to be a misnomer, as even introductory courses enter the worlds of Digital Video and 3D modeling, or platform needs/preferences dictate rooms, regardless of level. Some software has also been relocated as part of the separation of functions described in the next section. This year, in part to increase the number of machines available for Digital Video, the Mac Classroom was upgraded to new PowerMac G4s with DVD-RAM drives to provide adequate removable storage for students. Although the room does not have any permanent DV decks installed, a DV camera can easily be hooked up via FireWire or the students can bring their footage on removable media after capturing it in the Advanced room (DVD-RAM drives are also being added to the "Video" machines for this purpose). The rooms now serve overlapping levels and functions, each with different emphases, with the "Advanced Lab" being more specialized in terms of media capture/output capabilities.

2.2.3.3 *Video and Sound*

Especially on the high-end machines, the goal of multi-purpose machines proved to be unfeasible, at least with the technology available at the time. Each of the Digital Video and Sound/MIDI applications wanted explicit settings made, often in contradiction to each other, such as source of sound input. Some functions required disabling network connectivity, presenting a number of challenges to maintaining the machines with our existing tools of RevRDist, KeyServer (a must to prevent piracy), and network login to ensure only CMU affiliates used our facilities. A number of techniques, such as bootable removable media configured for only certain functions (i.e. Digital video capture) were developed and evolved over time. At best users had to spend several minutes (or more) to configure the machine towards their specific need, often without being fully cognizant of all that they would need to adjust. At worst, nothing functioned well/at all, and led to increasing frustration for all involved. Despite education efforts, many remained unaware that they

needed to checkout the removable media and boot them in a different manner. Troubleshooting problems with these machines was also difficult because they were unique configurations, only present in the Cluster, so all work had to take place in the Cluster, working around classes and patrons. Tech support callbacks were particularly difficult to coordinate. Since then, we have included test machines in purchases. These reside in/near our office area, although some peripherals and cards are too expensive to purchase a "spare" of. The machine in the sound isolation booth remains fairly unique.

After several consultations with Apple engineers and outside experts, we came to the conclusion that the machines were trying to fulfill too many functions that are usually relegated to separate machines customized for each function. After struggling with this system for two years, we proposed splitting the functionality of the machines into Digital Video and Sound/MIDI and removing all the general multimedia and other software not directly needed for the proscribed function from the machines. This made a small teaching facility effectively smaller, as instead of seven (plus sound booth) machines to teach/work on at a time, they were left with four of each (one of the four sound machines being located in the sound booth, therefore not usable for hands-on group instruction). At the same time, the Digital Video machines were replaced with PowerMac G3's with built-in FireWire and large hard drives, improving performance and stability and decreasing vendor finger-pointing that we had with the previous systems. This strategy has solved most of our technical problems, albeit reducing the total number of machines for each function.

2.2.3.4 *Staffing*

The School of Art initially committed their Facilities Manager to .5 FTE time to support the Cluster, but the individual did not have the technical skills necessary for the main function desired- maintaining the SGIs, which were an unsupported system type on our campus. In the first semester, several Computing Services staff members devoted 85 to 90 percent of their time to CFA vs. the eight other sites and other duties, although that was never the intention. The Advanced Labs and SGIs were not available to the public for the first one to two months of Fall classes due to hardware delays, configuration issues, etc. as we learned enough of the technology to set it up. Ongoing support continued to take up a disproportionate amount of time for several Computing Services' staff members well after the Cluster opened fully.

Many of the student consultants became frustrated with the user expectations of specialized knowledge, additional duties, and abuse from faculty and students when they worked in the CMS. This caused low morale and a large amount of turnover, some of which affected overall Cluster staffing levels due to the integrated nature of the staffing model with the other Clusters. The Advanced rooms of the CMS were only open when the Cluster was staffed, making it one of the highest priority Clusters for staffing, often resulting in pulling someone from another shift elsewhere.

In late 1998, approval and funding from the CFA Dean's Office was finally made for a full time staff Administrator for the CMS. Previously, CFA had been funding the salaries for staffing during the summer with CCons (student Cluster Consultant).

These funds were shifted to the new position, removing all summer CCon staffing, leaving the CMS Administrator to fill in the services that CCons normally provide during the summer. This funding is one of the few financial contributions from CFA or its individual schools. A mechanical closet entrance area off the CMS hallway was converted to an office for this position, so that they could be close to the Cluster. The CMS Administrator coordinates the day to day management of the facility, and handles issues not usually covered in other Clusters. He also serves as the point-person for troubleshooting problems and working individually with faculty members to make sure their classes' needs are being met. In addition, he provides a backup staffing option in case of a hole in the CCon schedule during business hours.

2.2.3.5 *Printing*

The initial plan was to provide our standard "free" black and white printing, in addition to "large format color" printing. The definition of large format became an issue as one department felt an inkjet printer was most appropriate for them, and another felt that a plotter was needed. As there was no space for two large printers, and there were financial constraints, the faculty committee was tasked with deciding on one kind of printer that would meet the widest range of needs. Approximately six months after the facility opened, a decision was finally made on a 36" wide inkjet and a model (HP DesignJet 2500CP) chosen. Due to the cost of the consumables, we developed a new and cost-recovery service for Clusters, color printing. Issues that needed to be resolved included: payment collection, what unit of measurement to use as a calculation, what technical mechanisms to ensure that only jobs that have been paid for are printed to avoid wasting resources on unclaimed printouts and developing a full set of policies and procedures for the service.

The general plan developed into *printing punch cards* that may be purchased at the campus Computer and Art Stores. Each punch represented a linear foot of the length of the printout (i.e. the printout could be any width up to 36" and each foot that came off the paper roll was 1 punch). Initially, the printer was networked to allow for multi-platform support (Mac, Windows and Unix) but due to technical difficulties, we switched to a dedicated stand-alone Mac with several different removable media drives that was hooked directly to the printer. Documents had to be brought on removable media to the CCon in order to print.

In addition to the color printer, there was a need for 11x17 printing for musical scores, and several departments indicated general dissatisfaction with how the HP LaserJet 4si handled graphics. To solve both problems, an HP 5000GN was purchased. This printer was especially suited for graphics, and one paper tray could hold 11x17 paper. The tradeoff was that this printer has a unique form factor compared to the rest of the models in use in our Clusters, using a different toner, limiting spare parts, and leaving no identical spare printer in case of problems.

2.2.3.6 *Lending*

Basic items have traditionally been available for students to check out while they were in a cluster: manuals, mouse pads, scratch disks. All of which have to be returned before the patron leaves the cluster. Now, in order to more fully utilize the new equipment, students needed quality media capture devices such as

DV camcorders and DAT machines for longer time periods outside the Cluster. Some of the schools/departments contribute non-digital items for this service such as light kits and tripods as well.

We came up with a system to enforce accountability and a strict return policy with strong late fees. Each student needs a Lending Access card to sign-out equipment. These cards are given after they sign an Agreement form that states their responsibilities and late, damaged or missing item penalties. We discovered that many students aren't carefully reading and understanding the Agreement they sign, therefore beginning in the Fall this year, a staff member will explain and highlight the penalties as they distribute the form.

Developing procedures for lending equipment for out of cluster use presented numerous challenges. The largest of which centered on how vital staffing became, especially compared to the rest of the Clusters, as the entire lending system broke down if there wasn't someone available at the time users expected to pick or return equipment. Also the traffic of people needing to check in and out items frequently became excessive, sometimes overwhelming the CCons and/or preventing them from dealing with any other issues that may arise. The addition of the full time CMS Administrator providing backup in this area, as well as designating only specific times for pick up and return in which there was a guarantee of someone available for the process has helped mediate this situation. The system remains open to abuse however, and is a significant drain on CCon and staff time, both for the actual lending procedure, as well as upkeep of the system, and dealing with problems.

Another area has been the difficulty in getting reliable, preferably local service for these items. Into their second year, small, but necessary parts of the equipment started to break off and other malfunctions requiring repair occurred. The turn around time for service on much of the equipment, especially the DV cameras, continues to be extended and often requires mailing units to either the vendor itself or other authorized repair centers. Constant follow-up with the repair center is often required to determine the status of the item. These lengthy delays on service greatly impact the lending service's ability to meet the patrons' needs.

2.2.3.7 *Training*

Several faculty members and students offered to provide documentation and training for our CCons, staff and anyone else interested. The most successful vehicle is a weekly 1.5 hour intro to video editing workshop. All other material has been difficult to maintain, keep current or find suitable and available instructors.

Faculty were encouraged to make their TAs available at self-designated hours for their students to seek additional assistance. A few faculty members arranged this during the first year, but no effort to coordinate this formally has taken place yet.

A small collection of information evolved in the form of web documents [3]. This contains basic information and how-to's. Web message boards or a user-driven web information system has been brought up, we're still working on its implementation.

Training CCons and support staff, in addition to providing end-user documentation and training, is a large and ongoing issue.

2.2.3.8 *Planning and Oversight*

After the facility opened, a joint governance model was developed for oversight of the facility and was implemented. It consisted of three committees:

- Technical Oversight Committee (TOC) – Comprised of Computing Services support staff, and facilities managers from each of the five schools in CFA. Responsible for day to day support and troubleshooting technical issues.
- Operational Oversight Committee (OOC) – Comprised of Computing Services Managers, and one faculty representative from each CFA school. Responsible for coordination of academic needs and resources required. To meet once per semester.
- Strategic Oversight Committee (SOC) – Comprised of CFA department heads, Associate Dean, Executive Director of Computing Services and Director of User Services. Responsible for providing strategic directions and discuss resources required. To meet twice a year.

Finding the balance between majority and unanimous among 5 academic groups has been difficult. Like any committee meetings, attendance may not always be complete and what may be important to one group may not be to another. To help address attendance issues and to help groups provide representation with minimal impact on their staff and faculty time constraints, the TOC was eventually combined with the OOC and became something of an advisory group that met monthly. Major changes in facilities or services are discussed, and the committee is supposed to “sign off” as CFA school representatives on these changes. Then, Computing Services' staff and the CMS Administrator perform the day to day management and implementation of planning decisions.

In the 1999-2000 academic year, we began discussing the need to develop a Vision Statement. This is on the agenda for the 2000-2001 academic year.

2.2.3.9 *Scheduling*

Due to the increased use and specialized hardware and software that were only available in the CMS, scheduling demands increased greatly. Although all Cluster reservations are handled by the Cluster Services' group in conjunction with the Applications Software Group, there was a need to work out the conflicts for CMS space earlier in the process, before class schedules were finalized. In order to accommodate this, the Associate Head of Art volunteered to collect all the CFA faculty requests and act as moderator for negotiations over specific time slots between departments. This has had mixed results, as the requests were solely for space, and those requesting the space may or may not be requesting the space that actually met their needs. This was not only inefficient but confusing since instructors who needed a room needed to contact two different groups in order to make sure their needs were met for each reservation.

2.2.3.10 *After Hours Access and Security*

All of Computing Services' Clusters utilize a fiber-optic alarm system to protect equipment from theft, however some of the small, yet highly valuable pieces required for this facility presented challenges in securing them. All of the rooms are available for student use 24/7 except the sound isolation and “advanced” rooms. Due to the complexity of the configuration and expensive equipment in these rooms, they were kept closed and locked whenever the site was not staffed, including scheduled hours when there was no CCon available. With only a few of these workstations to begin with, students with significant course projects needed extended hours of access. By the second year, we installed a card reader system and a drop-slot to the consultant's office. Another Agreement was needed for checkout of an After-Hours card. To enforce this, students needed to get their professor to sign the Agreement indicating they needed the access to complete coursework. Once the student was done in the room, they were to return the card and any cables borrowed in the drop-slot.

We've encountered very few problems here: students would leave the area to take a little nap, oversleep and leave their personal belongings and work in-progress disrupting the 8:30am class; students would allow unauthorized students in the room with them; and students would bring in food and drink, which are not allowed. When classes or services are disrupted, we immediately take action by restricting After-Hours access. For the past two years, we've only had to do this once or twice.

In the last year, we attempted to alleviate the administrative hassle of this procedure by leaving the room unlocked during the weekday nights, as well as during staffing holes, with the caveat that if problems occurred, the service would be discontinued immediately. This compromise has worked out surprisingly well so far.

2.2.3.11 *Rendering*

An unanticipated need in the planning of this facility was the extensive rendering times required for 3D modeling, animation, and Digital Video projects. Cluster machines and policies are configured for an active single user at any given time, with a ten-minute abandonment time policy that was to some extent, also enforced by technological means. This caused great frustration to students who needed to render for several hours at a time, and had no desire to sit and watch a processing machine. Overnight rendering required students to come back first thing in the morning to retrieve their files before classes began or other users cleared the space. And with most of the rendering applications installed on only 7 machines, competition for them sometimes became heated. Incidents settled down once we moved a rendering application to another set of machines in another room to help balance the load.

2.2.3.12 *Software Licensing*

In order to manage 400 lab machines, automated tools and license management are essential, and we had a number of tools that we depended on to maintain our machines. Some of the specialized packages and applications for this facility were at direct odds with our software licensing and management methods. A number of the specialized packages used their own methods to

prevent piracy that conflicted with a network distribution of software and/or KeyServer. The most difficult of these were the sound applications that utilized “key disks” that had to be used to “authorize” a hard drive for that particular application. We had to find a way to prevent this authorization from being accidentally or maliciously removed, and had to be very careful not to remove the authorization in the course of systems management. Several authorizations were lost when hard drives failed, sometimes requiring calls to the vendor to request additional key disks. Some applications would not even allow us to install an authorization on the hard drive, requiring the key disk to be available from the CCon at all times, making it prone to loss, theft, and damage. Applications that use key disks were not able to utilize KeyServer, which we also use for gathering usage statistics to make purchasing decisions. Extremely careful management of the variety of key disks became an ongoing administrative and technical burden.

Other issues that made it difficult to install software with our standard methods included: individual serial numbers for each copy and/or non-concurrent licenses that prevented optimum deployment, managing long chains of “dongles” (AKA hardware locks) in a secure manner without causing cables to fall out due to their weight, and software that had not yet been updated to operate under the currently deployed OS, making the setup of these machines even more unique than our other Clusters.

2.2.3.13 Mixed Platform Labs

There was a desire to buy SGI workstations, which was a platform Computing Services was unfamiliar with. The purchase of 10 SGI workstations raised several issues, which are not necessarily unique to SGI. Any new platform may raise some of the following issues:

- Due to the difficulty integrating these systems into the existing campus Unix environment, these new systems had to run independently. However, central account administration was required and we converted one of the ten workstations into a server.
- No one was familiar with available software for the new systems.
- Instructors had different needs/desires for animation tools, we currently have spent considerable money on several packages for one category of applications: Maya, 3D Studio Max, Electric Image, and formZ. Adding an additional platform increased the number of packages required.

The room was originally conceived as ten Windows and ten SGIs for mixed platform work. This left most classes with only ten machines to use at a given time on their desired platform. Also, despite the split use, because there was only one door, there was no barrier between the sides, so two classes could not meet simultaneously.

To resolve many of these issues, after extensive evaluation and testing, it was decided to use only one platform. This will allow a 20-seat room with supported, consistent hardware and software.

3 UNIVERSITY OF CALIFORNIA AT LOS ANGELES (UCLA)

Located in Westwood, California, UCLA is a public university of about 36,000 students and 17,000 faculty and staff. UCLA is a large and complex institution devoted to cutting edge research, undergraduate education, graduate and professional training, and public service. Sitting on 419 acres, UCLA’s 163 buildings house the College of Letters and Sciences as well as 11 Professional Schools, including the School of the Arts and Architecture.

3.1 Computing Services

3.1.1 Central Campus Computing Infrastructure

UCLA has a widely distributed computing infrastructure. Most central computing services support administrative pursuits. Academic Technology Services (ATS) administers campus & University of California-wide site licensing agreements, campus wide email for students, faculty, and staff and high performance computing for the sciences. Campus Telecommunication Services (CTS) provides the Campus Backbone network and Internet access as well as top-level campus DNS. A lab analogous to one of CMU’s computing clusters is located in Powell Library. It grew out of a lab cluster ATS had built in the early 1990’s, which was one of the first personal computer labs on campus. In comparison to CMU, the academic computing labs on our campus are run as independent entities. Staffs in these labs recognize the value of sharing information, but each lab carries its own budget and personnel.

3.1.2 School of Arts and Architecture (SOAA)

School-wide computing services provide connectivity from the desktop to the campus network backbone. They provide School and departmental DNS, and email for administrative staff and faculty. They also provide technical support for administrative staff and faculty throughout the School. Since the School is widely dispersed in ten separate buildings across a large campus, networking is of fundamental importance.

3.2 Center for Digital Arts (CDA)

3.2.1 Overview

The Center for Digital Arts [4] is a “small-c center” (i.e. non-degree granting) of the UCLA School of the Arts and Architecture. The CDA inhabits the second floor of the Wight Art Gallery in the Dickson Art Center. It is adjacent to Dickson Tower, which houses the departments of Design and Art. The CDA does not offer any degrees of its own; it serves as the teaching facility and meeting ground for faculty throughout the School engaged in digital activities. Our primary audience is the faculty, staff, and students of the School’s six Academic departments. Those departments are Architecture and Urban Design, Art, Design | Media Arts, Ethnomusicology, Music, and World Arts & Cultures. Our student audience is approximately 25 percent graduate level and 75 percent undergraduate. We also encourage use by the rest of the School’s community of public arts entities such as UCLA Performing Arts and the Center for Intercultural Performance. Each quarter the CDA attracts approximately 450 users. The total space is approximately 11,000 square feet. It now includes:

3.2.1.1 Labs

- Three general-purpose computer labs - one Mac lab and two NT labs. Each lab has 17-18 machines of its respective platform plus one machine of the other platform. A computer of each platform at the front of each lab is attached to an LCD projector. The labs range in size from 912-1,223 square feet. Software includes graphics, multimedia, internet content creation, video, 3D modeling and limited general productivity. The NT labs include additional 3D modeling and animation software as well.
- Audio lab. Used for recording, special effects and editing, this room has four Macintosh systems including an 8-in/8-out ProTools system and three machines equipped with audio in/out add-on boards from other vendors. The room has a Kurzweil MIDI keyboard and a collection of microphones for recording. Two field DAT recorders are also available to students using this area. The lab is 450 square feet.
- Two video labs occupy a total of 1,200 square feet. In the main lab, we have seven Apple G3/G4 DV stations running Final Cut Pro. These stations support miniDV and DVCAM formats. Also, we have three tape-to-tape SVHS stations, an SVHS A/B roll and a dubbing bay that supports miniDV, DVCAM, hi8, SVHS and 3/4". A second video lab contains a Media 100 system as well as an NT-based Discreet edit* non-linear editing system. This lab supports DV, BetaSP, and SVHS.

3.2.1.2 Other facilities

Lecture room. This has a Macintosh and NT workstation as well as DVD, Laserdisc and SVHS player connected to an A/V receiver and LCD projector. It seats approximately 40 (50 packed) people in 810 square feet.

Walk-up area. In areas adjacent to the lobby and wide hallway, we have a black and white (8 1/2" width) laser printer, 54" wide color inkjet plotter, color inkjet printer (11x17), two flatbed scanners, and two CD burning stations. This area is supervised by a student consultant and occupies approximately 600 square feet.

Servers. We provide each user with 100 MB of space (more available to certain graduate programs and faculty) on Novell file servers. Space is given out in 650-Mb increments to classes as a shared area for projects, handouts, etc. Also, space is available on a web server for faculty, class-built sites, and graduate students. Lastly, we have a machine running our KeyServer license server. These servers, as well as our 10/100 Mbit switched network gear, occupy approximately 250 square feet

Classes taught in the CDA often make extensive use of print media or other non-digital media for presentations. We have approximately 1,400 square feet of open space for critiques, pin-ups or small exhibits.

Lastly, there is approximately 1,300 square feet of staff offices, workspace and conference areas.

3.2.1.3 Current Staffing

Currently, we have two and a half FTE dedicated to the day-to-day operations of the Center. This includes a Network Administrator, Video Specialist, and an administrative person.

The Network Administrator oversees the NT labs, servers and software licensing. The Video Specialist is dedicated to the various video gear in the facility. There are also three half FTE student technical assistants for the Mac, NT, and Audio areas.

In addition to these resources dedicated to the Center, there are two FTE who oversee the Mac Lab, printing issues, audio lab and also lend a hand in video whenever needed. These staff divide their time between support issues at the Center and other special projects within the departments and the School; between 30-60 percent of their time is spent outside of the Center. The Center's Director is a teaching faculty member and Associate Dean. Although involved little in day-to-day operations, the Director works tirelessly for the Center at the administrative and managerial level.

Six to nine part time students staff the front desk during normal hours. They handle the plotter, collecting fees for printing, manual checkout, answering questions, light troubleshooting and general assistance. They are required to attend orientation and training sessions offered by senior staff.

3.2.2 History and Initial Vision

The Center grew out of the realization that departments within the School were increasingly trying to cope with a common - and steadily broadening - base of digital literacy. Chairs in very different departments were making requests for the same equipment, and artistic enterprises were becoming more and more collaborative. Our goal has been to maximize the School's resources as well as foster a vigorous discussion among the different communities within the School. To achieve this, the CDA was designed as both a teaching and research facility. An important component was creating a space where students would simply meet each other. In January of 1996 the building which was to house the facility was vacated and renovations begun. Renovations were limited to installation of new wiring - both electrical and network - and minor room reconfiguration. CDA opened in the spring quarter of 1996.

3.2.3 Evolution

Surprisingly, our facility's core functionality has changed little over time. All areas have expanded in capability - mainly due to equipment upgrades - and overall usage, but the basic services we provide are not radically different from those provided when we first opened. While not an exhaustive description of our evolution, the following highlights what may be learned from our experience.

3.2.3.1 Vision

Originally envisioned as both a teaching and research facility, our focus has been on teaching and service. At different times in the first two years, the Center did house several faculty research projects. As the space needs of those projects and the Center grew, those projects were moved out into their own areas in other buildings. Although these and other faculty continue to use certain services and support, we do not take an active part in their research.

3.2.3.2 *General Layout*

Initially, our teaching/working spaces consisted of one NT lab, one Mac lab, one video lab, a lecture room and a modest audio area. Midway through our first full academic year, we created a mixed NT and Mac lab in what is now our second NT lab. We also consolidated all our color printing and scanning from the NT and Mac labs into this area. This lab was a mixed success. Certain entry-level classes benefited from the mixed platform layout. In 1997/98, the Macintosh was far and away the preferred platform by our users and consequently the NT machines in this room were used very little. By far, the most successful part of this room was the walk-in facilities. As usage of the two main labs increased to almost full daytime use by studio classes, students needed daytime access to equipment outside of class to prepare work, complete assignments, etc. The walk-in facility provided such a resource. Eventually, additional equipment grants (largely from the Intel Corporation) made it possible to create a second NT lab. All printing and scanning facilities were moved from this lab into their current location in the lobby and hallways. (See Section 3.2.1.2) These facilities are easier to use and maintain since being moved to area with easy access to support.

3.2.3.3 *Video*

Our video area has evolved from a purely linear facility to a mixed one. Although we do not anticipate purchasing additional linear suites, they continue to be a valuable teaching tool. Functionally, they are often a more practical solution for editing long-format ethnographic films, which is a mainstay for at least half our video users. The DV suites are our most heavily used systems. Each system is a Macintosh G3/G4 with three to four large, internal IDE drives. The video lab manager assigns portions of drives for particular classes. The rest of the storage is available for scratch space and small, short-term projects. Recently, external FireWire hard drives were purchased to act as a pool of drives available for use by classes or graduate students with special projects. Our hope was the low cost of these drives and easy portability would make them an attractive solution for students wishing to purchase their own drives and transport work back and forth from their home computers. This would also alleviate some of the pressure to purchase an ever-increasing amount of video storage. Unfortunately, these drives have not performed as well in practice as they did during testing. We have found them too slow for capture or output work. Some students have purchased them, but we do not encourage it for video capture purposes. We are currently investigating SANS-type solutions based on fiber channel or FireWire. The major drawback to this type of solution is the lack of portability and the substantial capital costs. However, management of a central storage array will be much easier than the desktop level management we currently resort to.

3.2.3.4 *Staffing*

During our initial quarter, the staff consisted of one FTE Lab Manager, one FTE Audio & Mac, two 60-75% time FTE from the School's Network and System Administrators', and one FTE contributed from existing departmental staff. Our limited video facility (at the time all linear) was supported by Adjunct Professor John Bishop (the faculty member teaching in the room), himself an expert in video production. Initially, the Lab Manager was equally a technical and administrative position. By the end of the second quarter of operation, this position evolved into a 90

percent technical position to alleviate the need for continued support from the School's existing computing staff. The FTE for Audio & Mac has evolved into a 'Digital Facilitator' working with faculty throughout the School on new media projects. The department staff member is still with us, although much of his time is spent in his department. Professor Bishop's involvement in supporting the facility was a short-term commitment, though it lasted 18 months longer than expected. In the future we expect to add a fourth half FTE student technical assistant to support the daily operations of the video lab. Also, student groups have hosted training workshops for software used at the CDA. These workshops have proven to be extremely beneficial for the students and for the smooth running of the CDA. We anticipate the costs of instructors for these workshops will soon be shifted into the CDA budget.

3.2.3.5 *Printing*

In the beginning, printing services consisted of two black and white laser printers and one legal sized color inkjet printer. The laser printers were networked and accessible from either platform. The inkjet was a stand-alone printer connected to a Macintosh. All printing was free. As the number of users grew, the costs of supporting free color printing became prohibitive. Unfortunately, no automated accounting has been found that supports the different printers without prohibitive usability issues in our environment. In the future, we hope to implement an accounting system that is easy to administer, simple to use from the end-user point of view, and offers wide printer compatibility.

3.2.3.6 *Lending*

We provide short terms loans of a number of materials for use in the facility including manuals, training material and FireWire drives for video storage (see Section 3.2.3.3). Negative experiences providing video camera checkout has led us to stay away from this service. Instead, we find it best for individual departments to handle this service. Our main concern is lack of funding for staff to teach, maintain and checkout this equipment. Also, for a School of our size, the number of cameras required to create a School-wide pool of equipment would be tremendous. We do not foresee this changing unless we are specifically directed to provide this service.

3.2.3.7 *Training*

Initially, training and knowledge exchange was fairly traditional. Everyone involved, faculty, staff, students, teaching assistants, talked whenever issues arose. Each support person involved with the Center became, as the saying goes, an accomplished firefighter.

As the facility stabilized, more effort was put into lowering the support burden on staff. What has evolved is a collection of web based Intranet documents for basic procedures and FAQ: how to login, account policies, how to burn CDs, remote access to servers, tape to tape editing guide [5]. Instructors create how-to documents that they publish on their own websites, especially the animation classes. We have also tried using a web-based discussion board [6] as a forum for reporting problems, workarounds, linking to tutorials, etc. Unfortunately, to date it has been used little for this purpose.

In the future, we plan to expand the documentation specific to our equipment and configurations (e.g. how-to setup for plotting in different applications, step by step from film negative to poster sized images) We also intend to lend support to the student run workshops, which have been very successful. Beyond these measures, the Internet is a very convenient resource with countless tutorials, guide, etc. Some instructors already use it to pass along tutorials on individual software. We would like to build and maintain a collection of these links for use by everyone in the facility. Beyond this, building an extensive knowledge base is felt to be too labor intensive to create and maintain. Also, the feeling not to create a large knowledge base comes in part from how little people use our existing material.

3.2.3.8 Planning

During the initial conception a committee was formed with faculty from each department. The committee designed the core functions and we were born. The committee disbanded after the planning was completed. Now, staff responsible for a given area of the facility makes decisions based on their perception of the needs of the faculty and students using their area. In video, Professor Bishop (see Section 3.2.3.4) still maintains an advisory role. The Director has repeatedly attempted to re-establish a standing advisory committee but has been unsuccessful in gaining the necessary commitments. Like a lot of facilities whose primary purpose is service, faculty (and to a much lesser extent, students) find it more satisfying to complain than to lend themselves to creating solutions.

3.2.3.9 Scheduling

Our classrooms are scheduled by the Management Services Officer (MSO) of the Departments of Design and Architecture (currently the same person.) This is convenient since these two departments account for at least 80 percent of our scheduled classes and 60 percent of our total users. The MSO coordinates with our administrative person, who coordinates with the technical staff here. This arrangement, while seemingly easy on staff time, can generate problems. From quarter to quarter the exact technical requirements for a course may change based on faculty preference, syllabus, etc. While we strive to maintain a certain level of service from quarter to quarter, capabilities of the labs may change over time. For example, the Center may decide to stop supporting a particular version of software or stop leasing a software package altogether.

3.2.3.10 After Hours Access and Security

In the beginning, our hours were modest. During the week, labs opened whenever classes started in the morning. A student lab monitor staffed the facility from 5pm-10pm. To prevent unauthorized access and provide personal safety for the monitor and students in the facility, the front doors of the facility were locked and staffed by a second student security guard. Given these security measures, the risk of theft was light and anti-theft measures were minimal. Weekend hours were typically Saturday and Sunday 12pm-6pm.

Over the first four to five quarters of operation, class scheduling increased greatly. We added additional night and weekend hours to compensate. For one quarter, we yielded to student and departmental demand for 24-hour access. After the

trial quarter, we cut back to 24-hour access during the last four weeks of each quarter; this has been more than adequate for 95 percent of our users. Minor losses of mice and external zip drives during these 24-hour periods resulted in a tightening of anti-theft measures. Cables, tie-downs and adhesive plates are now standard on all theft sensitive equipment.

3.2.3.11 Rendering

Since our entrance into 3D animation beginning with Softimage v3.5 for NT, rendering has increasingly been a sore point in the facility. Initially, students needing to do rendering were told to restrict rendering to overnight batches running on individual workstations. Other students needing to use NT were asked to go to our second NT lab. This worked well when students in the animation class were the only users whose work truly needed the high-end machines in the first NT lab and the total number of students in that portion of the facility was low. As the number of classes and students increased, friction increased. Also, animation is no longer the only source of long rendering projects. After Effects, software MPEG encoding, and DV video projects all can require long setup and even longer rendering sessions. With these added sources one might find rendering taking place on virtually any machine in the facility. We continue to rely on the teaching assistants and lab etiquette to keep the friction to a minimum. We hope to develop a better system for this in the near future.

3.2.3.12 Software Licensing

Initially, the facility had roughly 20 Macintoshes and 20 PCs with all machines tightly located in our location. Software was purchased in multi-user lab packs. Over time, the number of machines has more than doubled. This growth lead to high software costs; both in license costs and human resources to administer license agreement compliance. We have found concurrent licenses administered by a central license server reduce long-term costs. Also, as departments gain experience on our equipment they tend to purchase their own equipment for easier access. With network monitored, concurrent licenses, we have the flexibility to offer these licenses to other departments.

4 DISCUSSION

This section will pose open-ended questions to provoke thought about fundamental pressures and issues that you may face as a facility evolves over time.

4.1 Faculty Involvement

Obviously, faculty will be involved in the facility during their regular teaching endeavors. How do you enlist their involvement beyond that? Virtually everyone working in higher education sits through endless committees meetings. Are committees effective tools for guiding the evolution of labs and increasing their academic value? The highly dynamic technology used inside these facilities almost gives them a mind of their own. How can faculty and staff work together to shape this naturally evolving beast? Besides committees, what other mechanisms can be setup which are better suited to shape this kind of evolving facility.

4.2 Working with the Latest Technologies

How to get on the cutting edge and stay there? It is now possible to purchase bleeding edge technologies at low costs. Clearly, getting on the edge is not difficult. Given finite human resources, the problem becomes how to work effectively once you are there. Perhaps this states the obvious: it is impossible to do everything in your digital labs. Your existing infrastructure can only do so much. In terms of human resources, there will be a place for both generalist and specialists; both are needed to be successful. Allow time to evaluate, learn, and experiment. Eventually, however, decisions will need to be made about the services and technologies you support. In other words, what is the proper role of new technologies in your environment?

4.3 Nurturing Your Gurus

The depth and breadth of knowledge of faculty and staff will be a main driving force behind the success of a facility. Both faculty and staff must be given opportunities to build their individual skills. Going beyond the traditional one-way exchange from faculty to staff, it is necessary to create a two-way exchange of technical information. This collaborative process will help both your faculty and staff experts grow individually and as a team with complimentary skills.

4.4 Why Create a Facility?

Reasons for having joint centers include fiscal and logistic efficiencies as well as interdisciplinary collaboration. Over time the idealistic goals, which help create a facility, may tend to become clouded or forgotten as the vision evolves. Your institutional culture will influence how these issues are addressed. Also, is the impetus to create a facility a reaction to existing academic pressures or it is trying to effect a change by itself? If changes are already taking place, it will be much easier to develop plans to shape the role a facility will play in those changes. In the absence of this pre-existing pressure for change, it may be difficult for a facility to be the catalyst for fundamental curricular change.

4.5 Ongoing Questions

Over time, how will success be measured? What are the benchmarks, both qualitative and quantitative, to determine if your facility is meeting the goals of the vision? How often will the vision be reviewed? Does it still apply? Who will be part of the review process?

5 CONCLUSIONS

5.1 Planning

5.1.1 Additional Staff

Plan for additional staffing & support, especially during development and the first year of operation. Even when staffed by people familiar with campus computing labs, the specialized tools you are implementing, or both, you *will* underestimate the staff resources required to launch a new facility. Do everything humanly possible while still in the planning stage to avoid this.

5.1.2 Use Outside Consultants Liberally

Especially if you only have one resident expert in a given area, it is essential to use consultants to provide sanity checks on

the technology choices and implantation plan. "Measure twice, cut once."

5.1.3 Planning, Vision, Planning

There has been a significant amount of progress in both facilities since inception, but you can't underestimate the value of extensive planning and validating it against your vision on a continual basis. Without strong planning, you are doomed to run in circles. New technology usually presents many collateral issues that need to be considered from the onset, rather than once you've committed to going down a particular path. Although good planning seems obvious, it is frequently compromised for supposed "quick fixes" and "neat ideas" that don't turn out to be in the long run.

5.2 Operational

5.2.1 Rendering

The time and storage requirements of rendering pose challenges not often encountered in general purpose computer labs. As a facility grows, so will the headaches caused by rendering. Neither of our facilities anticipated the degree to which this would be true. Unfortunately, neither facility has a good recommendation for a solution. Consider previous conclusions regarding consultants and pre-planning.

5.2.2 Disk Space Darwinism

Given adequate storage, the rendering issue (see Section 5.2.1) is mostly an issue of time. More generally, all types of digital media – sound, animations, video, and high-resolution scanned images – are required to complete the diverse types of projects performed on our workstations. Whether a facility offers file server storage, removable storage or both, it is likely that many student projects will exceed the capacity and practical limitations of those storage options- forcing them to store large media files on individual workstations for days (or even weeks). Large files usually translate to large investments of time in their creation. Lost files invariably result in severe aggravation, lost productivity and ill will. Neither facility has been able to implement workable policies to smoothly manage this issue. The most infamous imperfect solution tried by students at both facilities is folder names like 'do not delete until x/x/xx'. CMU is hopeful that recently installed DVD-RAM drives will provide a robust removable storage solution.

5.2.3 Use Mature Technologies

'Bleeding Edge' technologies may sound impressive to your administration and constituency. However, in the end no one will be happy with buggy, partial solutions using the latest, untested technology. Go slowly; avoid version 1.0 and beta products; investigate solutions used by other locations on your campus, at other Universities, and in industry.

5.2.4 Changes to Standard Operating Procedure

Adding new services, policies, and procedures to existing ones may be more difficult than you anticipate. Carefully consider how this facility will deviate from your existing procedures and policies, and the impact these changes will have on your overall practices. Especially if this facility must operate within a larger

framework that greatly differs in its practices, don't assume an easy transition or merging of procedures.

6 ACKNOWLEDGMENTS

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