So You Wanna Be a Rock Star: Bringing Digital Audio Editing to the Masses

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Abstract

In response to student demand, University of Washington's Educational Partnerships and Learning Technologies (EPLT) partnered with the Odegaard Undergraduate Library (OUGL) to provide a full-featured digital audio studio. The studio is available 24 hours a day and provides an entire suite of recording and editing software. Techniques used to deploy and maintain the digital audio workstation (DAW) are very effective for delicate, one-of-a-kind systems.

Concept and Background

Tucked away in a brick-walled room in the University of Washington's Odegaard Undergraduate Library and Computing Commons, the university's only general-access Digital Audio Workstation (DAW) provides a facility for students to experiment with recording, tweaking, editing and mastering audio projects. The workstation is heavily used by students across campus; projects have ranged from the normal music and video soundtrack recording to the production of radio commercials for marketing classes and the preservation of old recordings of Turkish folktales. The DAW, a collaboration between Educational Partnerships and Learning Technologies (EPLT), who run the campus computer labs, and the Odegaard Undergraduate Library (OUGL), grew out of a student demand for high-end professional tools for recording and editing audio at the University of Washington (UW).

Like many higher education campuses, the UW had no audio studio available to the general student population before the DAW came into being. Each year the University conducts a student survey designed to assess the technology needs and desires of the student body. The results of these surveys made it clear that an increasing number of students were looking for enhanced audio editing software to compliment the video editing systems which had been available in campus computing labs since 1997. Additionally, the task of importing media had been a troublesome issue. While many students have video cameras at their disposal, very few have similar devices for recording high-resolution audio, and students expected campus computing facilities to bridge this gap. In response to student demand, in 2002 EPLT and OUGL submitted a proposal to provide an audio editing facility in the OUGL Computing Commons.

In order for the facility to be successful, we felt that we needed to provide both the tools and the space to create audio products. Space is precious on the UW campus, and finding a location for the DAW was our first planning consideration. We felt it was crucial to install the DAW in an area where it would be the easiest for students to access and staff to support. Like many campus computer labs, our primary computing facility is centrally located in a library -- the UW's Odegaard Undergraduate Library, which is open 24 hours a day. The University Libraries and Educational Partnerships and Learning Technologies, who run the student computing labs on the UW campus, have a long tradition of collaboration, and have worked together on running not just the Odegaard Computing Commons, but also the computer classrooms ("collaboratories") in the Odegaard building, the well-known UWired project, and, most recently, an expansion of computer workstation functionality in all of the libraries on campus. The DAW was to be another collaborative project; EPLT would spearhead the project and provide support for students using the facility, but would need a donation of library space to install the audio studio and the cooperation of library staff in administering the facility.

However, we foresaw problems with locating an audio lab in a library setting. Unlike video editing, audio editing is an inherently noisy task; in order to realize the full spectrum of sound, it is necessary to edit audio files both with and without headphones. The presence of a large computer lab on the second floor of the Odegaard building ensures that OUGL will never be a particularly quiet space, but we worried that an audio lab would be too loud

even for such a loud library. We decided that there was no way to locate the DAW out among the general use computers; it would be far too noisy and would need to be in an isolated area. Fortunately, the undergraduate library has several group study rooms near our computer lab. EPLT proposed a two-room space—a control room and a tracking room,--thereby providing full isolation and the highest sound fidelity. The librarians were very excited about the idea of housing an audio lab in the OUGL building, and, more importantly, the head of the library was willing to give up the space needed for the facility. That being said, we still needed to be certain we could preserve the study-driven nature of the library.

We began testing the study rooms for noise leakage to determine an acceptable level of sound penetration. Odegaard, built in the 1970s, is a large brick pile, and due to the formidable building construction the rooms were fairly well isolated. Proximity was the greatest problem; the study rooms are all adjoining each other and share some air vents, so there would be audible leakage from the DAW into the nearby rooms. We decided to move forward with our proposal despite this known drawbacks.

At the UW, students pay a quarterly technology fee, and a student-run organization known as the Student Technology Fee Committee (STFC) governs and distributes the money from this fee, entertaining proposals from campus groups once every academic year. It is to this committee that we submitted our DAW proposal. With endorsements from the students and the collaboration for support (EPLT) and space (UW Libraries), the proposal was funded. We were awarded $20,000 to develop and install the studio.

It was our original intention to build a tracking and editing facility; however, a fair amount of construction would be required to soundproof the space and redesign it as a studio. The Student Technology Fee does not cover these costs. It was also becoming apparent that many of the students would be using the room individually. Since the room was initially designed to have an engineer record the session and the artists perform simultaneously, requiring a minimum of two people, this demand for a single-user space posed a problem. Coupled with the fact that there was nothing we were going to able to do to dampen the sound of loud acoustic instruments, primarily percussion and brass, this need for a space that could be operated by one individual meant that we had to go back to the drawing board and re-think the facility.

After a bit of brainstorming and considerable research, we came up with a very reasonable compromise. We decided to collapse the tracking room and the editing room into one space. This meant that an individual artist could be his or her own engineer. However, it also meant that there would be no way to isolate drums or brass from the engineer, making the tracking of loud instruments impossible to do well and a compromise in fidelity. The electronics associated with recording are not silent, despite our best efforts, and so artifacts of this would remain when recording with microphones in the studio. The proposed DAW's original specifications called for a 36-track recording system from Digidesigns, which was most of the $20,000 budget in the proposal we had submitted. Since it would not be possible to track an entire group at once in the new space, we trimmed down the system to accommodate the recording of only two instruments simultaneously. Since we were installing a multi-track recording system, this posed no serious problem. If a student wished

to record five guitars, that would still be possible; they would just have to be layered in by the software.

With the tracking studio removed, students would still need a place to create drum tracks. To meet this need, we turned to a technological solution. There are many excellent software packages out there that allow users to created entire instruments out of either samples or synthesis. We felt that, in order to accommodate all types of musicians, we would need both. In addition to drums, these pieces of software could also reproduce a range of very rare instruments created over the last 30 years.

We were still faced with the issue of isolating loud amplified instruments. Again, technology came through. Several products exist on the market that model the characteristics of amplifiers produced over the last 50 years. These, unlike real amplifiers, require no miking skill and produce excellent results in minutes. Better still, they plug directly into the DAW and carry a higher fidelity and produce great sound at nominal power output. This gave students the ability to play their instruments back on amplifiers to which they would never have had access otherwise. [Appendices 2 & 3 list the hardware and software we use in the DAW.]

With the room technically functioning, focus needed to shift to administration of the facility. Initially, room reservations were taken using a paper system. A schedule was posted weekly, and students could sign up for a maximum of 4 hours. Before a student could check out the room, they signed a statement acknowledging their responsibilities for the equipment, and agreeing to pay for any damages they incurred. These signed statements were kept on file and renewed annually. Both lab consultants and librarians handled the room checkout process. Librarians took room reservations, made sure the statement was signed and filed, collected the student's ID card for the duration of the session, and unlocked the facility for the student. When the session was finished, the student returned to the desk for checkout, and the lab consultants verified the state of the room and returned the student's ID card. Over time, this process became overly cumbersome and was converted to an electronic reservation system. Now, students can book the room online and check out the room the same way they do a book in the library, via the Libraries online system. We no longer require students to sign a statement to keep on file; instead, by checking out the room, students agree to the terms and conditions outlined in the statement of responsibility, which they are given along with a package containing removable equipment (the key to the room, plus microphones, cables, headphones, adapters). Room verification is still done by lab consultants upon checkout. [Appendix 4 shows the text of the current statement of responsibility.]

Challenges, Problems, and Solutions

Maintenance

When adding any new piece of equipment to a general access computer lab, staff must develop a support strategy. Often, already implemented support models can be adapted to accommodate the new gear. With the DAW, though, we had to from scratch. The two biggest issues we experienced were related to the operating hours of the OUGL building. Firstly, Odegaard is open 24 hours a day, which meant that in order to perform

maintenance, we had to take down the studio during hours of operation. Secondly, we needed a system with redundancy, in order to protect studio uptime. This was a failsafe in case scheduled maintenance did not go as planned; the room could still operate in a backup mode until the problem was dealt with. A redundant system was critical to assure uptime during off-peak hours when full-time staff were not available to troubleshoot technical issues.

Our solution was to combine tried-and-true tools, with new and unproven technology. At the time the DAW went online, all of the workstations in the campus computer labs were maintained with a suite of tools designed to rebuild and clean systems between logons. These tools deleted or replaced files that differed from our master image. Pyzzo's PCRdist is a Windows tool similar to the UNIX standby Rdist. When a client logs out of a workstation, a quick comparison is made between the workstation and the master image, files are replaced as necessary and the system reboots and readies itself for the next client. While quick and effective, it was designed for the Windows 9x line of operating systems and cannot deal with the complexities of a modern operating system. To compensate for PCRdist's shortcomings, we combined it with Symantec Ghost for mass deployment. Ghost is able to push a bit-for-bit copy of our master image down to several hundred lab machines simultaneously in a process known as casting, but is unable to deal with small changes--it is definitely a sledgehammer approach to the problem. Together, PCRdist and Ghost made up a fairly comprehensive set of tools that allowed us to maintain a safe working environment for our students, free of worms and viruses, and with ample amounts of privacy. [Note: this past year, we switched the labs from PCRdist to Faronics deepFreeze, which preserves the original workstation configuration from end-user interference.]

However, for the DAW, this system, which worked adequately for the general-use computers, was insufficient. We ran into an issue whenever a client modified a system file that PCRdist could not touch. At this point, the system had to be recast, which took quite a lot of time. Since the DAW is a unique campus facility, this solution was unacceptable, and we needed to add an additional buffer to ensure maximum uptime. We accomplished this with a new device known as a Trios III by Romtec. The Trios allows a single system to contain multiple bootable, yet discreet, hard drives, selectable by a push of a button, which can be conveniently disconnected and removed from the system. The DAW has three identical hard drives, two for production and one for testing. This allows us to book the room as any client would, test and build an image on the third drive, and, upon completion, push that new master image down to the other two production drives. This also allows our student staff to boot quickly to the backup drive should any problems occur when full-time staff are unavailable. Though not without its own unique set of issues, this solution has allowed us to run a one-of-a -kind room, 24 hours a day with almost zero downtime.

Vandalism and Theft

Although we were concerned about the expensive equipment in the DAW falling victim to the normal petty theft and destruction we occasionally see in the general-use labs, vandalism and theft have turned out not to be an issue. Even though the students using the DAW facility are unsupervised, we have seen no evidence of theft or vandalism of any kind. This is surely due in part to the statement of responsibility to which the students must agree, but it is our belief that the studio is so unique that no one will risk it being shut down.

When the DAW first went online, small "walkable" items such as microphones and headsets did disappear occasionally; however, these components are now checked out with the rest of the DAW kit at the library's circulation desk, and the kit is not checked back in unless all items are present and accounted for.

Noise

Initially, we sited the DAW in a former group study room along the library building's eastern wall, adjacent to additional study rooms and sharing an air vent with the neighboring room. Before the audio facility even went online, we realized that this was a less-than-optimal setup; once students actually began using the DAW, it became clear quite quickly that we would have to find another location for the studio. Instruments that could be plugged into the digital audio equipment didn't cause too many noise issues, but students also brought in drums, acoustic guitars, flutes, and tubas, and sounds from these instruments not only filtered into the adjacent study rooms, but also crept out into the larger library facility. In addition to the problems caused by noise leakage, the audio room was also far too small and overheated easily when more than one person crammed themselves into the studio. We began scouting for a new location in the library building, and found what we were looking for around the corner – a little-used maintenance closet. Off on its own and buried in a brick wall, which would act as a natural sound barrier, the closet was larger than the original facility. The locks needed to be changed and the room wired, but once the studio moved around the corner to its new home, the complaints about noise from the DAW slowed to a trickle. Odegaard is not a quiet library, so the occasional tuba scale is tolerated with equanimity, although on quiet Saturday mornings we do still get a few complaints.

Reservations

Our initial use of a paper-based reservation system caused much angst at the library reference desk, where the DAW schedule was located. Students wanting to ensure time in the facility had to show up in person to make a reservation, since the room was often fully booked only hours after the new schedule came out on Friday mornings and they couldn't count on reaching the reference desk by phone in time to get a prime time slot. The reference desk was often mobbed on Friday mornings, and throughout the week the librarians had to leave the desk in order to lead students to the DAW and unlock the room for them, returning to find a line of students waiting for reference assistance. When the UW Libraries acquired a booking module for their Innovative Interfaces online library system, the DAW became the test case for online room booking. The move to online self-booking and electronic circulation of the room key in 2003 eased congestion at the reference desk and gave students a more control and flexibility over how they reserved and used the facility. We are currently investigating more user-friendly online booking options for the DAW and our fourteen group study rooms.

Training and Support

Training has been the most demanded addition to the DAW since its opening two years ago. In order to make the space available to the student body as soon as possible, we opened it up to our clients immediately after it was completed. We figured that many of the students interested in using the space would already have some experience in using audio equipment, and we did not wish to delay use of the facility for those students who knew

how to use it. This decision was somewhat short -sighted, since our own staff hadn't yet been trained to use and support the system, and we knew it would take several months just to get them up to speed. In the interim, we relied heavily on the few full-time lab staff who understood the room for client support. Initially, if students wanted to know more about the audio lab, they made an appointment for a 30-minute consultation with someone on staff. In that amount of time, we could show a client how to get audio files into the system, how to perform basic edits, and how to write the sound out as either a compressed format or CD audio. However, this consultation model was inefficient and placed a heavy support burden on the few staff who knew how to use the facility. We began a search for students who were interested and skilled in audio and wanted a part-time job teaching "how to" classes and writing documentation.

Though we did not yet have trained instructors on hand when the DAW opened, we did have several students skilled at writing manuals. They began writing Quickstart manuals to help clients find answers to DAW questions themselves. These 3-page manuals covered the basic topics and are available in print and PDF formats on the workstation itself. In the meantime, the studio relocated to its new, larger location, which offered more potential for small-group seminars. Last fall, student lab staff taught the first classes in the room itself, and by spring quarter, this curriculum had expanded to a series of weekly drop-in workshops for students who want to learn how to use the studio and its software. The DAW classes are now integrated into EPLT's successful workshop program and have become a regular offering.

Conclusion

When the University of Washington's Digital Audio Workstation opened in the fall of 2002, it was booked 24 hours a day for three consecutive months. Two years later, now that the novelty has worn off, the room still receives a steady stream of users (346 in the last five months) and is in enough demand that we are considering a second space. The DAW is a clear success, and an example of what can be accomplished when campus groups collaborate on construction, maintenance, and ongoing evaluation of technology facilities.

Appendix 1: DAW information online

Background Information:

University of Washington Libraries. Odegaard Undergraduate Library and Computing Commons home page. http://www.lib.washington.edu/ougl/ (accessed Oct. 17, 2004).

University of Washington, Student Access & Computing Group, Educational Partnerships and Learning Technologies. "OUGL Digital Audio Workstation Proposal." http://depts.washington.edu/sacg/projects/commons_audiolab.shtml (accessed Oct. 17, 2004).

University of Washington Student Technology Fee Committee. "UW Student Techfee." http://techfee.washington.edu/ (accessed Oct. 17, 2004).

End-User Support:

University of Washington Libraries. "Digital Audio Workstation." http://www.lib.washington.edu/ougl/daw.html (accessed Oct. 17, 2004).

University of Washington, Student Access & Computing Group, Educational Partnerships and Learning Technologies. "ProTools Quick Reference." http://depts.washington.edu/sacg/facilities/labs/handouts/protools_quick.pdf (accessed Oct. 17, 2004).

University of Washington, Student Access & Computing Group, Educational Partnerships and Learning Technologies. "Reason Quick Reference." http://depts.washington.edu/sacg/facilities/labs/handouts/reason_quick.pdf (accessed Oct. 17, 2004).

University of Washington, Student Access & Computing Group, Educational Partnerships and Learning Technologies. "Sonar 2.0 Quick Start." http://depts.washington.edu/sacg/facilities/labs/handouts/sonar_quick.pdf (accessed Oct. 17, 2004).

University of Washington, Student Access & Computing Group, Educational Partnerships and Learning Technologies. "Walk-In Workshops: Multimedia Series." http://depts.washington.edu/sacg/facilities/workshops/multimedia/ (accessed Oct. 17, 2004).

Appendix 2: DAW Hardware

Dell Optiplex P4 2.4Ghz

1GB RAM
(3) 20GB hard disk drives
Trios hard drive selector
80GB data drive
Pioneer DVD-R drive
19" LCD monitor

All of the PCs operating in the surrounding lab are Dells, so in terms of maintenance and experience it made sense to have a Dell in the DAW. Unlike many other manufacturers, Dell focuses on the amount of mechanical noise generated by their workstations and has made a conscious effort to keep such noise to a minimum. Since the recording room and the editing room in the DAW are collocated, this feature is critical.

Mrack 3R3 MIDI Workstation Desk

The Mrack is a specially-designed audio desk custom-made in Australia that dramatically improves usability and workflow when using the DAW. It thoughtfully organizes the most-used equipment, placing it all within arms reach in very comfortable and logical zones. Its modular design allows the user to configure it to best suit project needs and work style.

Furman PL-8 Power Conditioners

These are standard signal power conditioners, which help to protect the equipment and reduce the amount of electromagnetic interference, which is a major problem in the Seattle area.

Mackie 1642 mixer

Product of a Seattle-based company, the Mackie 1642 mixer was chosen based upon reputation, price and its 4-channel bus design, which allows for the ability to quickly reconfigure inputs and outputs without having to unplug cables. Since we are not using this device as a traditional mixer (with a DAW, the mixing is usually done in the digital rather than the analog environment), the routing ability was the most important aspect of this device. Today, there are many more choices available for this type of mixer than when we built the system in 2002, and we might not purchase a Mackie 1642 were we to build another DAW.

KRK V8 Studio Monitors

These professional near field speakers allow the user to accurately monitor the sound reproduced by the DAW. KRK is known for solid design and focus on minimizing the listener fatigue rate.

Tascam DA-40 DAT Deck

Installed for our professional users, the DAT deck allows easy transportation of audio files to and from a professional studio. This is probably the DAW's least-used piece of equipment; almost every studio can now accommodate master files on compact disc.

Line 6 Pod Pro Amp Simulator
Based on the guitar amps from the last 40 years, the Pod Pro can accurately simulate the amplifier, cabinet, speaker and microphone setup, eliminating the need to assemble and set up the equipment.

Roland JV-1010 General MIDI Synthesizer
The Roland JV-1010 provides all the standard general MIDI sound banks and a few extra bells and whistles. This is an external box that can be controlled by any keyboard, sequencer or computer that is equipped with a MIDI interface.

Fatar Studiologic SL-61 MIDI Keyboard Controller
This is a basic 61 key MIDI keyboard, similar to a standard keyboard except it has no sound banks of its own. It is solely an input device.

CM Motormix Control Surface
The Motormix is an interesting piece of hardware that adds a tactile surface to software that is usually controlled with a mouse and keyboard. It gives those with a professional background a familiar control set for mixing in a digital environment. It is fully motorized, which allows the user to input and record mixes and movements on the fly.

Echo Audio Gina Soundcard
A tried-and-true soundcard from the home environment, the Gina allows for two mono sources (or one stereo pair) to be recorded simultaneously while playing back as many as 99 tracks through 8 outputs. The Gina is a standard WDM soundcard, which makes it accessible to any Windows software.

Digidesign Digi001 Soundcard
The Digi001 is similar to the Gina device described above, but with a more professional interface. Students used to a professional studio will be right at home with this hardware/software combination; it is the home version of the very popular professional turnkey solution.

Appendix 3: DAW Software

Symantec Ghost
Used to copy, distribute and archive the contents of the hard drives. This is one component of the maintenance software suite.

Faronics deepFreeze
Protects and preserves the original workstation configuration, which can be restored by a simple restart. This program reduces system downtime while allowing students full reign, and is deployed on all machines in the EPLT-run computer labs on campus.

Sonic Foundry Acid
Acid is a sample/loop based composition tool. At its most basic level, it is paint by numbers for music. Excellent software for quickly creating original music, with no prior music experience required.

Sonic Foundry Soundforge
Soundforge is to music what Adobe Photoshop is to pictures. It is an ultra-detailed, high-resolution wave-editing program designed primarily for post-production and single track recording.

Sonic Foundry Noise Reduction
This plugin for Soundforge offers the user a very simple interface for quickly removing annoying background noises, hisses, pops, and clicks from recordings.

Propellerheads Reason
Probably the most powerful editing suite for the home user, Reason has modeled many of the vintage keyboard and drum machines of the past 30 years into a full-featured sequencing program. Wildly powerful and very confusing, Reason can reproduce everything from a symphony orchestra to modern trip-hop pieces without ever using another piece of software.

Sibelius Software Sibelius
Installed for our traditional composers, Sibelius is very powerful notation software for transcribing original pieces and preparing them for print.

12 Tone Systems Sonar XL
Sonar XL is the modern day digital equivalent of the traditional 2" 24-track tape deck used in professional studios. Because it is digital, the software allows engineers to edit non-destructively and to experiment without fear of erasing work. It supports 99 tracks of audio or MIDI with full sequencing and effects processing built in.

Digidesign Protools
Protools is the equivalent of Sonar (above), with a professional twist. A scaled-down home studio version of the interface that made Protools a success with professionals, it is a powerful software multi-tracking software package.

Appendix 4: Text of Audio Room "Statement of Responsibility"

By checking out the Digital Audio Workstation through the Libraries online system and accepting this case, you agree to the following terms and conditions. If you do not agree, please return this case to the OUGL Information Desk.

STATEMENT OF RESPONSIBILITY FOR AUDIO ROOM USE IN UNIVERSITY OF WASHINGTON LIBRARIES

RESPONSIBILITY

1. I understand that while the audio room is checked out to me it is my sole responsibility and I will take all reasonable precautions to protect it. I will not allow others to use it and understand that if I do, I may be held liable for any loss, damage or criminal acts that may occur.
2. I agree that I will be responsible for repair or replacement of equipment in the audio room due to any loss or damage while it is checked out to me. I also understand that if I do not make arrangements with the University of Washington Libraries to pay such charges, it may affect my ability to register for classes at the University of Washington or receive my diploma and transcripts.
3. I understand that if audio room equipment is stolen or I suspect it is stolen, I must notify the library unit from which it is checked out and file a theft report with the University of Washington Police immediately.

USE GUIDELINES

4. I agree to adhere to the terms and conditions outlined in licensing agreements including licensing grant restrictions, copyright restrictions, and transfer restrictions. For example, I may not copy software for personal use.
5. I agree to adhere to acceptable use policies for uniform access computing as outlined by the University of Washington.

LIABILITY

6. I understand that the University of Washington Libraries is NOT responsible for loss of data or other damage to files that may occur due to use of the audio room.
7. I understand that all data will be deleted from the equipment and that if I want to save my work, I must either copy it to a floppy disk/CD-R/DVD-R or transfer/copy the file(s) to my uniform access account.
8. I am a currently enrolled student at the University of Washington

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