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Project: UC San Diego's Podcast System

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This project could not have succeeded without the management support and guidance of:

> Tony Wood, Director, Academic Computing Services now ACMS
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Summary: UC San Diego's podcasting system is unique in that it's an end-to-end service designed collaboratively by IT and audiovisual experts that encompasses the whole process from request to recording to problem resolution. The benefits for instruction are many, especially empowering students to listen and engage during class time knowing they can relisten to the podcast later. Podcast.ucsd.edu has served as an incredible outreach tool, bringing in attention from across California and the world. Faculty request podcasting online, podcasting computers are managed centrally and recordings are processed automatically and served from a dynamic website. The system is based on inexpensive components, the existing classroom technology infrastructure and known technologies. Guiding the design were the principles that it be scalable, affordable and easily replicated at other higher-ed institutions. The system is almost entirely automated and is administered by existing instructional and classroom support staff, a feat given the wide campus adoption of 95 courses podcasts per quarter.

Project description:

Main Website: http://podcast.ucsd.edu
Sautter Presentation: http://tinyurl.com/sautter (Youtube video, 4:37)

Current Service Overview

UC San Diego's podcasting service supported 95 courses during Spring 2010), or about 255 hours of recordings per week. The service is primarily audio only, but also features video podcasts. The image portion captures the projector output and displays the instructor's laptop or document camera output. The service is almost completely automated. It's unique in that it's an end-to-end service encompassing the whole process from request to recording to problem resolution. Code and diagrams are available for use on other campuses. The system is based on inexpensive components, the existing classroom audio infrastructure and known technologies. Audio podcasting costs as little as $1,000, up to $2,000 per room depending on existing equipment installed. Video podcasting costs about $4,000 per room if there isn't an existing, fixed document camera in the classroom. Podcasting is available in all large lecture halls and a few satellite classrooms, 27 locations in total.

Process

1. Request
The podcast system extracts data from the campus data warehouse for all potential classes that could be podcast. Just before the start of each quarter, the Instructional Web Development Center (IWDC) emails instructors that they are teaching in a podcast ready room. The data is also integrated with the instructional technology request form for Academic Computing, the Course Information (Cinfo) application. When an instructor logs in to request a WebCT course, special lab software or server-based computing resources, if they are teaching in a podcast-ready room the option appears dynamically to request podcasting.

Faculty can request podcasting by going to the podcast request site: https://cinfo.ucsd.edu/podcastagreement/default.aspx . Though instructors may be teaching several courses, only those in podcast ready rooms are displayed. If video podcasting is available in the scheduled room, the option is given to record video or audio only. The instructor is also given the option to keep their podcast on the website after the quarter ends; otherwise the podcast removed after finals by default. Once an instructor selects the courses and options, the podcasting agreement is signed electronically. The podcasting agreement is based on UC Berkeley's agreement and was vetted by UCSD campus counsel. The agreement's language was crucial to alleviating concerns by faculty about how their recordings would be used. Faculty give permission for campus to post the recordings online, to trim off dead space and to add an introductory bumper branding it as a UC San Diego podcast. Instructors retain all intellectual property rights to the content of their lecture. Paper copies are accepted in rare circumstances, for example for guest speakers without UCSD network credentials. Once the scheduled course is in the podcast system, special requests for study sessions and additional course meetings are made by email.

2. Scheduling
Two reports aid the creation of podcasts. The administrator interface is how podcasts are added. This is one of the only manual steps and ensures that crosslisted courses and non-standard meeting times, for example TTh + W meetings in different locations and times, are scheduled correctly. To add a podcast,

the administrator clicks one button (Figure 1). Support staff can view all completed podcasting agreements in another online report. This benefits help desk staff by showing current requests with all the information pertaining to the podcast (location, instructor, time, days).

The add podcast action creates local entries in iCal on the classroom Mac mini to start and stop recordings for the specific course (Figure 2). The classrooms' computers check every 15 minutes for schedule changes, such a recordings canceled due to midterm or recordings to extend by five minutes. New podcast recordings are scheduled once a day.
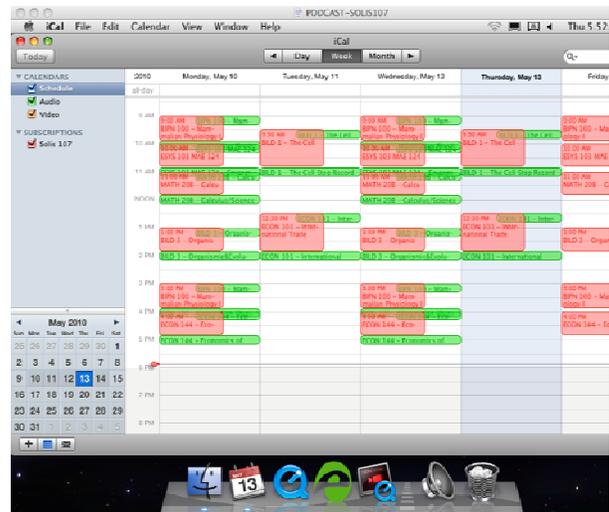

Figure 1: Add Podcasts

Figure 2: Podcast Recording Schedule

3. Recording

The classroom computers use Quicktime Pro to record audio. This is one of the last software components that require purchase. In the newer version of Mac OS X (10.6), the free Quicktime X can be used instead. Signal from the wireless microphone receiver is sent to the mixer, which preamplifies the microphone-level signal from the receiver. The computer is fed from the tape outputs of the mixer. Once the raw recording is available, two free Unix-based utilities process the file.   LAME converts the wav file to MP3 and adds metadata (ID3 tags). SoundeXchange is used to remove dead space and the intro recording.

Video podcasting uses Quicktime Broadcaster to record the audio and the output from the projector. It relies on Mac minis with improved video cards and an Epiphan VGA 2USB device (Figure 3).   Modmovie in QTCoffee is used to convert the file from Quicktime to MPEG4. The file is pushed to the podcast server using the same method for audio podcasts.
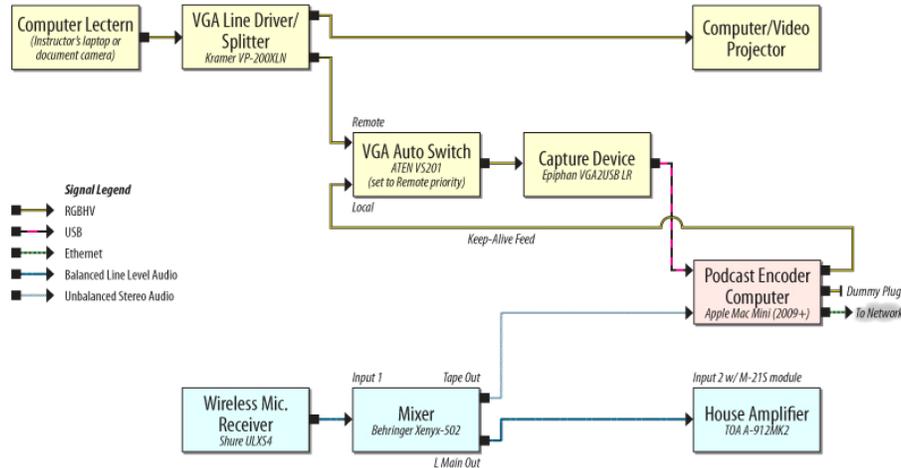
Figure 3 Video Podcast Diagram

Detailed description of Figure 3: Video from the lectern laptop input and the document camera is switched and amplified at the lectern and sent to the projection booth. In the booth, the feed goes to the line driver/splitter's input. Since the monitor output on the computer projector is inoperative at certain scan rates, a splitter is used to ensure a feed to the capture hardware regardless of display settings on the instructor's laptop. The projector is connected to one output of the splitter. The second output of the splitter is connected to the Remote input of the VGA auto switch. The Local input on the auto switch is fed from the Mini DisplayPort output of the podcast encoder computer via an adaptor (the keep-alive feed). The auto switch is set to remote priority; connecting and powering up a laptop or turning on the document camera overrides the keep-alive feed. The auto switch is necessary to ensure the rest of the capture hardware receives a signal at all times, to prevent a capture software error due to no signal should the instructor not start on time. A VGA dummy plug, emulating the load of an actual display, is connected to the podcast encoder computer's Mini-DVI output to enable two-monitor, extended desktop display mode. The capture device receives the output of the auto switch, converting analog RGB video into digital video. This data stream is passed on to the podcast encoder computer via a USB connection.

In the classroom, a podcast light is mounted in the control booth (present in the large lecture halls). The light is constructed of inexpensive and readily available components: an LED connected to an open source Arduino board. The light informs faculty when they're being recorded. The light is especially helpful for signaling the end of the recording. The Arduino is set to listen for commands on a USB port. A shell script sends ascii characters to turn on and off light based on recording times.

Once the recording has been processed, within five minutes of the recording's end, the podcast file is pushed to the podcast server. If the network or the transfer fails, the file can be retrieved later from the machine.

4. Listening

On the podcast website, recordings are organized by course and then by lecture. Users can download, subscribe or play the files on the site (Figure 4). Faculty can elect to have the links only posted within the learning management system WebCT (behind a password). In rare cases accommodation is offered to faculty who wish to edit recordings prior to being posted online. Blank recordings aren't posted; if

the file is less than 500K, it's blank. Students can report a problem for a specific recording by choosing from a preset of issues.
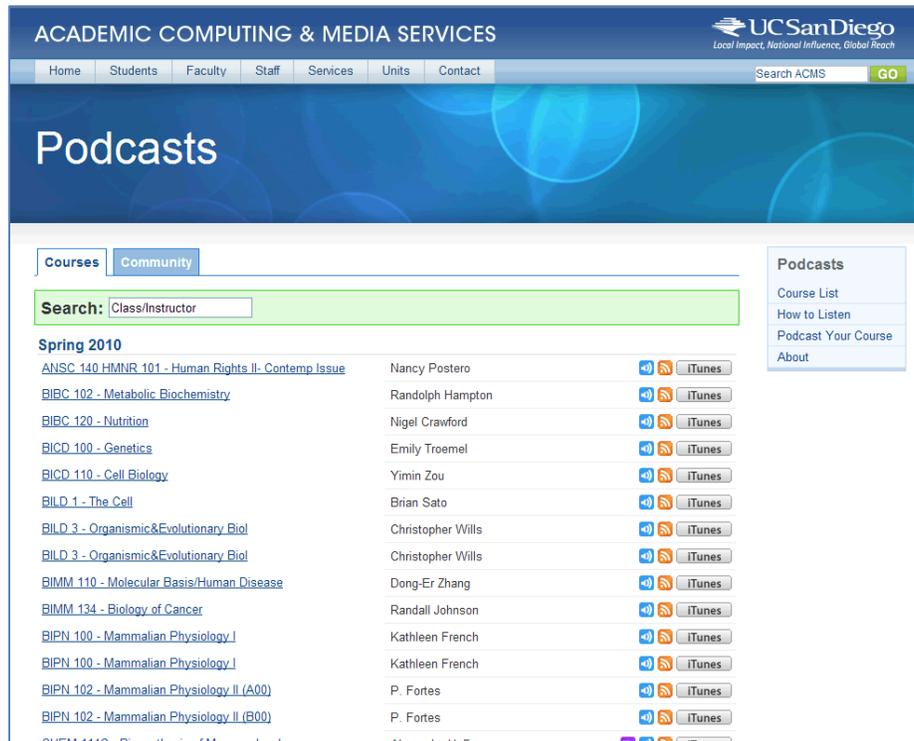

Figure 4: Podcast Website

5. Investigating Reported Problems
Online administrative reports, such as the 'recording status report', help support staff to alert faculty who forget to wear the wireless microphone. A second report, 'machine status', notes the Mac Minis' status (online/offline) and when the next recording is scheduled. The 'report a problem' online report lets support technicians quickly survey issues raised by listeners and mark them as resolved. If a problem requires escalation, a Help Desk (Footprints) ticket can be generated with one click. The form could be easily adjusted to another Help Desk ticketing system's format.

6. Imaging of Field Computers
Without automating the security updates and configuration changes, this service wouldn't be possible. By collaborating with the instructional lab support group, ACMS/Microsupport, the existing infrastructure and knowledge was leveraged. A prototype machine is used to create and update the master image. When a new change needs to be propagated, the prototype machine is attached to a second Mac as a firewire device. This is typically done once per quarter. An image is created using OS X's disk utility and the image is uploaded to a central server. An XServe running Deploy Studio Server holds all IP and MAC addresses for the computers served off this image. To initiate the update, remote desktop is used to send a command to all remote classroom computers; the computers use a netboot to connect to the XServe reload server (Figure 5). The XServe waits for connections from the classroom computers and copies in the new image.
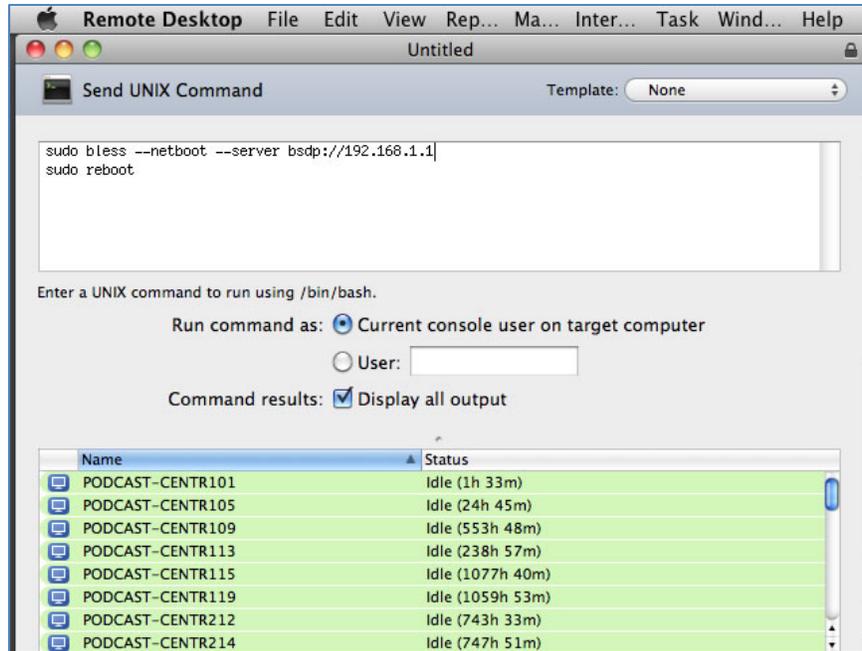
Figure 5: Initiate Reloading of Podcast Machines

Future Plans

With the last features added, work has turned to replacing the last proprietary software applications on the Mac mini with free software; the eventual plan is to move from Mac OS X to Linux. Arecord will replace Quicktime for audio podcasting capture and cron will replace iCal for scheduling. This will allow for the transition to nettops (akin to netbooks without a monitor). This will cut the cost of podcasting computing classroom hardware in half. The podcast site itself is in the process of being converted to PHP so the entire system utilizes a LAMP environment. To date, the system is only being used in one small classroom. Once the transition to nettops is complete, it will be much more affordable to deploy podcasting in the remainder of UCSD's small classrooms.

Technologies utilized: The existing implementation is based primarily on free, open source tools including:

- Arduino – open source circuit board to control the podcasting light
- ASP.Net – current dynamic page platform being phased out in favor of PHP
- Deploy Studio Server – pushes out new podcasting image based on authorized IPs and network (MAC) addresses.
- iCal – used to schedule podcasts. Podcasting machines poll the server for changes and update calendars stored locally on each machine. Being phased out in favor of cron.
- LAME – converts sound files to MP3 and adds metadata (ID3 tags)
- Mac OS X – used on the podcast systems and the imaging server. Being phased out in favor of Linux.
- Modmovie in QTCoffee – converts Quicktime to MPEG 4 (video podcasting)

- MySQL – database used to store possible podcasts, requests, recommendations, issues and serves website.
- Quicktime – used to record audio podcasts. Will be replaced with Arecord.
- Quicktime Broadcaster – used to record video podcasts.
- Sound eXchange – removes dead space and prepends the branding intro.

Timeframe of implementation: The first podcast took place during Fall 2006. The system was developed throughout the 2007-08 school year and expanded as funding for classroom equipment and personnel time became available. Major work included the integration with the schedule of classes' data, one click to add podcasts and server side iCal scheduling. During 2008-09, the system was automated, streamlined and administrative tools were added. In the first summer session of 2009, video podcasting was added. Most recently, work centered on enhanced user options, recoding the website for HTML 4, adding support tools and a podcasting light, and migrating towards a LAMP-based system. Now that the system is fully developed, another university could implement the same system within one quarter.

Accessibility: The podcast website is the primary interface for users and administrators. The site has been validated to Section 508 standards.   The Apple products are accessible including Mac OS X, iCal, Quicktime and Quicktime Broadcaster. The other open source utilities are primarily text-based and are scripted to run in an automated fashion. ACMS is partnering with the Office for Students with Disabilities to create transcripts for audio only podcasts and captioning for video podcasts. The sheer number of recording hours is challenging, but we're committed to providing text alternatives for hearing-impaired viewers.

Objective customer satisfaction data:

Student Survey

Prof. Laurie Smith from the Division of Biology surveyed her students on the importance of the availability of podcasting. 95% of the students found the podcasts somewhat valuable or valuable. According to Prof. Smith, "You don't get agreement like that on too many things (and these were students who mostly did come to class because I was giving them extra credit for clicker responses in class)." Details of the survey response (N=263):

Which of the following best describes your opinion on the value of video podcasting:

A. Somewhat valuable if I didn't attend class that day (11%)
B. Very valuable if I didn't attend class that day (22%)
C. Somewhat valuable whether or not I attended class that day (11%)
D. Very valuable whether or not I attended class that day (51%)
E. Not valuable (5%)

Website Feedback

2,043 "likes" or recommends have been logged since the new feature was introduced, including 1,203 likes during Winter 2010 alone.

Usage Data

The podcast service is very well utilized. Usage data for the most recently completed quarter (Winter 2010):

- Audio: 448,090 downloads, 2.56 TB downloaded, 95 courses
- Video: 282,380 downloads, 1.66 TB downloaded, 12 courses

Every academic year since podcasting has been offered, there have been substantial increases in the number of faculty using the system, the number of recording hours and breadth of offerings.

Quarter	Courses Podcast	Recordings per week	Video Podcasts*
FA 06	1	3	
WI 07	4	12	
SP 07	18	54	
FA 07	42	94	
WI 08	58	145	
SP 08	59	135	
FA 08	71	180	
WI 09	69	178	
SP 09	72	171	
FA 09	94	255	4
WI 10	95	255	12
SP 10	95	255	8

* First videopodcast Summer 2009

Podcasting 2006-10 — line chart of Courses and Recordings/wk from FA 06 to SP 10.
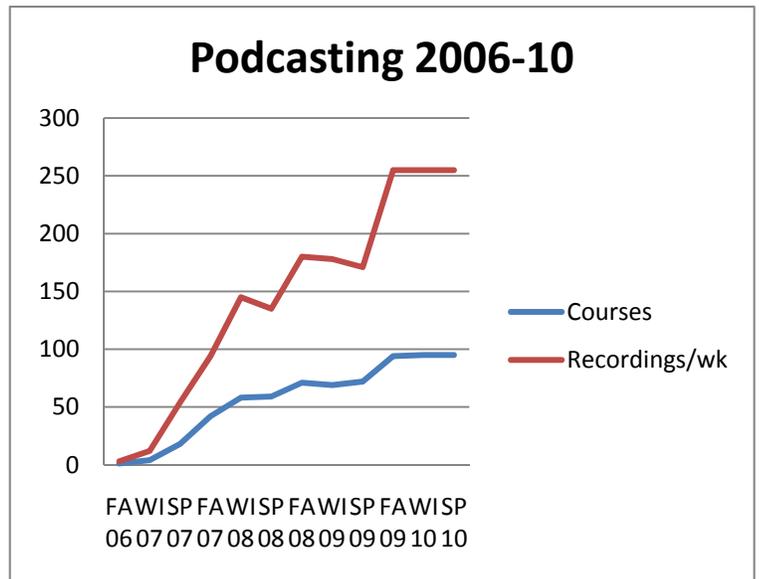
Analysis of web statistics show that 75% of visitors are repeat visitors returning anywhere from twice (10.8%) to 101-200+ times (5%). 42% of traffic initiates on campus, with the remainder of usage scattered throughout the local region and the state (Figure 6). The service is also popular in Canada, India, the United Kingdom, China, Germany, Australia, Israel, South Korea and Sweden.

Figure 6: Usage Data for California Winter 2010

Academic Departments Represented

- Anthropology
- Bioengineering
- Biology
- Chemistry
- Cognitive Science
- Communications
- Computer Science & Engineering
- Culture, Art & Technology
- Electrical & Computer Engineering
- Economics
- Education Studies
- Environmental Studies
- Environmental Systems
- Ethnic Studies
- Human Development Program
- History

- International Studies
- Linguistics
- Literature
- Mechanical & Aerospace Engineering
- Mathematics
- Making of the Modern World
- Music
- Philosophy
- Physics
- Political Science
- Psychology
- Scripps Institution of Oceanography
- Structures
- Theatre & Dance
- Urban Studies & Planning
- Visual Arts