Nomination of the

UC Berkeley Webcast Project

for the

Larry Sautter Award

May 1, 2002

UC Berkeley Webcast Project
Team Members
May 1, 2002

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BMRC=Berkeley Multimedia Research Center
CSHE=Center for Studies in Higher Education
ETS=Educational Technology Services
CCS=Central Computing Services

UC Berkeley Webcast Project
Abstract
May 1, 2002

The Webcast project at UC Berkeley provides live remote viewing and on-demand replay of courses and special events using streaming audio and video over the Internet. This project was a unique collaboration between a research group and central campus service providers to continue an innovative technology service. It is an example of a creative faculty member applying his research directly to the educational process, then working with campus service providers to develop an ongoing educational resource.

The system, originally called the Berkeley Internet Broadcasting System (BIBS), was developed as a research project by the Berkeley Multimedia Research Center (BMRC). As the system developed and was used for more courses, it became an integral part of some large, lower division survey courses. The campus administration put a high priority on turning the system into a production service. Both Central Computing Services (CCS) in Information Systems & Technology (IS&T), and the Educational Technology Services (ETS) department worked with BMRC to transfer the system to central campus management.

Goals and design principles of BIBS

The original goal for BIBS was to use Internet streaming media to allow students to review material from courses anytime, anywhere, on any computer. For students to review course material or make up a missed lecture, streaming media was considered superior to commercial note-taking services and viewing videotapes of the lectures. Virtually all UC Berkeley students have access to computers connected to the Internet needed to use this service.

The original design principles of the BIBS system were: 1) the technology must adapt to the teaching style of the instructor; 2) lecture webcasts are not intended to replace attendance at live lectures; 3) operating the system must be cost-effective; and 4) the system must be easy to install and use.

Service evaluation

 The service is very popular with students. Faculty attitudes vary about the virtues of course webcasting: some question the use of this technology while others believe it is a valuable aid to education. The pedagogical impact of webcasting courses on student learning is being evaluated as part of the grants from the Hewlett and Andrew Mellon Foundations.

UC Berkeley Webcast Project
Project Description
May 1, 2002

The Webcast project at UC Berkeley provides live remote viewing and on-demand replay of courses and special events using streaming audio and video over the Internet. This project was a unique collaboration between a research group and central campus service providers to continue an innovative technology service. It is an example of a creative faculty member applying his research directly to the educational process, then working with campus service providers to develop an ongoing educational resource.

The system, originally called the Berkeley Internet Broadcasting System (BIBS), was developed as a research project by the Berkeley Multimedia Research Center (BMRC). The work at BMRC was supported by funding from the National Science Foundation under Academic Research Infrastructure Grant 9512332 and Internet Technologies Grant 9907994. Additional funding was received from various BMRC industrial sponsors including Fujitsu, FX PAL, NEC, and Philips, and from the Berkeley campus. The evaluation was partially supported by grants from the Hewlett and Mellon Foundations.

Internet webcasting of courses by BMRC began in January 1995 with the weekly Multimedia, Interfaces, and Graphics (MIG) Seminar. After webcasting this seminar for a few years and experimenting with different technologies, lecture webcasting of regularly scheduled courses by BMRC began in Spring 1999.

As the system developed and was used by more courses, it became an integral part of some large, lower division survey courses. The campus administration put a high priority on turning the system into a production service. Both Central Computing Services (CCS) in Information Systems & Technology (IS&T), and the Educational Technology Services (ETS) department worked with BMRC in 2001 to transfer the system to central campus management. Webcast was among the few e-Berkeley projects selected to receive funding in the 2001 budget process.

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The original design principles of the BIBS system were: 1) the technology must adapt to the teaching style of the instructor; 2) lecture webcasts are not intended to replace attendance at live lectures; 3) operating the system must be cost-effective; and 4) the system must be easy to install and use.

How it works

ETS captures audio and video and routes the feed from campus classrooms to five "video gateway" computers in its master control room. Each computer is a Linux box equipped with sound and video cards. The video gateways automatically begin and end digital capture of scheduled classes based on a schedule stored in a central database. The video gateway forwards the recording to the streaming media server for live broadcast. When recording is finished, a copy of the lecture is transferred to the streaming media server for on-demand replay. Both the live and archived versions of the lecture appear in the dynamically-generated web pages listing what courses are available, what lectures are currently being streamed live, and what lectures are available for on-demand replay.

Behind the scenes

The Webcast server is a Sun E450 server with 4 cpu's and 4 gigabytes of RAM running: the Solaris 8 operating system, Real Server 8 to provide streaming media, and the Apache web server. The database that contains information about the courses being webcast is Postgres and the program code is written in PHP. The user interface consists of web pages dynamically generated by PHP programs from data in the Postgres database. The system allows program information to be specified such as class meeting times, lecture titles, class location, and even an external URL if available. Specifying start and end times for the playback of archived lectures allows Webcast's audience to skip over the "noise" before the start of a lecture that was recorded by the automated capture process.

How Webcast is used

Most students do not watch the live lectures remotely. The highest use of Webcast by students is on-demand replay when studying for exams. Other reasons students use the Webcast include:

- To revisit material they didn't understand in class
- To review selected topics before exams
- To watch missed classes
- To listen again to a speaker who was difficult to understand (i.e., a non-native English speaker)
- To review how the material was presented in a prior semester.

Currently during the Spring 2002 semester, fifteen courses are being webcast including such large introductory courses as Astronomy 10, Biology 1B, Chemistry 1A, Computer Science 3, and Interdisciplinary Studies 110. Other courses are being webcast in Electrical Engineering, Mechanical Engineering, and Nutritional Sciences. Extensions of webcasting include integrating it with discussion forums and live chat.

Lectures are played 20,000+ times per month by students, members of the Berkeley community, and people around the world.

Webcasting of special events was added to the service this Spring. These events included the visit by former President Bill Clinton in January and the visit by acclaimed photographer Sebastião Salgado in February. A special class, Harry Kreisler's *Issues in U.S. Foreign Policy Since 9/11*, features renowned speakers whose lectures stand alone as campus special events.

Which courses get webcast?

Courses are selected for webcast based on the following criteria:

- Classroom with a video signal to ETS master control (for automatic encoding into RealMedia)

- Student / faculty demand

- Video quality production from a given site (camera, lighting, video switcher for multiple camera views)

- Faculty member who has previously embraced and incorporated the webcast system into his or her teaching

- Departmental funding for video capture

Service evaluation

The service is very popular with students.   Faculty attitudes vary about the virtues of course webcasting: some question the use of this technology while others believe it is a valuable aid to education. The pedagogical impact of webcasting courses on student learning is being evaluated as part of the grants from the Hewlett and Andrew Mellon Foundations.

Graphical overview

This is a graphical representation of the Webcast system.
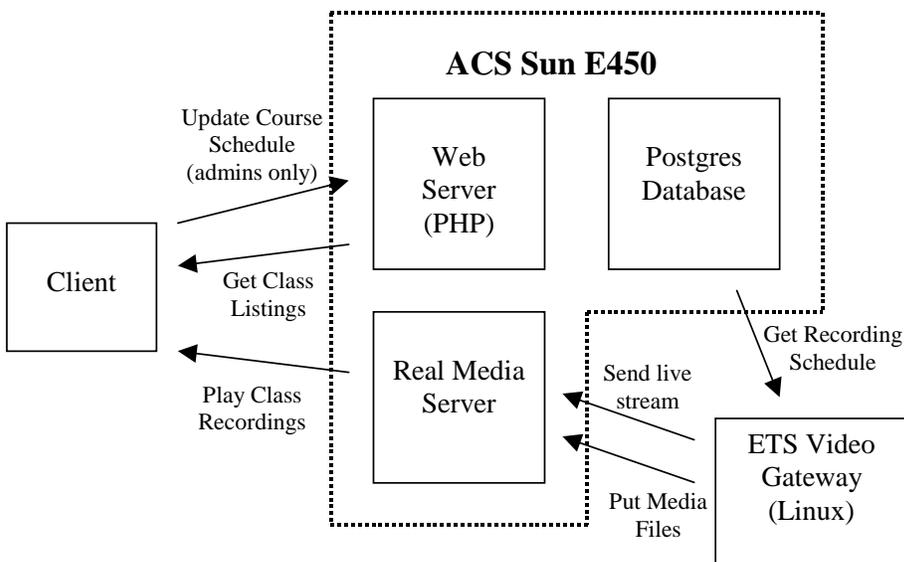
Relevant URLs

Webcast website: webcast.berkeley.edu

Clinton's visit to Cal: www.berkeley.edu/news/features/2002/clinton

Sebastião Salgado's visit to Cal:
www.berkeley.edu/news/media/releases/2002/01/18_salgado.html

BMRC website: bmrc.berkeley.edu

BIBS website: bmrc.berkeley.edu/bibs/index.html

BIBS: A Lecture Webcasting System (paper on BIBS system)
bmrc.berkeley.edu/research/publications/2001/160/index.html

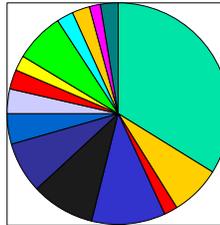Digital Chem1A: socrates.berkeley.edu/~chem1a

Webcast Statistics

The following graphic images detail webcast statistics for Fall 2001. These statistics are gleaned from the RealServer log files. These data include connections of at least 59 seconds in duration.

Total Views by Source Address, Fall 2001

- 84,073 Total Views
- 33% From Residence Halls
- Pacbell DSL and ATT @home widely used
- Large number of hits from Taiwan, China, Korea

Legend:
- UC ResHalls
- UCBnet
- UCBhip
- ATT@home
- Pacbell
- GB China
- TANET
- KITNET
- AOL
- Earthlink
- US/Canada ISPs
- Other ISP Asia
- Other Edu
- Other
- ATT
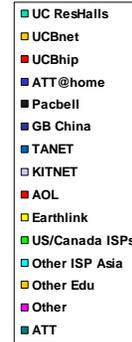
Total Views by Source Address shows total views for Fall 2001, plus a breakdown by residence halls (UCResHalls), other UC Berkeley network (UCBnet), UC Berkeley dial-in (UCBhip), and other ISPs.

Live Views by Source Address, Fall 2001

- 3,701 Total Live Views
- 50% From Residence Halls
- 10% Remainder of UC Network
- Very few live views from overseas

Legend:
- UC ResHalls
- UCBnet
- UCBhip
- ATT@home
- Pacbell
- GB China
- TANET
- KITNET
- AOL
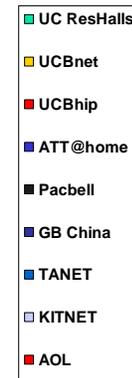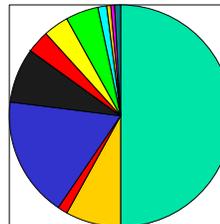
Live Views by Source Address shows the same data for live views.

RealPlayer Os and Client Version

- Most webcasts were viewed with a windows version of RealPlayer 7 or 8
- Noticeable use of Linux and freeware clients
- Macintosh not as widely used as expected

Legend:
- Win 2K/98
- WinNT
- Linux
- MacOS
- QTS
- RealPlayer 6 Win32
- Streambox(linux)
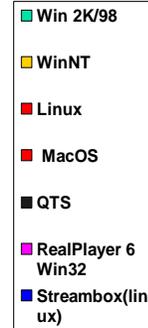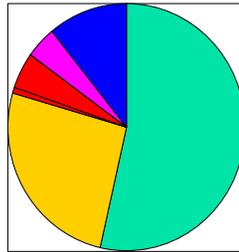
RealPlayer OS and Client Version shows what platforms viewers are using to access the webcasts.

Day by Day Views for Astronomy 10
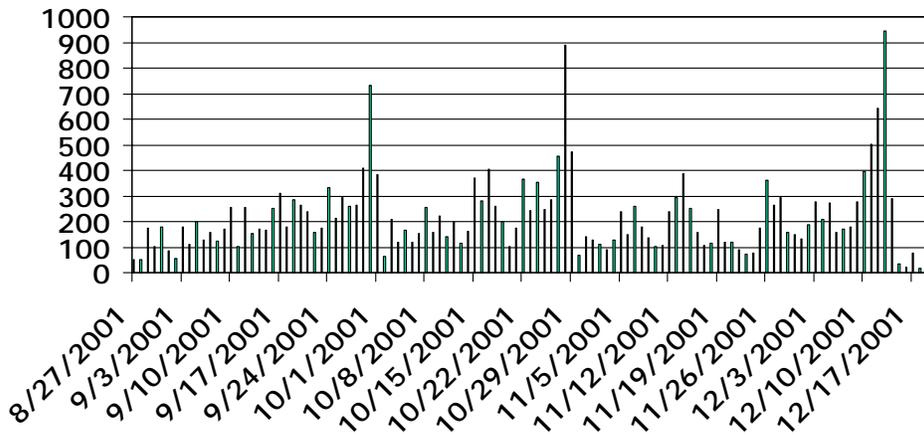
Day by Day Views for Astronomy 10 shows the activity for the popular Astronomy 10 class on a daily basis. This graphic shows a close association between heavy usage and the occurrence of midterms and the final exam.

UC Berkeley Webcast Project
Customer Satisfaction Data
May 1, 2002

Evaluations were conducted in Spring 2000 on student and faculty use of BIBS (e.g., student surveys, focus groups, usage statistics, and instructor interviews). More in-depth evaluations of Chem 1A student and faculty use of BIBS were conducted in Fall 2000 and Fall 2001.

The primary use of the webcasts is to study for examinations. Students report they watch BIBS lectures because they did not understand material presented in lecture, because they wanted to review what the instructor said about selected topics, because they missed a lecture, and/or because they had difficulty understanding the speaker (e.g., non-native English speakers).

Results from these evaluations, in combination with other feedback received from students and faculty, suggest that lecture webcasting is a valuable service that enriches the UC Berkeley learning experience. Further study is required to accurately assess the pedagogical impact that lecture webcasts have on student learning.

The streaming video server received 17,302 requests for Chemistry 1A lecture videos during the Fall 2000 semester, an average of 14.3 requests per student. Of these, 1,199 (7%) were for live lectures, and the remainder were for archived videos. Analysis of the usage logs revealed several other trends:

- The duration of each play was short. Over 60 percent of replays lasted less than ten minutes, and only ten percent of replays lasted for the entire lecture.

- Webcast usage peaked during the 4th, 8th, 12th, and 16th weeks of the semester, corresponding exactly to the course's midterm and final exams.

- Students accessed the archive beginning around 10 a.m. in the morning, building to a peak around noon. Usage continued heavy throughout the afternoon and evening with a short drop around dinnertime. Usage continued until 2 a.m. when it fell off rapidly until it picked up again later that morning.

Taken together, these data support the observation that students use webcasts primarily for on-demand study, rather than replacing attendance during live lectures. These observations parallel trends in other large courses using the BIBS lecture webcast service (Figure 1).
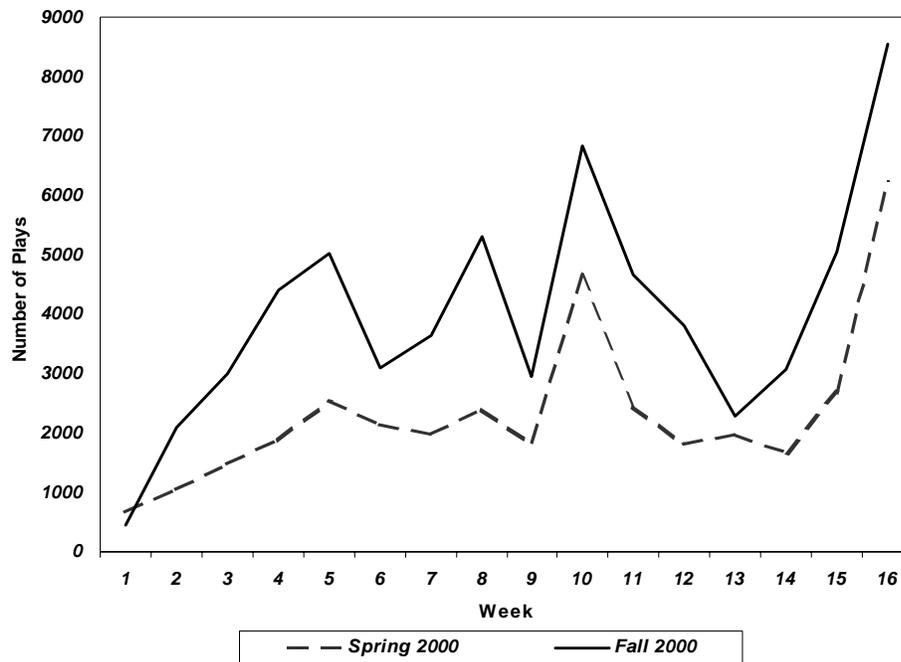
Figure 1: Plays Per Week
This chart shows the number of plays of all webcast lectures each week during the semester at UC Berkeley. A class with two midterms typically schedules them during weeks five and ten, and a class with one midterm typically schedules it between weeks eight and eleven. Week sixteen corresponds to the final examination period on campus. (Rowe et. al., 2001)

Students who completed the online post-survey found the webcasts useful, but preferred to attend lecture in person. Students indicated through comments in the in-class paper short survey that they preferred the webcasts because of the convenience and the ability to rewind and pause the lecture (e.g., "I can always rewind to listen to explanations if I didn't understand the first time."). When students whose first language was not English (approximately 28% of the enrolled students) were asked about the utility of the on-line lectures, a large number responded that the ability to review difficult sections of the lecture on-line was particularly helpful.

Overall, students expressed the opinion that webcasts were a valuable resource, but most useful as a supplement to in-person lectures, rather than a substitute. The focus group comments from students confirm our findings from the online post-survey regarding the reasons for preferring to watch lecture webcasts.

Six interviews were conducted with faculty during the Spring 2000 semester. Though all course instructors felt that lecture webcasts provided students with a useful tool, faculty perspectives about the webcasts varied. Some instructors fully supported the webcast system and either planned to or did integrate the webcasts as part of their overall curriculum. In doing so, they adopted the webcast technology as essential to the overall teaching process. Others were more removed from the webcasts, though no instructor objected to lecture webcasts as a tool for student learning.