Low-Cost Internet Synchronous Distance Education Using Open-Source Software

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Presentation Overview

• Introduction - motivation
• Software requirements
• Open source software
• System structure
• Scaling up to many students
• Conclusions
Motivation

• Experience shows instructor-led education is most effective
• Synchronous course delivery from live instructors via Internet is practical today
  – Audiographic delivery is most cost-effective
  – Best when combined with asynchronous delivery
• How to make this affordable?
  – Simulteaching to in-person and Internet students
  – Dialup using inexpensive personal computers
  – Record as it is taught, for missed classes/review
  – No-cost, open-source software

Simulteaching Setup

[Diagram showing the setup with labeled components such as Video Camera, Workstation Display/Tablet, Clip-On Microphone, Workstation Keyboard and Mouse, Recording of Class, Classroom Projector, etc., connected via LAN to Internet.]
Simulteaching Software Requirements

- Works on inexpensive PC
- Works over dialup modem
- Quality: well designed, doesn’t break
- Simple, robust, easy to use
- Scalable to large numbers of students
- Works despite firewalls and NATs
- Authentication and floor control

Modular, Open-Source Software
Parameters of the Solution

• We have determined through experience:
  – Entire system, from teaching to online delivery, must be designed to be simple and robust, functioning in almost any Internet environment.
  – Quality, robust software is essential.
  – System must make online teaching and learning easy
    • Comparable to teaching with overhead projector
  – Software must function over low-capacity Internet connections to reach most students.
  – Use with (not in place of) email, Website, WebCT/Blackboard.

Software Components

• Internet audio: Speak Freely by John Walker
• Whiteboard: WBD by U. of Loughborough
  – Authoring via PDF, for example LaTeX or PowerPoint
• Internet video: VIC by Lawrence Berkeley Labs, U. of Southern California and U. College London
• Record/Playback by GMU NETLAB
• Floor Control by GMU NETLAB
• Transport Layer Multicast (live) server and client by GMU NETLAB
• Apache Webserver by Apache Digital
• MySQL database by MySQL AB
• Chat: browser-based phpMyChat (also MySQL)
System Structure

• Multi-platform target architecture
  – first release client is Windows-only

• Thirteen building blocks
  – all communicate via Internet Protocol
  – allows flexible configuration

• Generally, one server per classroom
  – peer-to-peer client supports range of modes
  – lecture, seminar, conferencing
  – two-way audio (also text questions and chat)
Talking Head Video Interface
(NEW also supports downloaded video clips)

Scaling Up Course Management

• Started with one course per semester
  – Ran it on desktop computer
• Now have twelve per semester
  – Need a real server
  – More than that: webpages and a database
• Learned how to scale up
  – And stay cost-effective
Scaling Issues

- Worldwide or regional access?
- Technologies used must be scalable
- System design and procedures too
- Webpages make system easy to use
  - Students are no longer “early adopters”
- Dialup modem for quality of service
- Not all students want online access
  - But nearly all of them want playback

NEW Webpage Functions

- User authentication
- Download/install software
- Connect to live class
  - Spoken input and video optional
- Connect with a recorder for teaching
- Class chat room
- Review: playback, teaching slides
- Instructor email to class
- Upload/download slides and recordings
- Database and server administration
Institutional Issues

- Do this to make education more accessible
  - Probably no cost savings to university
  - But it reaches an underserved group
- Even progressive faculty members resist new media
  - Simulteaching helps (known paradigm)
- Online teaching requires more institutional support
  - Save on classrooms; pay for assistants
Instructors Must Be Reminded

• The online student does not benefit when you point your hand at the screen—use the WBD arrow!
• The online student can’t hear other student questions from the back row—repeat the question!

Conclusions

• Synchronous online teaching with open source software is popular with our students
  – And the faculty are growing to like it too
• Software must be simple to use and scalable
• Requires some extra support
• Inexpensive computers and free software allow cost break-even or better
  – While reaching a new group of students!
For more information:

http://netlab.gmu.edu/NEW