RC 22008 (98858) 19 March 2001 **Computer Science**

IBM Research Report

Media and Distance - A Learning Experience

Arnd Steinmetz
IBM Research Division
Thomas J. Watson Research Center
P.O. Box 218
Yorktown Heights, NY 10598

Research Division
Almaden - Austin - Beijing - Haifa - India - T. J. Watson - Tokyo - Zurich

Column IEEE MM

Media and distance – a learning experience

Arnd Steinmetz, IBM Research

Multimedia, educational software, distributed or remote learning, knowledge management
These are the buzzwords that came up (again ?) lately and seem to melt into one solid base for the new 'knowledge age' (as opposed to the 'information age' which used to happen last century). How ever if one takes a minute to look around and analyze what is out there one will find a very sparsely occupied field. Now is that because we are just lurking across the edge of a yet undiscovered land or is it because we are already gone over it and only few seeds actually grew up? Let's take a (certainly not complete) look at the multi medial distance learning systems that have been or still are in existence and then draw a conclusion what might be needed.

The field I'd like to look at specifically is the recording and distribution of a class scenario. To put a tag on this, let's call it a *remote participation system.*
These systems are characterized by

- No special preparation for the recording is necessary by the lecturer/speaker
- The recording system is not intrusive, i.e. it does require no special attention by the speaker
- There is a local audience
- The remote audience might be assembled in groups or watch individually on their computer screens

The remote participation could happen live while the event is happening. In that case the recording is being broadcasted or multicasted instantly through the network(s) letting *the* remote audience *participate synchronously.* In addition to this the class/lecture/talk recording can be stored on a server and be available for viewing on demand therefore allowing for *asynchronous participation.*

A scenario
Recent multimedia education or tele teaching applications still have to cope with the problem that classical education uses various ways to mediate contents that is hard to represent in multimedial environments. This especially takes into account settings where a pre- or post-production is not possible, such as in live recordings of talks or classes. In such settings the speaker might use foils, show videos or use a (virtual) white board thereby using gestures to stress specific passages or regions of his or her foils or board. A simple video and audio recording can - in assumption of very high quality - catch the scene in total but cannot focus on specific details and even if there was a focus it wouldn't be personalized and user-defined. And still even while recording live presentations, a multimedia1 education application should be more then yet another copy of an audio-visual impression of some virtual attendant, it should allow every single user to e.g. flip back a few foils to look something up or even to automatically sort out uninteresting parts. It should be an addition to just seeing and hearing.

Systems like this have existed since the 'pre-computer' age, utilizing analogue video recording. Synchronous distribution was handled by TV-cable or airing ('campus TV'), the asynchronous distribution by shipping magnetic tapes.
Recently most systems added or changed to digital recording and distribution via the data networks, utilizing video servers for both, synchronous and asynchronous distribution. Examples of these are the Berkeley BIBS, Cornell Lecture Browser (now included into Berkeley's MIG Seminar) and Georgia Tech e-Class (see the sidebar for more information on other organizations, systems, and products). Asides from public education, companies use such systems for internal education and corporation communications (CEO's Speech). Daimler-Chrysler uses such a remote participant education system based on analogue video; it is utilized to train technicians and mechanics on new engine and car models.
IBM Research's e-Seminar is an example for a completely digital system. It is used to distribute lectures and invited speeches throughout the division. Caused by the time zone shifts for all its labs worldwide, both synchronous and asynchronous distribution are required.

Problems with digital media recording in education

One important aspect of the digital recording systems is regarded towards the types of media they record. The need for the recording of additional media streams arises from the 'poor' resolution of the video signal. A standard NTSC video image has a nominal resolution comparable to 640x480 pixels. This makes camera shots of any projected computer screen (slide presentation) blurry and unreadable but for the largest fonts and boldest graphics (see Figure 1 below). Therefore a separate recording and/or transmission of the material shown during the lecture/talk are needed. The same basically holds true for blackboard/flipchart usage.

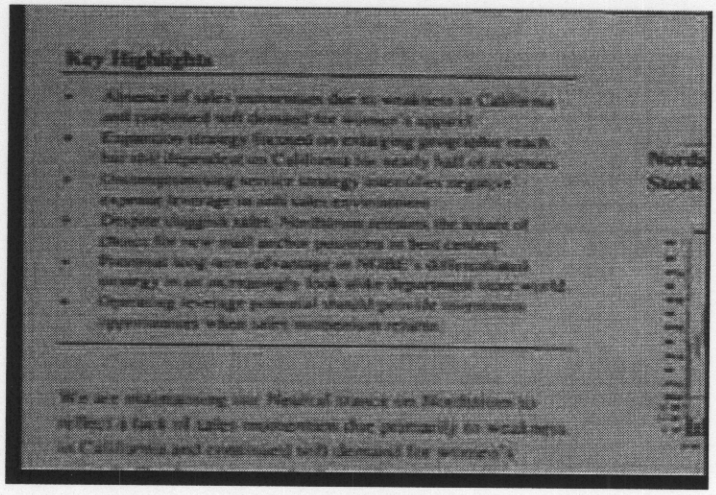

Figure 1: Typical video capturing quality of projected slides

The recording of several separate streams of media brings with it the typical problems of re-synchronization for play back. Because even if the recording system was able to include a copy of the presented PowerPoint or Freelance file into its dataset, how does it know when which slide was presented? Tracking the speaker's actions on the presentation machine (e.g. tracing page up and down buttons or mouse clicks) might be a solution but leads straight to the next aspect: Intrusiveness.

The basic idea is to record and distribute/store a live event to gain an additional audience for it. Especially in education great efforts have been taken to ensure, that the 'operation of the educational environment' is simple, straightforward and instantaneous. Blackboards are always usable, as are flipcharts. An infrastructure is provided to refill chalk and board markers. Most conference/lecture rooms today are equipped with built-in, ready to use slide- and video projectors as well as audio equipment (microphones, speakers). So should remote participation enabling systems be built into, ready-to-use.

However, this implies that the speaker/lecturer should not be disturbed by the recording it self. In the ideal case they would not even be consciously aware of it. So, installing software on the speakers machine or even remotely controlling it should be a 'NoNo'. The speaker should be able to walk in with his prepared material on his usual machine, connect it to the projector and start. Get your tracing data where you want.

Storing this kind of data is another problem. There are no accepted standards to store this kind of multitude of information in dynamic and static media and their relation in a neutral (i.e. vendor independent) way. MPEG-4 and MPEG-7 are supposedly under way to help out and solve (among many others) the tele teaching data dilemma, but they still have a long way to go.

On the other hand, experience has shown, that enabling the possibility to remotely participate in the event often leads to less local audience. Therefore the speaker must have a means to sense the number and interest of his remote audience. How does he know that there are 50 remote participants, when his auditorium is almost empty? The data to be gathered here must not be restricted to 'somebody was here and watched something' but quite exact data has to be traced on which part of the presentation was watched, when which user joined and left (anonymously, of course, taking private data protection e.g. in Europe into account). This is especially true for asynchronous participants, viewing the presentation on demand at a later time.

In the case of synchronous participants, they might want to ask questions. But handling a chat system or even a question queue is not yet common ground for everybody. So a moderator might be needed.

More to learn for solutions

All in all still there are many unsolved problems. Many requirements actually seem to be mutually exclusive (like non-intrusiveness vs. need for moderator). Each of the tele teaching systems mentioned above tackle some while neglecting others.

Systems like Class2000 basically replace the existing educational infrastructure and equipment completely and are struggling because of their complexity and intrusiveness but deliver high quality, high volume recorded data. Others like the Berkeley BIBS are very discrete and non-intrusive but need to heavily rely on manual production and postproduction.

Although changes happen fast these times – yes, even in schools, universities and corporate education – I believe we still need some more time to acquire a basis of cultural knowledge about distance education, its possibilities and especially its implementation.

Coming back to the metaphor used at the beginning of the article we're not looking at an undiscovered land but have been over it several times. Yet we still have to go over it again and plant new seeds as well as to change our taste of things.

Sidebar:
Links to multimedial talk/lecture recording systems

University of Berkeley, US	
Berkeley Media Research Center	http://www.bmrc.berkeley.edu
Berkeley Internet Broadcast System BIBS	http://www.bmrc.berkeley.edu/frame/research/bibs/ http://media2.bmrc.berkeley.edu/bibs/schedule.cfm
BMRC Lecture Browser	http://bmrc.berkeley.edu/frame/projects/lb/index.html
Cornell University, US	
Zeno Lecture Browser	http://www.cs.cornell.edu/zeno/Projects/lecture%20browser/Default.html
Georgia Tech, US	
e-Class	http://www.cc.gatech.edu/fce/eclass/
IBM Research, US	
e-Seminar	http://www.research.ibm.com/projects/_eSeminar
GMD-IPSI, DE	
CSCL	http://ipsi.gmd.de/CSCL/
European Community, EC	
CUBER	http://www.cuber.net
Open University, UK	
Knowledge Media Institute	http://kmi.open.ac.uk/home-f.html
Learning Resources	http://www.ouw.co.uk/
Viktoria Institute, SE	
Interactive Learning	http://quiz.informatik.gu.se/vil/
University Mannheim, DE	
Tele Teaching	http://www.informatik.uni-mannheim.de/informatik/pi4/projects/teleTeaching/
US Distance Learning Association	http://www.usdla.org/
The Distance Learning Resource Network	http://www.dlrn.org/
University Links Distance Learning	http://www-net.com/univ/list/distance.html
AutoAuditorium	http://www.autoauditorium.com/
Cisco	
IP-TV	http://www.cisco.com/warp/public/cc/pd/mxsv/iptv3400/index.shtml
MBONE	
The Mbone tools	http://www.savetz.com/mbone/