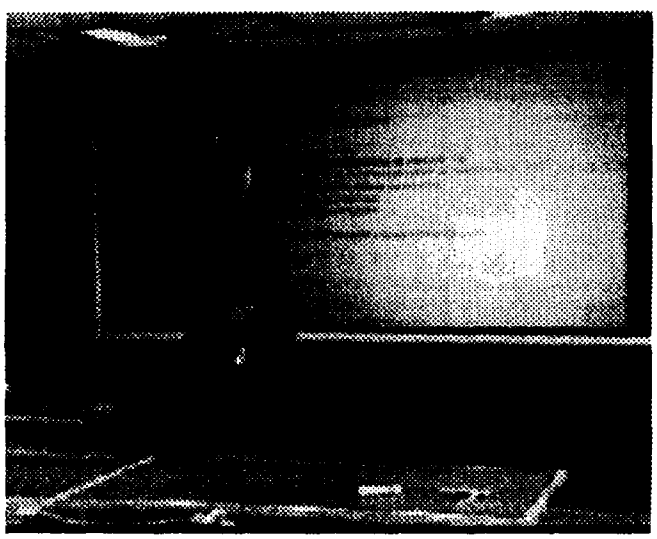
# Combining Realtime Multimedia Conferencing with Hypertext Archives in Distance Education

Per Einar Dybvik, Håkon W Lie
Norwegian Telecom Research

Video conferencing systems are currently being used to distribute lectures over geographical distances. Through 2-way video and audio links, students can actively participate in classes without being physically co-located with the lecturer.

While this use of video conferencing systems may reduce travelling and make more courses available to students, the video link only conveys a limited part of the communication that naturally takes place during a course. Handouts, copies of tranparencies and high-quality images are examples of data that are not easily transferable over a video link.



Norwegian Telecom has established a high-capacity digital network for experimental applications. The bandwidth of the Supernet (33Mbit/s) allows for establishing real time video conferences over a packet-switched network using Internet protocols. This duplicates the functionality of a traditional video conferencing system while allowing us to integrate common Internet applications into the lectures.

A course at the University of Oslo has been using video-conferencing systems to make the lectures available to a larger group of students. Two electronic classrooms, one located at the main campus and the other at a satellite location has been linked over the Supernet allowing for video and audio transmission. Each classroom contains cameras and monitors, in addition, the rooms are equipped with large electronic white boards where the lecturer can present and interact with information.

Also, students connected to Internet are able to participate in the course. Through freely available, but lower quality videoconferencing software, students in Trondheim, Tromsø and Stockholm can follow lectures. Unfortunately, this has been a one-way link not allowing student interaction.

All students, wether in the electronic classrooms or at their machines, can follow the whiteboard presentation in a window. The shared whiteboard is based on the World Wide Web system, which has established itself as the hypertext system of choice on the net. An increasing number of information servers around the world allow users to access information through client programs.

The hypertext markup language, which is the native data format of the web, allows for simple, but effective, presentation of textual information. Also, client programs may support other data types such as images and sound. The whiteboard, which is a modified version of the Mosaic client software, is rendered at each participating site. As the lecturer moves forward in the presentation, a multicast protocol instructs each client to fetch the new transparency from a common server. Compared to sending a video image of the transparency, the presentation quality is significantly higher, while utilizing the power of distributed processing and high-resolution computer screens.

The shared whiteboard window has proved to be valuable for all participating students -- probably more so than the image of the lecturer or the participants. Still, audio seems to be most important.

By, putting the presentations into the web, transparencies are available to the students for review after the lectures, thereby replacing paper copies.

However, making the lecture transparencies electronically available has raised some questions with regard to the structuring of information. The sequential nature of a

lecture and the corresponding transparencies does not exploit the capabilities of hyper-linked structures -- which users expect to find on web-servers.

The World Wide Web represents an information architecture that can be a basis for distributed groupware applications. By combining a hypertext system with real-time multimedia communication, we are seeing the contours of a rich, distributed groupware environment where distance education will thrive.

**ACKNOWLEDGEMENTS**

The classrooms and the technology are developed in a collaborative project between Norwegian Telecom Research (NTR), University of Oslo (USIT) and Center for Technology at Kjeller (UNIK). We would like to thank Bjørn Hestnes and Hjalmar Martinsen from NTR, Geir Pedersen and Ronny Nilsen from USIT and Rune Fløisbonn and Morten Sørdal from UNIK for helping out and letting us use the classrooms. We would also thank Tim Berners-Lee and his team at CERN for giving us World Wide Web.

**REFERENCES:**

D. Solvoll, et al: *Information Exchange in MultiTorg*, Telektronikk 4/93, Norwegian Telecom 1993

I. Hovig, H.W. Lie, Teleteaching in a Graduate Seminar: *Practical Experiences and a Look Ahead*, Proceedings of the IFIP TC3 International Conference: Teleteaching 93, Trondheim, Norway, 1993

T.J. Berners-Lee, R. Cailliau and J.F. Groff, *The World-Wide Web*, Computer Networks and ISDN Systems 25 (1992) 454-459. North-Holland. Presented at Joint European Networking Conference , Innsbruck, Austria, 1992.

C. Egido, *Videoconferencing as a Technology to support Group Work: A Review of its failure*, Proceedings of CSCW'88, pp. 13-24, Portland, Oregon, 1988

K. Bringsrud, G. Pedersen, *The MUNIN Project: Distributed Electronic Classrooms with Large Electronic Whiteboards*, Proceedings of the IFIP TC3 International Conference: Teleteaching 93, Trondheim, Norway, 1993

C. A. Ellis, S. J. Gibbs, G. L. Rein, *Groupware — some issues and experiences*, Communications of the ACM 32, 39-57, 1991

B. Olsen, *Third Generation Distance Education*, Proceedings of INET'92, pp. 359-367, Kobe, Japan, 1992