

The University of Michigan Final Report  
as Subcontractor to the  
Stanford University "ADVANCED NETWORK INFRASTRUCTURE FOR DISTRIBUTED  
LEARNING AND COLLABORATIVE RESEARCH (HAVnet)"  
National Library of Medicine Contract No: N01-LM-3-3512

Goal of the Project:

To develop and implement a network based teaching/learning environment to understand the needed network and application infrastructure.

Introduction:

Using anatomy materials and tools from Stanford University, in conjunction with University of Michigan enhanced National Library of Medicine (NLM) Visible Human Female (VHF) material, a collaborative networked learning environment was tested. Stereo imaging in teaching was the primary modality explored with Stanford University and the University of Wisconsin-LaCrosse. The Access (Insors) Grid teleconference unit (a teleconference system with multiple video streams viewed simultaneously between sites) was extensively used in parallel with the UW-Lacrosse Remote Stereo Viewer (RSV).

Body:

Dr. Ameer Raof provided access to University of Michigan graduate, undergraduate and medical students for the evaluation activities and, in collaboration with Dr. Sakti Srivastava of Stanford University, developed instructional goals. All evaluation sessions ended with questionnaires filled out by the students attending the sessions to assess their understanding of materials presented and the usability of the learning environment.

Alexander Terzian was the primary interface with Stanford for the setup of the UM testbeds, specifying and purchasing equipment, producing the VH knee movies, and coordinated schedules and session timing extensively with Margaret Krebs of Stanford University.

Dr. Steven Senger (UW-LaCrosse) was instrumental in the collection of end-to-end network performance metrics and diagnosis of connectivity problems. The issues of degradation of network performance as sites were added by multicast or bridge techniques were explored, with a maximum of four RSV – Access Grid sessions run simultaneously.

Evaluation Session Dates: 10-15-2004, 11-3-2004, 02-18-2005, 04-6-2005, 04-13-2005, 04-20-2005, 06-01-2005, 07-14-2005, 12-02-2005.

University of Michigan Multimedia Material created or used during the project:

1. UM developed movies of NLM VHF color images, with anatomical labels incorporated: views of the VH knee in sagittal, coronal, and transverse sections. The coronal section movie is available at <http://treehouse.ctaalliance.org/CoronalKnee5.mov> (Quicktime required).
2. Between 01-05-2005 and 04-18-2006, Dr. Ameer Raof participated in a Digital Media Commons (DMC) project to create a Virtual Anatomy Atlas prototype through a DMC GROCS (Grant Opportunities [Collaborative Spaces]) award. The team members applied their photography and dissecting skills to capture a series of images of a human hand through five

levels of dissection to produce the University of Michigan Virtual Hand Project. The images captured from these dissections were used to produce a prototype QTVR movie. This movie was used during evaluation sessions <http://www.dc.umich.edu/dmc/grocs/06/anatomy.html> (hand prototype QTVR).

In January of 2006, Dr. Raof visited Stanford University with 2 students to assess the application of the University of Michigan Hand Anatomy Project, and compared content-creation techniques with the techniques used by Stanford SUMMIT.

*Software, Networking Environments and Facilities Used:*

Primary software used: the University of Wisconsin-LaCrosse Remote Stereo Viewer (RSV), Virtual Network Computing (VNC) (during the early stage of the project), and two versions of the Access (Insors) Grid software. The RSV required Multicast networking functionality for its use. The implementation of multicast for this project occurred in two stages: the first evaluations were held at leased University of Michigan space at 3600 Green Court, where multicast routers were already functionalized and were 'on the edge' of the University network environment. The teleconferencing room at 3600 Green Court was outfitted with three stereo workstations (two funded by the project and one existing unit). These workstations, in conjunction with the built in Access Grid, formed the basis of the distance learning sessions. The second stage moved operations to the UM Medical School (UMMS). Multicast for this stage was enabled for the entire Medical Center Information Technologies (MCIT) network. A considerable time lag for this second stage occurred as MCIT staff became trained in multicast and worked with campus networking to review the router changes.

With multicast enabled in UMMS, the December 2<sup>nd</sup>, 2005 evaluation session occurred in the Learning Resource Center (LRC) of the Taubman Library. Equipment consisted of a portable Access Grid, together with the three stereo workstations. The equipment was setup "on the fly", due to the limited availability of the classroom. This proved the concept that a distance learning room could be installed quickly in any room where multicast networking is available. This very successful session was attended by the current Dean of the University of Michigan Medical School, James Woolliscroft, Medical School faculty, and medical and undergraduate students.

Multicast in the UMMS is now a production service because of this evaluation session and the RSV application required for it.

After multicast for the Medical School network was enabled and during the no-cost extension of this project, classroom 2036 in the UM Palmer Commons building (100 Washtenaw Avenue) was fully equipped with an Access (Insors) Grid system with multiple displays, cameras and microphones, and the computer and display systems needed for 3D viewing.

Lessons learned during this project were used by the UM National Center for Integrative Biomedical Informatics (NCIBI) for demonstrations of 3D protein visualization software from the NLM NCBI at the start of the Fall 2007 semester.

Conclusions:

Remote real-time instruction with advanced display, and interaction capabilities benefits from Multicast IP protocols. When such is implemented, network bandwidth can be significantly conserved.

Implementing Multicast in a secure environment which has not previously used such resources requires significant training of the network personnel to assure the continued security of the network.

The benefits of remote collaborative teaching/learning environments are dependent on the understanding of how new technologies can be used. Limitations caused by lack of optical resolution, mobility of vision, and loss of auditory cues can be compensated for by using teaching methods and providing teaching resources and source material that takes full advantages of the strengths of the digital environment.