

VIRTUALSCHOOL.CINECA.IT

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The Italian Interuniversity Consortium CINECA every year offers two highly specialized summer courses to students coming from all over Italy: "High Performance Computing" and "3D Scientific and Interactive Visualization". The high interest for such topics is evident from the large number of applications, but the demand for participation always exceeds the number of seats available at CINECA. As a result many qualified people are left out from the courses; moreover sometimes eligible students can't afford to leave their homes or workplaces to attend classes in Bologna for the entire duration of the school.

CINECA has taken action to try to meet the students needs and to give to a larger number of students the possibility to have access to the knowledge and expertise of CINECA on such topics.

Since 2005 it is possible to attend lessons via e-learning. The summer schools now use the e-learning platform Moodle to register students and to offer several interactive instruments: chat, discussion forum, software downloading and streaming videos. Lessons are broadcast live and delivered on the Internet using a Videolan Encoder and a Darwin Streaming Server. The web interface allows remote students not only to see the teacher, but also to view the slides presented and to see the classroom whiteboard. Remote students can also interact directly with each other and with the teacher using the Moodle chat or the Skype internet phone.

The use of such e-learning technologies has proved to be quite successful as the participation to the online community has been very active and animated and the feedback from students was enthusiastic..

Keywords: moodle, videolan, streaming videos, remote interaction, skype, online lectures, online community

1. Introduction

CINECA every year organizes summer schools for students and postgraduate interested in the themes of supercomputing and scientific visualization, held by skilled internal and external teachers.

The excellence of the teachers and the high level of the courses lead to the necessity of a hard and difficult selection of the participants, as the number of the requests is always higher than the available seats. The low student/teacher ratio is due to the fact that every participant has full access to the resources of CINECA, and so is unavoidable to reduce their number.

During the last two years, in an experimental way, CINECA has used its e-learning infrastructure and its experience in the streaming delivery of video contents to allow a greater number of students to access these summer schools. In particular this possibility has been greatly appreciated by students living far from Bologna, where CINECA is located.

The experiment has been a success, and we have decided to continue the experience improving the system also thanks to the feedbacks of the participants, both teachers and students..

2. Materials and Methods

CINECA summer schools are split in theoretical lessons and practice sessions, held in two different classrooms. Remote students must be able to attend both of them, with the same facilities and the same satisfaction of a local student, but in virtual presence.

The preparative meetings between the technology experts and the teachers, made it clear that besides the streaming video, it is of paramount importance to give remote students the possibility to access all the files and didactical materials that are available for the local students (slides, software for exercises, papers, etc.), to communicate between themselves and with the teacher, and, of course, to have the possibility to access to the CINECA mainframes from home.

Those services are provided by a LMS (Learning Management System), a web service projected to deploy an interactive virtual environment with a number of different features shortening the distance between the virtual students and the teacher in the real classroom.

The e-learning platform chosen for the project is Moodle. The reasons of this choice are the easiness of use and of customization and the compatibility with the streaming interface. 3.2 Figures and tables

2.1 Streaming setup

On-line students are provided with a video interface showing two video streams, a smaller one with the images of the teacher, and a larger one with the contents of the teacher computer screen or with the images transmitted by a document camera pointed on the whiteboard.

The main problem of this environment is the video synchronization. Streaming servers, to prevent the interruption of the streams due to an oscillation of the available internet band, buffers some seconds of the video before it delivers it to the clients. Two different streams have different delivery delays, and so they are not synchronized.

To avoid this we use an encoder with two video acquisition boards, to guarantee no delay between the sources, and the Quicktime streaming technology which allows to encapsulate two video flows in one streaming session.

The encoding software we choose is Videolan, open source, very stable, and supporting MPEG-4, viewable with Videolan player, Quicktime player and Real Player. With these technologies the school is virtually accessible from all existing operating systems.

The streaming server is Darwin, which, compared to other systems we tried, guarantees the best control of flows synchronization.



fig.1

2.2 Audio/video setup

To give remote students the sensation of being in the classroom we use two remote controlled cameras on the teacher, and one camera to frame the students. To transmit the contents presented we have one

document camera and a scan converter to capture the computer screen. In the practicing room we use another camera and another scan converter.

In this way remote students have the point of view on what happens in the real classroom.

The teacher is equipped with a lavalier microphone and there are two environment microphones to capture the students questions in the most natural way. For the remote students a Skype audio channel is also available to talk directly to the teacher during the lesson.

To manage all these audio and video signals we have a direction booth equipped with an audio and a video mixer, a switch to select between the document camera, the computer screen of the lesson room and that of the exercitation room, and all the usual equipments of a recording studio. The system is designed to be used only by one person that controls the remote cameras with a joystick, switches between the streams and helps the e-learning students to solve technical problems.

2.3 E-learning management system

Both remote and local students are provided with a username and a password to access to the internet site <http://virtualschool.cineca.it> from which they are able to download materials and watch the live streams of the lessons.

The minimum required bit rate for the internet connection is 350Kbs; this is usually not a problem if students follow the lessons from university or from institutions with a broadband connection, but it can be a bottleneck for a home dial-up connection. For this reason it is possible to choose to watch videos in full mode (teacher video and audio and computer screen video) or in low band mode (only the teacher audio flow and the computer screen video). The latter mode reduces the sensation of presence, but the educational content remains the same.

However, few days before the beginning of the schools, students can test the functionality of theirs apparatuses trying to connect to a simulated lesson and solving the possible problems with the help of CINECA technical staff.

Remote students are free to modify their user profile on Moodle. In particular they can insert a photo and a brief description of themselves, which is useful to create a community.

CINECA e-learning support staff includes a technical aid for infrastructural problems and a tutor for didactical questions.

Remote students can communicate with the tutor, with the technical support and between themselves using the chat, provided by the LMS platform.

In addition, some of the local students are equipped with their own wireless connected notebook, and can participate to the chat, greatly improving the sensation of real presence for the remote students.

There are three interaction channels between the teacher and the e-learning students: the chat moderated by a tutor, the Skype audio channel that enables students to take active part to the lesson and the forum, also provided by the LMS platform, which allows for asynchronous, more contemplative communication.

3. Results and Discussion

The e-learning experience has involved the 14th and 15th School of Parallel Calculus and the 5th and 6th School of Scientific Visualization and Interactive Graphics.

The number of on line students has been 54 and the number of traditional classroom students who have taken advantage of the service of virtualschool.cineca.it has been 44.

At the end of the school, remote students have filled in a questionnaire to help us understand the grade of satisfaction and the main problems encountered using this particular way of attending a course.

The global impression has been very good, besides some initial difficulties and technical problems, a large part of the students has expressed enthusiastic opinion on the experience.

The chat has turned out to be a great success: the possibility to exchange opinions and experiences between the students and the possibility to have a tutor with strong knowledge of the matters of the schools,

has been a great improvement even over the simple presence in the classroom. The virtual community of students has had the same or even better experience with respect to the real one. Of course some aspects still need to be improved, like the management of the practical exercises, that are still hard to perform for remote students, but the global impression enforces our determination to continue the experience.

Even the most skeptical teachers have acknowledged the success of the use of the new technology and have expressed the wish to continue exploiting its advantages.

The e-learning platform is currently used also for educational initiatives that involve only local students, to allow the downloading of didactical materials and to provide communication channels between the participants.