

A Proposal for Remote Ph.D. Courses in the Field of Telecommunications in Italy and Europe

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Abstract. Multimedia technology is a new exciting field with many applications that are growing rapidly. Among them those related to educational programs are taking place with a variety of forms which are used for a new way of presenting the content of dictionaries, textbooks, etc. where words are used together with sounds, images, video clips, in order to attract the interest of the "reader".

The proposed school for Ph.D. students in the telecommunications field wants to test the feasibility of a mixed mode to approach teaching by giving students the possibility of attending classes with a professor teaching and with the possibility to ask questions during classes (Synchronous service). Moreover the students have the possibility to test offline their preparation by solving problems and asking questions prepared by the teachers, and to have access to the set of slides and a commented textbook, which should be linked with video clips derived from the lectures (Asynchronous service).

1. Introduction

In recent years tele-education is gaining an increasing favor because it permits to students to learn new update matters at home. In Italy the Ministry of University and the Scientific and Technologic Research (MURST) recently funded an experiment to teach graduated courses in telecommunications, under the name of "Teledottorato". The home page of the project is reported in Fig. 1



Fig. 1. Home page of the Teledottorato Project.

The Teledottorato system aims at offering a complete environment to support post-graduate courses in Telecommunications at a distance, using an integrated platform to cover the following functionalities:

- A synchronous system for the distribution of lectures using video and audio conferencing to keep the actual functionality of classes with a high interaction between students and teachers, even if they are geographically sparse in a large territory. The teacher uses standard support like blackboard,

viewgraph, etc and they are diffused by videoconferencing with the possibility of direct interaction with students;

- An asynchronous system for the management of course material and activities, to offer support to the distant classes. This system should provide a sound support through the implementation of individual training facilities and co-ordination, as it will be detailed in the sequel.

The proposal consists of 27 modules, 10 hours of lecture each, which cover all the areas of Telecommunications Engineering. All the material is prepared in English, so those modules can be offered worldwide.

The paper is organized as follows: Section II is devoted to the course organization and its educational content. In Section III the synchronous service is illustrate as well as the telecommunications network that support it, while Section IV is devoted to Asynchronous Service and its possible widespread use and test bed for future applications.

2. Educational content and course organization

The motivation of the “Teledottorato” is related to the fact that few Ph.D. courses have been proposed in the Italian Universities since the beginning of the Ph.D. program in the early 80’s.

This lack has been gradually raised as a problem, but it is difficult to find appropriated solutions because of the fact that there is lack of funding for the courses and an ever-increasing lack of competence to cover a broad field of applications.

The proposal came up by strengthening the whole Italian knowledge in the field.

The ideas behind the educational content was to put efforts in the area less covered by widespread knowledge, but in rapid growth as the area of Telecommunication Networks is. Then, some arguments related to nearby areas, like microelectronics, measurements, etc have been considered. The final results is a program in which the 27 modules have been assigned to the areas of follows: 7 modules to Communication Networks, 7 modules to Transmission Systems, 5 modules to Signal Processing, 2 modules to Optical Communications and 6 modules to nearby areas.

The modules will be scheduled for the satellite transmission starting spring 2001. The calendar will be based on 2 modules delivered in the same days, each module two hour per day, two days per week. So, students have to follow 8 hour lecture per week for a period of two and half weeks.

We have roughly 4 groups of 7 modules each, by grouping together Signal Processing and Optical Communications, so that in a cycle of six weeks we deliver a packet of four modules, one per group. The full set of courses should be delivered in 15 months, by considering breaks in summer and other holidays. Then, it will be completed by June 2002.

Titles of the modules are given in the Appendix.

3. Synchronous services

The remote teaching or distance learning (depending on the point view) service will be primarily offered using synchronous tools such as a multipoint to multipoint audio and video conference application which is distributed using the multicast backbone (Mbone) of the Internet. In order to have a smooth delivery of classes we need to schedule the courses in advance and to organize the sessions for the videoconferences. We found useful to use the sdr - Session Directory designed for announcing and scheduling Multimedia conferences on the Mbone - since it extends the session directory model proposed in Mbone, particularly in the degree of detail about the timing and resources required by a conference [1]. SDR enable to permit to new user to enter in a scheduled conference as active participant or as an authorized listener. Also, we are currently testing the VIC&RAT suite, developed at UCL, London [2, 3]. This videoconference tool allows setting the bit rate of the full duplex audio and video connection with the granularity of 1 Kb/s. In order to efficiently use the bandwidth it is fully configurable in terms of activity (listening or transmitting). A sample of the session is reported in Fig.2.

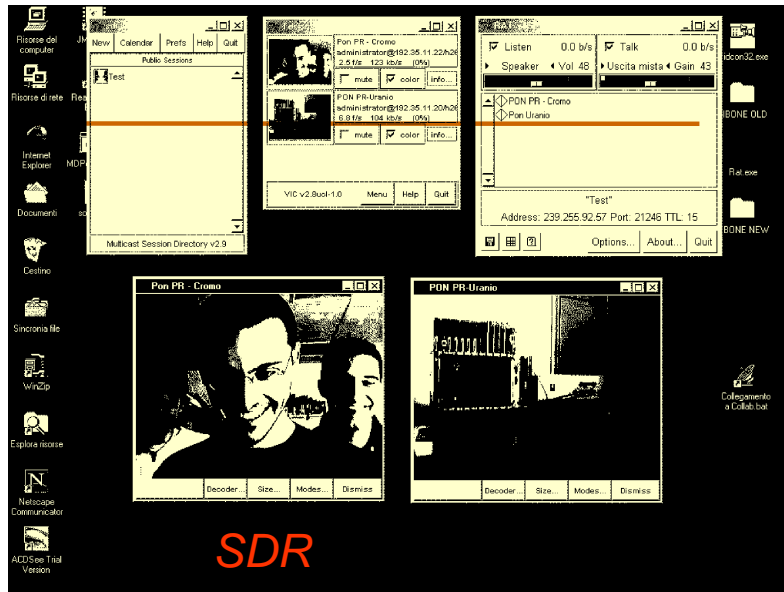


Fig.2. Example of SDR session shows on video

As regards the course content, the full configuration will make use of a collaborative browser; while the teacher drives the navigation is replicated on the student screen. The browser comes with a shared chat and text editor, and which has the "floor", are controlled by the master. Only the owner of the floor can control the browser and the other tools.

Requests from the audience to get the floor can be satisfied using a FIFO serving policy. A student who gets the floor has the right to drive the browser asking questions to the teacher. His navigation is also replicated on other student's screens, including the teacher screen. The HTML content, which is browsed, is the output of the authoring system developed for this project [4]. The scenario is shown in Fig. 3.

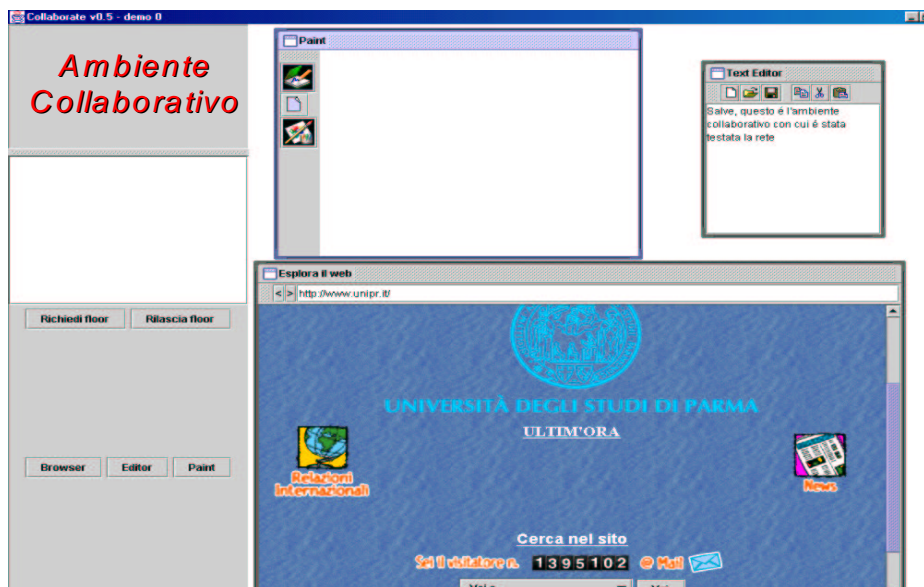


Fig. 3. Cooperative scenario as it appears on video

Network infrastructure

The experimental scenario where the test has been performed is reported in Fig.4. Remote LANs located in Genova, Prato and Bologna are connected through a satellite link at 2 Mb/s. Other appendices LAN located in Pisa and Parma are connected, respectively, to Genova and Prato using an adequate number of ISDN lines (3-4). The system employs the ITALSAT II (13 EST) satellite, providing a country-wide coverage in the single spot beam on Ka band (20-30 GHz). Each satellite earth station can be assigned a full-duplex dedicated traffic channel with a bit rate ranging from 32 Kb/s to 2 Mb/s. Stations are also equipped with the following components: satellite modem, radiofrequency device, IP router and the above mentioned software tools. These latter are the source of the services under test (TCP/IP Videoconference tools, TCP/IP file transfer and terminal applications, multicast applications and remote access to scientific instruments). Other sites are equipped with an IP router and a number of applications PCs. An accurate evaluation of the Quality of Service related to the test bed have been analyzed [5].

For the delivery of the "Teledottorato" program, new satellite stations will be available in Catania, Napoli, Padova, and Pisa with the same set up of the three stations used in the test bed. Moreover, other seven sites should be connected using an adequate number of ISDN links.

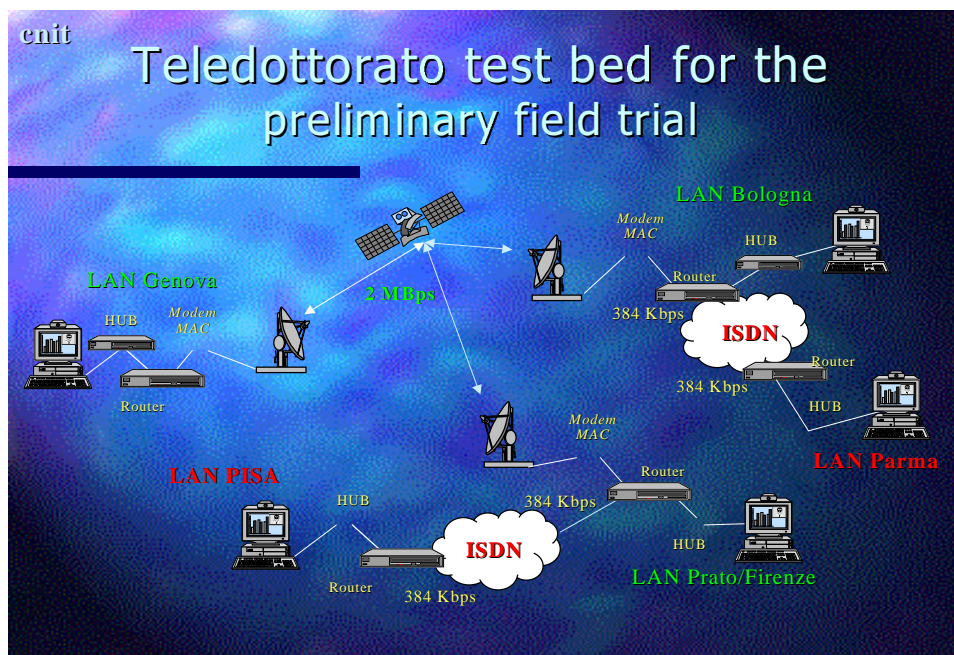


Fig. 4. Experimental scenario for the field trial before the beginning of Teledottorato

4. Asynchronous services

Asynchronous services has been designed in order to support the off-line teaching activities related to lecture notes, Quizzes, tutoring, FAQ, etc. On this base it is also possible to organize a full web based interactive module for self-learning.

The software platform is compatible with the two browsers Microsoft Internet Explorer and Netscape Navigator.

The platform enables three different accesses:

- Teacher
- Student
- Administration

a) Software installation and administration

The computer system administrator installs the software on the server and distributes logins and passwords to the Teachers, Students and administrators of the courses.

b) Teacher

Each Teacher has the permit to access his own space, which is easily manageable with on-line help, in which are shown the modules he is in charge (Fig. 5). He could view one of the modules by accessing the home page of the module, which show all the available services (Fig. 6).



Fig.5. Home page of the Teacher



Fig.6. Home page of one module for the Teacher

Teacher could upload a new chapter, prepared off-line, simply adding/correcting the chapters present in the file system. Also he has the possibility to check if the students have done their own work (quizzes, homework, etc) and the related score reached in the module the teacher is in charge. He has also the possibility to send e-mail to the students inquiring about the module and covering the unexpected difficulties encountered.

c) Students

Once enrolled, a student has his own access to the system (login and password) which enables him to access the modules he registered for.

The student selects the module he wants to access and he has the possibility to go through available services, e.g. the module content, lecture notes, or he can proceed with quizzes or homework. Some of the services are available only for a limited number of accesses, for example the final exam should be accessed only once, quizzes on a specific topic could be accessed few times (2 or 3 at most), etc.

d) Quizzes

Actual organization of quizzes is based on a question with multiple choices and the student selects one of them. Actually we are working for a more elaborate system where quizzes enable the student to access simulation packages and doing more complex operation like a guided system design with choice of system parameters.

e) FAQ

Frequently Asked Questions (FAQ) should be organized by arguments in order to allow students to get answer to the FAQ, before accessing directly to the teacher.

f) Time and Work Management

Some time it is useful to give a time constraint to complete the preparation. It is possible to schedule the access to the chapters of the module in the sequel with a given timing, as happens for class attendance, and also to give a deadline to answer Quizzes and to complete the module preparation. In Fig. 7 it is shown a schematic procedure, called fil rouge.

Fil Rouge		Time
	Main Objectives (Themes)	
	1. workpackage 1 first section	2H30
	2.	0 min
Total		2H30

Fig. 7. Fil Rouge organization

5. Conclusions and next developments

After completing the field test of the functionality of the synchronous services we are ready to offer to Ph.D. students of the Teledottorato program in Telecommunications Engineering the

synchronous services, first. We are scheduling the installation of the new satellite stations by the end of January 2001, and after some tests we are ready to start with the beginning of March 2001 with the lectures. Together with the synchronous services, part of the asynchronous services will be offered too. We have required the teachers to prepare lecture notes of the modules and an appropriated number of exercises and quizzes with the solutions. This material will be available to the students enrolled in the program. The modules will be presented to the students on the basis of a two hour lecture twice a week. So that a module will be delivered in three weeks.

In the future we intend to extend the material available for the asynchronous services by adding video clips derived from the lectures to comment some aspects of the lecture notes in order to permit to the students to get the feeling of the classroom participation.

On the basis of the results of the field trial of the complete course we expect to modify both the content of the modules and their presentation to the students.

Appendix

List of modules to be delivered within the Teledottorato Project

-Communication Network 7 modules

Control Techniques for Performance Optimization of Telecommunication Networks

Traffic Models for Network Performance Evaluation

Network Architecture to Support Quality of Service over the Internet

Radio Resource Management in Cellular Networks

IP Over Wireless Networks - Main Issues and Recent Research Results

Optical Networks

Network Management

-Digital Signal processing (audio, video and coding) 5 modules

JPEG2000: A New Standard for Still Picture Data Compression

The New Frontier of Channel Coding: Generalized Concatenated Codes with Interleavers

Source Coding Theory

Image-based Scene Modeling

Representation and Composition of Natural and Synthetic Audio/Video Objects for Creating Multimedia Contents

-Optical Communications 2 modules

Fundamentals of Optical Communication Systems

Polarization-Mode Dispersion (PMD) in Single-Mode Optical Fibers

-Transmission Systems 7 modules.

Fundamentals of Mobile Radio Communication Systems

Multicarrier Systems

Introduction to Per-Survivor Processing

Advanced Receivers for CDMA Systems

Multi-user Receivers for Wireless Communications on Fading Dispersive Channels

Satellite Systems and Applications

Emerging Technologies for Mobile Communications: Smart Antennas and Software Radio

-Others (CAD, Propagation, Measurements) 6 modules.

Conformance & Performance

Propagation and Planning Principles in Cellular Radio Systems

Imaging with Propagating Waves
Synthetic Aperture Radar (SAR)
CAD Tools for the Design of Analogue Integrated Circuits
High Speed Digital Design

Acknowledgements

Thanks are due to M. Masseti and M.C. Pettenati for the software platform organization, L.S. Ronga, M. Marchese and D. Adami for the satellite link management; P. Castoldi and F. Davoli for the off-line field trial of the overall Teledottorato system.

The project Teledottorato is supported by Ministero dell'Università e della Ricerca Scientifica e Tecnologica (MURST, web site www.murst.it) of Italy

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