A multimedia system for tele-education in Secondary school

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Abstract

Last year we developed and tried out a system to allow students and teachers, distributed on the Net, to carry out learning/teaching activities. For this purpose we defined and implemented a new Internet protocol to support cooperative educational activities and then we developed a system based on it. We have recently experimented this system creating a virtual classroom with students and teachers from two secondary school classes, one in Palermo and the other in Pisa.

In this paper we will describe the main considerations arising from this experience and the consequent new functionality that we are introducing into the system, to improve the quality and the opportunities for interaction.

Key words: Tele-learning, network protocol, cooperative learning systems

Introduction

While new tools allow the space-time barrier to be removed, studies of human interactions are dedicated to making the most of opportunities to meet on line without losing usual contacts (we know that a look can say more than so many words). There are now network services on Internet for creating complex environments where interpersonal relationships mingle both between single individuals and between individuals and groups. There remains an interesting open problem as to whether and how telematics can maintain the usual means of face to face communication and define new ones.

In this study, we are interested in the new opportunities in the educational field. We can see that the main use for its economic and cultural impact is distance education aimed at children who for various reasons are unable to attend their school.

We refer for example to students with long term illnesses or young people who live in remote areas. In Italy there are small islands where travelling is difficult (either for pupils or for teachers) especially in winter or in bad weather. Today the most common solution is to create teaching environments using teleconferencing systems, where the relationship continues to be that of the teacher giving lessons and the pupils listening and asking questions.

As we have already observed in [1][2], there is a loss of immediacy and a weakening of the relationships typical of a real class, in which I can prompt, wink, make comments behind the teacher's back, or put up my hand to speak in a class discussion.

The aim of our work is to define new tools and network services for didactic support [5][8][11], integrating in new applications behavior typical of a real class: the creation, development, correction, suspension and renewal of a didactic activity, the exchange of opinions with a classmate.

But this is not all. We also want to study and define new methods of giving lessons, exploiting the characteristics of the Net [7].

In the following paragraph, we describe the first system that we implemented and then we discuss its

experimental use with two classes in different Italian cities, Pisa and Palermo.

The observations and the results obtained from this experience have led us to the introduction of a new version of the system, which we describe in paragraph 4. Finally, in our conclusions, we express the hope of seeing a wide spread use of educational network environments.

Main aims and functionality of the first release

The first prototype developed is the result of a careful analysis of the scholastic activities which take place within a class in order to establish a preliminary classification of the functionality to support the development of cooperative didactic environments [1]. This theoretical classification, connected to a terminology derived from cooperative work [10], is reflected in the concrete implementation of a network service; it allows the start up and the control of a session for cooperative learning activities, by means of which we have developed the first prototype of our on line learning system. A lesson is conducted in a way which imitates a traditional lesson in a classroom: students go into the classroom, listen to an explanation, work in groups together with the teacher. Using the definition of a communication protocol cactp (*c*ooperative *a*ctivity *c*on*t*rol *p*rotocol) whose functionalities follow the classification made previously, a student/client application and a teacher/server application have been developed.

In this first release of the software the classroom communication takes place through the teacher/server system (fig.1).

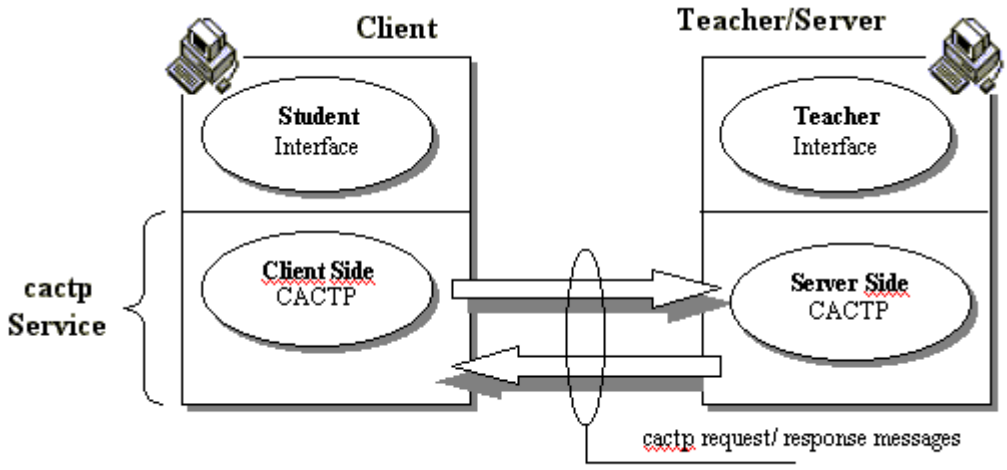

Fig 1 First architecture of the system

The teacher uses the server application to communicate with the class and students use a client application; this choice was motivated by the wish to enable the teacher to monitor all the educational processes, without forwarding all the information from the server to an eventual teacher-application.

In order to retain the atmosphere of a real class with its discussions and relationships, the system uses the protocol functions to activate a synchronous communication session where it is possible to: enter the class, carry out debates, group activities, voting, and the preparation, assignment and evaluation of classwork.

The teacher controls the pupils' behavior in classroom by the server. S/he starts the on line synchronous session in which both cooperative and individual activities take place. In the cooperative activities the continuation depends on the answer given and, in general, on other pupils' activities. Individual activities are extremely important in a class both because acquisition of knowledge requires personal re-elaboration, after which the comparison with shared knowledge continues, and because the teacher must evaluate his/her students' work. The environment therefore depends on the activation of the teacher/server application. Obviously this choice prevents the pupils from communicating in the teacher's absence and prevents the teacher from leaving the server.

It is therefore possible in the first version of the system to use a "freetime" session where the teacher doe not control class communication and physically leaves his/her place while the server is running. In this way a more complex environment is set up, where cooperative and group activities are possible even when the teacher is not present.

Experimenting the system

From our experiments with the system between the Computer Science Department and the Institute for Educational and Training Technologies, we would like to mention the sessions held during the week of culture and scientific research in Italy, when we tried out a cooperative teaching network [4]. Two middle schools took part in the experiment, one from Palermo, in the South of Italy, and the other from Pisa, in

the North. The educational activities, planned with the teachers, were carried out with the support of the system and consisted in a competition aimed at learning vocabulary and proverbs in the local dialects, both of Sicily and Tuscany.

During these sessions some interesting results emerged. From the learning point of view, we observed strong motivation. In fact pupils were attracted by the possibility of contacting people who were far away, they were anxious to get to know each other, and they exchanged their best photos, and they told each other about themselves. Then, during the competition, in which they had to listen and guess a word in dialect which was recorded and sent by the network to the remote students, their curiosity was aroused and they were keen to compete, to guess the words and learn how to pronounce them.

Furthermore, the use of the system has also highlighted some educational needs that have led us to adapt the architecture of the system in order to add new capabilities. For example some difficulties concerning the temporal visualization of class dialogs became apparent: the chatting was envisaged according to the traditional mechanism of temporal visualization of the sentences sent by different users; but in an educational context, where starting from a teaching cue several dialogs can develop, the time of the responses can become a determining factor for the evolution of the whole dialog, and cause the student to get lost. When a student was slow in responding, because of personal elaboration ability or speed of typing, other messages appeared on the screen between the question and his/her answer, making it difficult for him/her and the teacher to follow the dialog. Thus comprehension of the dialogs was complicated in some parts of the communication.

During the sessions we were also aware of the advantage of having more teachers available to coordinate several work groups at the same time by the system, and of having the opportunity to save the dialogs which were begun, in order to restart them later (after a connection problem or in a new session). Besides, the visualization of the pupils involved in the group activities using a simple list created some problems for distinguishing between pupils in Palermo and in Pisa. In the on line classroom there was an obvious need for the visualization of desks and student positions.

All these considerations have led us to develop a second version of the system which has enabled us to integrate the on line activities and the traditional ones more effectively. To achieve this we have defined a client/server architecture [9] capable of restoring the learning system in its entirety, in order to resume the lesson from the point at which it was interrupted, and improve synchronous and asynchronous interactions within the class.

Towards a new co-operative learning environment

The new learning environment (Fig 2), projected according to the client/server model consists of three applications: student client, teacher client, and cooperation server, that can be distributed on several computers.

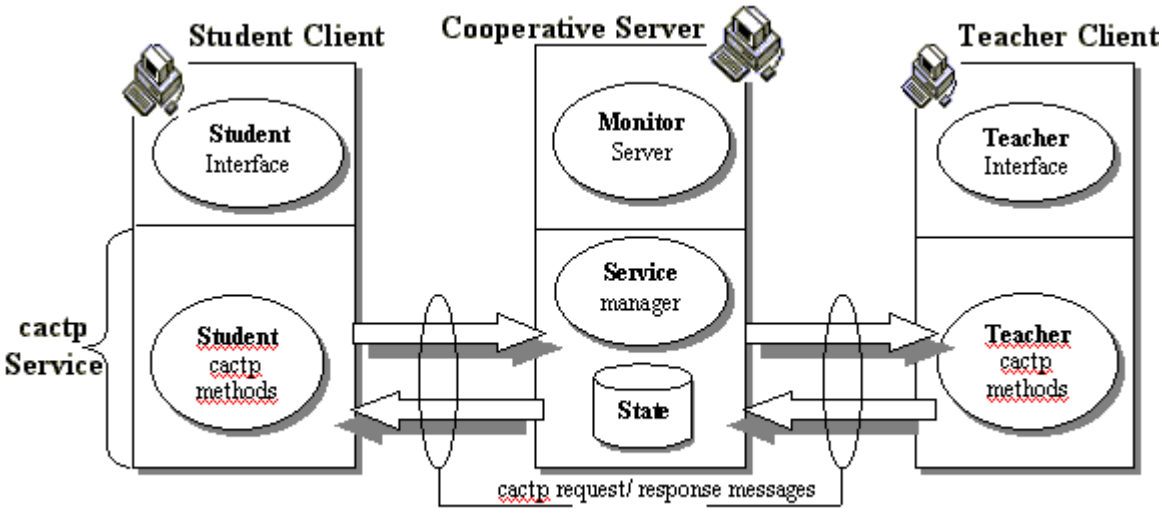

Fig. 2 The new architecture of the system

We would emphasize that in this architecture the management of the educational network is more flexible and modular. In fact the teacher application includes all the activities typical of the teacher, and s/he participates in the class by sending requests to the server, in the same way as student clients; the only difference lies in the kind of requests they send.

The greater modularity introduces a number of advantages into the system and brings about further development of the protocol methods for the network didactic cooperation. In particular the system has an internal state. In fact in a real school, the lessons evolve over time: topics studied develop and change in the course of the weeks thanks to the various contributions of students and teachers; the composition of

the work groups remains constant for some activities; each student has his/her own desk.

So, our system must also be capable of remembering information linked to the evolution of the educational environment in order to modify, save and restore a learning context. Besides, by the state of the system, the server allows anyone who enters the class to understand the current situation of the class to take part in a dialog which has already begun, to sit down at his/her desk.

Greater flexibility is introduced by the new teacher/client application, which allows the teacher both to be present in the classroom with the students during the lessons and to work on his/her own, so that, for example, s/he can plan a series of activities and decide how to distribute them the following day.

We are planning to use this new system in specific educational contexts where there is physical separation between teachers and students which hinders normal activities in the classroom. In particular we are planning to experiment the system in cases of learners isolated from their teachers as in the following two cases: schools on small islands near Sicily where teachers sometimes cannot reach their school in bad weather or students are forced to stay at home or in hospital for long periods because of illness.

Conclusions

New Information Technologies are being studied today to evaluate their potential in educational contexts. Current research tries to take the reality of concrete human environments into the virtual reality of the Net and one of the most interesting applications is in the educational field. Here our proposal can be most naturally included. We think that new educational environments based on the Net have important additional values: classroom walls do not exist, and bad weather and distance do not prevent participants from meeting to get to know each other and grow up together in the culture in which they live, passing it on to successive generations.

Moreover, in our research, the set of methods of the *cactp* protocol, created ad hoc to set up and control educational activities [3], allows the stimulation of cooperative learning, avoiding certain problems due to the real environment. The first results have been encouraging, but we hope that later ones will be more significant, as we improve user interface, add new protocol methods and try out our proposals, demonstrating concretely their effectiveness. Teachers and students' *Net-desks*, filled by *real* teachers and pupils, will allow us to test effectively whether our environment is suitable for retaining and improving the learning mechanisms typical of a real class.

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