

Work in Progress - Petri Nets as Applied to the Modeling of E-Learning Cooperative Systems

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Abstract - In this work we demonstrate the use of Petri Nets as applied to the interaction in a Collaborative Environment in the educational context, particularly E-learning. The scenarios and models proposed in this paper have been studied and applied to TeleMeios, an e-learning platform in the Multimeios Research Laboratory of the School of Education, at the Federal University of Ceará. TeleMeios is a unique tool which supports E-learning, as the professor becomes the main element (instead of the computational resources), acting at the core of the educational process, in order to better understand the existing methods and behavior of the system. This study also highlights the importance of mediation in the educational process.

Index Terms - Petri nets, E-Learning, Collaborative Systems, Computer Aided Teaching.

INTRODUCTION

In this work we demonstrate the use of Petri Nets as applied to the interaction in a Collaborative System in the educational context, particularly E-learning.

This modeling aims to better understand some scenarios in which mediation is essential for communication. Toward this end, we have modeled one scenario in which participants communicate verbally and one scenario in which users compete for common computational resources (in the case proposed and under study, application sharing, not in the sense of file sharing, but in the sense of Collaborative Tools).

PETRI NETS

Petri Net [3] is a formal description technique developed by Carl Adam Petri whose purpose is to describe the activities, the resources, and the state of a system, such as: competition, conflict, synchronization processes, and the sharing of resources.

Pedagogical mediation [1] refers, generally, to the relationship between teacher-to-student and student-to-student in search of learning, as a process of acquiring knowledge. This relationship suggests treating materials, activities, and interaction, the three constituent elements of mediation, in a coordinated and integrated manner, as well as new possibilities for expansion which occur through the integration of the virtual environment's computational tools, in a system of cooperative activities [2].

The use of models in the stages preceding the construction phase of a prototype is justified, as the system's performance can be tested, analyzed and evaluated before its conception. All scenarios proposed in this work were prepared using Colored Petri Nets (CP-Nets), as they are able to model large and complex systems with a considerable amount of resources for modeling. Toward this end, we used a tool called CPNTOOLS [5], which facilitates the construction and management of CP-Nets.

COOPERATIVE SYSTEMS

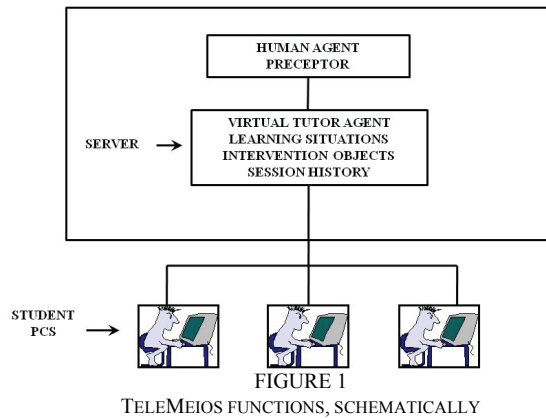
A cooperative system can be defined as a computer system (software) used to promote, enhance and stimulate the implementation of work groups, with well defined tasks and levels of hierarchy. CSCW (Computer Supported Cooperative Work) is the term which refers to systems and applications oriented toward cooperative efforts.

It should be emphasized that cooperative systems should offer their users forms of interaction to facilitate control, coordination, collaboration and communication among participants, both local and at a distance (geographically separate locations), in the same space or in different time periods.

TELEMEIOS

TeleMeios, a tool developed in the Multimeios Research Laboratory of the School of Education, Federal University of Ceará, is a Tele-Environment [7] for learning, consisting of a telematics multimedia structure, incorporating video, sound, image, text, mail and a shared interface between the teacher and the student (including sharing, cooperatively and in real time, in a Virtual Learning Environment, a specific software chosen to run an activity of the CSCW type), in order to develop a Virtual Learning and Discussion Environment, through which interactive on-line courses can be taught, with direct mediation by the teacher, when necessary.

Despite the great similarity between different E-learning platforms (like EVO, Moodle, Paltalk, Teleduc, VRVS, WebCT, etc.), TeleMeios is centered on the teacher-student (or user-user) relationship for classes at a distance. Furthermore, the use of this tool enhances the teacher's didactic activity, given the variety of educational resources and software which can be shared.



This platform is also characterized by enabling its users using synchronous and asynchronous tools, which fosters teamwork and collaboration - key aspects in Distance Education. Another important feature is the application sharing, because in addition to work collaboratively in real time and interactive enables users to remotely piloting an application without the need to take it into their equipment, even though this software is not compatible with your computing environment.

We emphasize that TeleMeios can also be used for the validation and use of Learning Objects [9].

SCENARIOS MODELING

The main objective of the current stage in scenario modeling is to develop more succinct scenarios, which are susceptible to changes and which keep the user involved in the process. When a system is modeled, we wish, essentially, to create an interpretation of the same. This interpretation provides the link between the abstract and the concrete system we intend to model.

Regarding the scenarios and respective models proposed in this work, two interactive situations were planned and projected: one in which the "voice" resource is claimed by the participants of the communication and one in which the shared computing resource (in our case, application sharing) is competed for and administered on a queue.

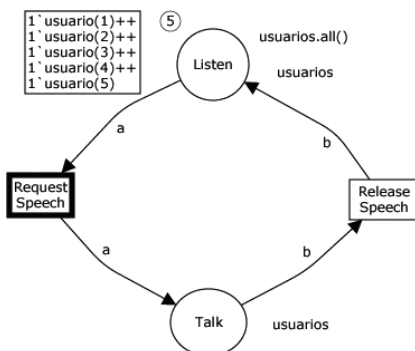


FIGURE 2

SCENARIO 1 - PARTICIPANTS USE FREELY AND INDEFINITELY THE 'VOICE' RESOURCE OFFERED BY THE SYSTEM

In Scenario (1), as shown in Figure 2, the common resource, "voice", can be used freely and indefinitely by any

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of the system's users. Initially, the user enters the system at 'Listen'. At this point the user is called *Listener*, and is not active in the communication process. After selecting 'Request Speech', the participant goes to 'Talk', and changes his/her status from *Listener* to *Speaker*, free to use the "voice" resource and become active in the communication. In this scenario, pedagogical mediation [7] is of fundamental importance in controlling and managing resources and users during the communication.

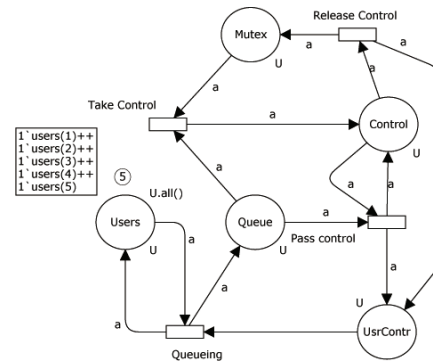


FIGURE 3

SCENARIO 2 - A COMPUTER RESOURCE IS SHARED BY THE PARTICIPANTS IN THE COMMUNICATION. A QUEUE IS USED TO CONTROL USERS

In Scenario (2), shown in Figure 3, the computer resource can be shared by all the participants, but there is a queueing system that controls access to the resource, represented by 'Queue' in the Coloured Petri-Net. The user who wishes to take control of the resource gets in line and waits until the resource is released by the current user. This scenario is applied, in our case, to an application shared by different users, but controlled by only one user at a time. In an application of Geometry, for example, a student interacts using a specific tool and then releases it to another student, who can undertake another interaction in his/her own way. It's up to the system to control, through the queueing system, the users' order of access to the computer resource.

CONCLUSIONS

The modeling of scenarios, as proposed in this study, is fundamental in E-learning environments. TeleMeios is unique as a tool that supports E-learning, as the professor becomes the main element (instead of the computational resources), acting at the core of the educational process, in order to better understand the existing methods and behavior of the system.

Further scenarios and more complex situations may be modeled in future studies, such as one in which a *Listener* invites a user from another room in the virtual environment to join in his/her communication or classroom.

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