

# Multi-agent System Architecture for Computer-based Tutoring Systems

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**Abstract.** This paper reports on an ongoing research on developing a multi-agent system architecture for distributed computer-based tutoring systems environment. This system acts as a mediator between the user and the tutoring environment. The system architecture consists of several software agents that are cooperatively interact with each other to find and process the tutoring materials and then disseminate it to the users or other software agents. A prototype of this environment is being implemented to demonstrate its feasibility.

## 1 Introduction

The World Wide Web became the important and the natural educational medium for online learning. Thus, it is essential that for the authors of web-based educational software applications to consider making their systems more adaptive and intelligent [2]. Intelligent tutoring systems have been an important and an expanding research interest to many researchers [1]. Lately, many researchers have shown a lot of interest in using software agent approach.

This paper proposes a multi-agent system architecture for computer-based tutoring systems (MSACTS) environment. The agents interact cooperatively with each other in a distributed environment and collectively provide the users with the appropriate tutoring materials from distributed resources based on their time and pace.

## 2 System Architecture

All entities and objects that exist in the tutoring system environment are shown in Fig. 1. The architecture of the proposed system is designed to help users to learn from distributed tutoring systems based on their time and pace. Each agent is autonomous, cooperative and able to communicate with other agents to fulfill the users' needs. The system consists of two types of agents, namely: interface agents (IA) and resource agents (RA). The interface agents interact with the users and keep track of the users' performance based on the users learning skills. The resource agents access, retrieve and monitor the content of the intelligent tutoring systems. The following briefly describes the main components of this environment.

The Expert Model identifies the knowledge domain required for the course materials. The User Model contains all cognitive states and learning preferences for each user, such as login names, roles, etc. The structure of the user model can be derived from the following: (1) the problem-solving behaviour of the user, (2) user direct questions, (3) historical information based the user's assessment to his/her level (novice to expert), and (4) the difficulty level of the content domain. During interaction, MSACTS compares the user's actual performance to the User Model to determine the user's learning ability. The Student Model contains a database of user misconceptions and missing conceptions. A misconception refers to the knowledge that the user has and the expert does not. A missing conception refers to the knowledge that the expert has and the user lacks. The Instructional Model makes MSACTS actively interacts with the user's inputs and diagnoses the user's level of mis/understanding of the knowledge domain.

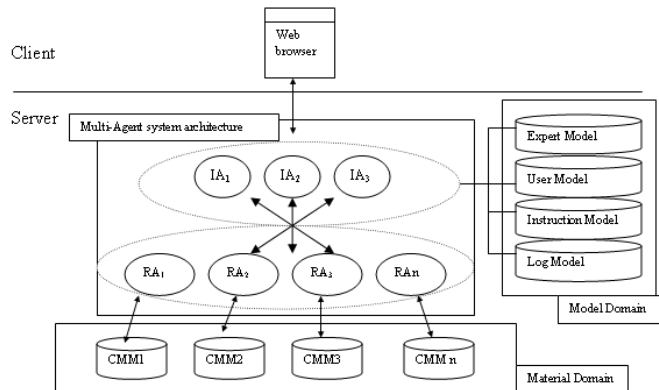


Fig. 1. MSACTS Environment.

### 3 Implementation

A prototype of the proposed system is implemented with one interface and two resource agents, using Zeus [4]. Each resource agent monitors a tutoring system separately. Users interact with the system via a Web browser, as shown in Fig. 2. The interface is divided into 4 windows. The top window contains a clock that shows the time spent by the user during his/her learning period and shows a graphical presentation of the user's performance. The left-hand side window provides a list of questions that might be answered by the user. The middle window allows the user to submit the answers to the selected questions. The right-hand side window provides the user with some hints and the expected answers. The resource agents are implemented with the functionality to access and update all course materials. All course material models (CMM) are designed and implemented as a set of tables in the agents local database. All metadata indexed course materials are in XML/RDF format.

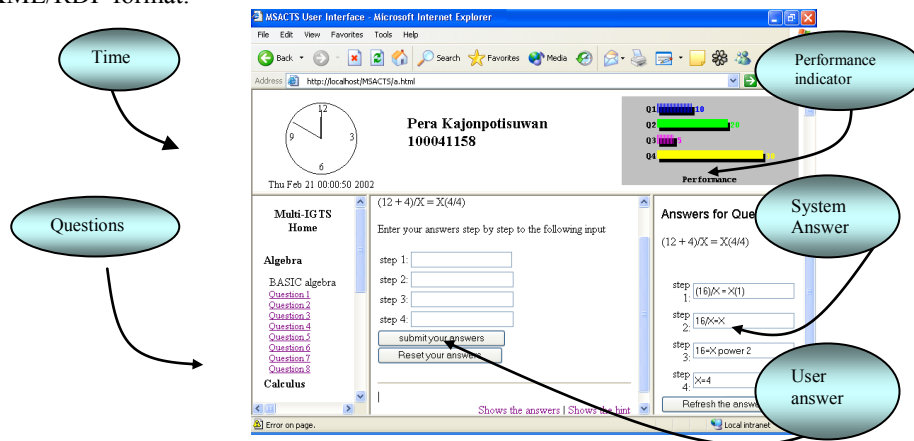


Fig. 2. User Interface of MSACTS System.

### References

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