Distributed Information Retrieval and Integration through a Centralized Agent-base System

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Rapid changes have taken place in our world over the past few years. Information technology is revolutionizing the way we live. Knowledge is power and the ease of access to this knowledge makes the manipulation of the data critical. Yet, if one can harness the vast integration of data which flavors the users' knowledge the end result could somehow satisfy the elusive quest for complete knowledge integration. This paper overviews the Distributed Intelligent Architecture for Logistics (DIAL) system, currently being developed as a project for the U.S. Army Logistics Evaluation Agency. The DIAL system is designed to integrate existing software packages into an unified architecture to support the needs of the end users. To ascertain what integration is needed in the DIAL system three major questions were addressed (1) what task(s) will the users be facing, (2) what data will be needed by the user, and (3) how to integrate across a distributed platform of resources. The solution to these questions resides in the design and development of the centralized agent-based architecture DIAL, where the software applications, data, and users are all treated as software agent components residing in distributed computer systems.

Within the DIAL system a software agent is defined as an entity capable of performing a specific single task, such as the retrieval and formatting of a data file. Currently the architecture is composed of agents residing in the following three categories: supervisor agent (decides course of action to solve the current problem), support agents (provides task-oriented support for the user and applications), and application agents (interfaces to the software application). At the heart of the DIAL system is the supervisor agent, which is responsible for deciding how the users' requests will be resolved by the underlying agents. This centralized problem-solving approach provides the system with two main advantages (1) multiple users problems can be easily integrated within a centralized decision area and (2) reduces the overall complexities of internal agent interactions found in decentralized problem-solving systems.

The hidden layers of agents within the remaining architecture collectively cooperate to improve the users ability to retrieve and manipulate data quickly between the different software applications. The first layer of hidden agency consists of the five support-based agents: user interface, database, unity, priority, and timephase. Each agent represents a specific task that assists in the integration of data and provides recommendations, based on the users objectives. Although the user only has direct access to the user interface agent, the supervisor directly decides how the current request should be handled by the underlying software agents.

The second hidden layer consists of application agents acting as direct interfaces or wrappers to the integrated applications. These agents provide the communication needed between the applications and the other agents in the system. The complexity behind each application agent depends on the complexity of the attached application. All of the interface agents have similar front-ends that can interpret the standardized communication of the other agents. However, translating this into something understood by the applications is solely dependent on the particular application. For example, if the user is using an application that requires additional data files, this request must be routed through the corresponding application agent before the file can be retrieved the support database agent. It should also be noted that the application agents are responsible for understanding the formatting of the files used by each of their respective applications.

A prototype of the DIAL system has been created in the SUN Microsystem environment and builds on the supplied ToolTalk facilities for inter-agent communication. Through further experimentation with this system we hope to tackle those issues needed to further enhance and improve the use of this multiple resources environments. Furthermore, we believe that the concepts being discovered during this project are generalizable to other domains where the integration of distributed multiple information resources are required.