Abstract

In this work, a multiagent based framework for collaboration between business organizations like a hospital, an university, etc. is presented. The modeling of the organizations (also called as nodes in our work) is done using a hierarchical structure. The agents in each of the organizations are modeled in a formal domain-independent manner. The agents within the nodes coordinate using the Generalized Partial Global Planning (GPGP) approach [Decker, 1995; Decker and Lesser, 1993] and the tasks are specified using the Task Analysis Environment Modeling and Simulation (TAEMS) [Decker, 1995] language. The system can work with soft real-time constraints. A heuristic real-time scheduler for the agents that addresses the real-time constraints is designed and implemented. The applicability of the proposed approach is demonstrated by identifying and modeling three examples from different domains.

All types of resources may not be present at each of the nodes and the nodes can share their resources through cooperation. The GPGP approach has been extended by providing an adaptive coordination mechanism for resource sharing across nodes. The mechanism uses the contract net protocol (CNP) to identify a target node for a task if a resource required by the task is not present at the node where it is submitted. The task is then migrated to the target node and it is sent back to the requesting node after the execution is over.

The proposed framework allows the specification of multiple objectives with a task and preference ratings are associated by the user for each of the objectives. The preference ratings are specified very conveniently by comparing two objectives at a time using non-crisp ordinal values. The important problem of task assignment to a node in the presence of multiple criteria and subjective preference ratings is addressed. The multiobjective decision making process using the fuzzy set approach is adapted for task assignment in a dynamic distributed system. The earlier proposed coordination mechanism is then extended to incorporate multiple objectives and the preference ratings.

It was observed that the system performance drops down at very high

task arrival rates due to the prohibitive communication time required by the CNP. In order to overcome this limitation, an Instance Based Learning (IBL) mechanism is incorporated with the coordination mechanism. It uses the history of task migrations for future target node predictions. The IBL mechanism is used when a task has little laxity (it is close to its deadline). Since the computation is local, a lot of message exchanges are avoided thereby giving rise to significant performance improvement.

In the proposed framework, fault handling mechanisms to tolerate failures of the resources have been developed. When a fault is eventually repaired, reconfiguration mechanisms are implemented so that the system resumes normal functioning.

All the above mentioned techniques have been implemented in a simulated system and an extensive experimentation has been carried out for all of them. Evaluation of the proposed techniques against commonly used and heuristic schemes is done. It is observed that there is significant gain in the system performance due to the techniques over other schemes.