LOAD BALANCING AND RESOURCE MANAGEMENT ON AGENT BASED GRID SYSTEMS FOR APPLICATIONS WITH HARD DEADLINES

SUMMARY

As internet and very fast connections become more widespread, distributed computing has become one of the populer research topics in computer science. Most of the scientific calculations take very long time using convential methods. However after the usage of distributed computing, these scientific calculations can be done within acceptable times.

One of the applications of distributed computing is grid systems. Grids give the capability to build decentralized virtual super computers with the usage of distributed computing. Grid computing is a model for wide-area distributed and parallel computing across heterogeneous networks, aiming to reach breakthrough computing power at low cost. Reliability, stability, data security and trustworthiness are important specifications of grid systems.

Another application of distributed computing is agent systems. Agents are encapsulated and autonomous software and hardware systems, which execute an assigned task by communicating and collaborating with other actors at the same time or different physical environments. In traditional agent systems, agents have limited information about the problem on hand and limited capacity to solve the whole problem, thus no single agent controls the whole system. Agents build a virtual organization by combining limited capacity of each agent through intensive cooperation.

An important aspect of distributed computing is load balancing and resource management. Overall success of the distributed and parallel computing environments rely on the success of the system's load balancing and resource management strategy. The two common studied economics model in the context of resource management and load balancing are centralized and decentralized approaches. Both of these approaches use auctions in order to match jobs with interested parties.

Decentralized approaches use separate actors to find and participate in currently open auctions. However this approach requires extensive messaging and awareness of the current grid system.

Centralized approaches use a central market to handle load balancing and resource management. Only market needs to be aware of the whole grid system, which gives it the ability to make an optimized load balancing and resource management.

In this thesis, an intelligent agent based grid system that combines the two different perceptions of distributed computing is proposed and implemented. After that a load balancing and resource management strategy on the implemented system is proposed and implemented.

The main reason of the introducement of an agent based grid system is because such a system fits our needs. An agent based system is needed in order to implement a succesful economics model algorithms. In addition to that, a grid based system allows access to system resources and is needed in order to implement a succesful economics model. The agent based grid system mentioned in this thesis is based on the previous work of Uygar Gümüş and Nadia Erdoğan from İstanbul. There have been changes on the system proposed by Uygar Gumus and Nadia Erdogan, that is why whole system will be explained in detail.

Firstly a research of prior works on distributed computing environments is done. Strong and weak parts of grids and agent systems are identified. A formal and broadly accepted definitions on agent systems are identified. After that a grid system based on agents is proposed.

Agent types and actors of the system are identified. Responsibilities and tasks for each actor are analyzed and protocols for each type of agent are defined. Interaction ways between agents and management etiquettes are described. Methods of connection, disconnection, messaging are declared.

Secondly a research of prior works on load balancing and resource management on distributed environments is done. Strong and weak parts of centalized and decentralized market structures are identified. After that a new load balancing and resource management strategy on the implemented system is proposed.

Agent types and actors of the system are identified. Responsibilities and tasks for each actor are analyzed and protocols for each type of agent are identified. Methods of auctioning, task scheduling, task assigment, task executing and result delivery are declared.

Life cycle of the proposed grid system is identified.

By merging smart and flexible structure of agent systems, stable and robust structure of grid systems, flexible and efficient load balancing structure of centralized market structure, a fully FIPA standards compliant agent based grid system is identified.