MASTER'S THESIS

A concurrent negotiation mechanism for grid resource co-allocation

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A Concurrent Negotiation Mechanism for Grid Resource Co-allocation

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Abstract

Since computationally intensive applications may often require more resources than a single computing machine can provide in one administrative domain, bolstering resource co-allocation is essential for realizing the Grid vision. Given that resource providers and consumers may have different requirements and performance goals, successfully obtaining commitments through concurrent negotiations with multiple resource providers to simultaneously access several resources is a very challenging task for consumers.

Negotiation is a process by which the parties involved resolve matters of dispute by holding communications and coming to an agreement which can be mutually agreed by each other. Whereas there are research works adopting automated negotiation for solving the Grid resource allocation problem in recent years, this work is among some of the earliest research works adopting a *concurrent* negotiation mechanism for solving the problem of Grid resource ***co***-allocation. In traditional negotiation, once a contract is established, both negotiation parties are bounded to the contract, i.e., neither party can breach the contract. This work adopts the idea of *leveled commitment contracts*, in which negotiation agents are allowed to renege on a contract during the negotiation.

The novel contribution of this work is devising a concurrent negotiation mechanism that (i) coordinates multiple one-to-many concurrent negotiations between a consumer and multiple resource providers such that the consumer can simultaneously access several resources by reaching agreements with multiple resource providers, (ii) manages (de)commitments for consumer agents during each one-to-many negotiation where

reneging on a contract is allowed for both provider and consumer agents, and (iii) devises an adaptive commitment management strategy profile such that the consumer agent can adopt appropriate negotiation strategy for each kind of Grid resource.

In this work, three classes of commitment management strategies (i.e., *Linear-CMS*, *Conservative-CMS*, and *Conciliatory-CMS*) and two kinds of utility-oriented coordination strategies (i.e., an intuitive utility-oriented coordination strategy and a regression-based utility-oriented coordination strategy) are first presented. Then, based on the properties of the *CMSs* observed through empirical studies, a fuzzy decision making approach for deriving adaptive commitment management strategy (i.e., *adaptive-CMS*) profiles of a consumer is devised.

A series of simulations was carried out in a wide variety of settings to: i) evaluate the commitment management strategy in a one-to-many negotiation environment, ii) validate the performances of three classes of *CMSs* (i.e., *Linear-CMS*, *Conservative-CMS*, and *Conciliatory-CMS*) in three different kinds of resource markets (i.e., favorable, unfavorable, and balanced markets for the consumer agent), iii) compare both intuitive *UOC* strategy and regression-based *UOC* strategy of this work with the patient coordination strategy in different kinds of market situations, and iv) evaluate the *adaptive-CMS* profile in an *n*-resource market. Favorable results show that the strategies presented in this work (both commitment management strategies and utility-oriented coordination strategies) outperform existing strategy models, and the *adaptive-CMS* profile works effectively and efficiently in terms of utility, negotiation speed, and success rate.

Contents