

Economic Models for Resource Management and Scheduling in Grid Computing

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ABSTRACT

The accelerated development in Peer-to-Peer (P2P) and Grid computing has positioned them as promising next generation computing platforms. They enable the creation of *Virtual Enterprises* (VE) for sharing resources distributed across the world. However, resource management, application development and usage models in these environments is a complex undertaking. This is due to the geographic distribution of resources that are owned by different organizations or peers. The resource owners of each of these resources have different usage or access policies and cost models, and varying loads and availability. In order to address complex resource management issues, we have proposed a computational economy framework for resource allocation and for regulating supply and demand in Grid computing environments. This framework provides mechanisms for optimizing resource provider and consumer objective functions through trading and brokering services. In a real world market, there exist various economic models for setting the price of services based on *supply-and-demand* and their value to the user. They include commodity market, posted price, tender and auction models. In this paper, we discuss the use of these models for interaction between Grid components to decide resource service value, and the necessary infrastructure to realize each model. In addition to usual services offered by Grid computing systems, we need an infrastructure to support interaction protocols, allocation mechanisms, currency, secure banking, and enforcement services. We briefly discuss existing technologies that provide some of these services and show their usage in developing the Nimrod-G grid resource broker. Furthermore, we demonstrate the effectiveness of some of the economic models in resource trading and scheduling using the Nimrod/G resource broker with deadline and cost constrained scheduling for two different optimization strategies on the World Wide Grid (WWG) testbed that has resources distributed across five continents.