SCHOOL OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING
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Economic models for management of resources in peer-to-peer and grid computing

R Buyya, H Stockinger, J Giddy and D A Abramson

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. The 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 for goods based on supply-and-demand and their value to the user. They include commodity market, posted price, tenders and auctions. In this paper, we discuss the use of these models for interaction between Grid components in deciding resource value and the necessary infrastructure to realize them. In addition to normal services offered by Grid computing systems, we need an infrastructure to support interaction protocols, allocation mechanisms, currency, secure banking, and enforcement services. Furthermore, we demonstrate the usage of some of these economic models in resource brokering through Nimrod/G deadline and cost-based scheduling for two different optimization strategies on the World Wide Grid (WWG) testbed that contains peer-to-peer resources located on five continents: Asia, Australia, Europe, North America, and South America.