SuperQuant Financial-Benchmark Suite for Performance Analysis of Grid Middlewares

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Abstract: Computational finance has mostly focused on theoretical algorithms for derivative products (options) pricing and their serial implementations. However, financial models and analytical methods have become more sophisticated and computationally hungrier. Pricing and hedging of higher order derivatives such as multidimensional (up to 100 underlying assets) European and first generation exotic options represent mathematically complex and computationally intensive problems. Grid computing promises to give the capability to handle such intense computations. It has been an attractive cost-effective solution for high performance scientific computing for the last decade. However, non-functional features of grid computing such as support for heterogeneity, fault tolerance, deployabiliy, load balancing and efficient resource utilization have not been widely applied in the computational finance domain. In this paper we present our work that explores such issues and aims to demonstrate benefits from the application of grid techniques to computational finance. Furthermore, with several grid middleware solutions available, it is cumbersome to select an ideal candidate to develop financial applications that can cope up with time critical computational demand for complex pricing requests. Another contribution of our paper is to present SuperQuant Financial-Benchmark Suite to evaluate and quantify the effects of the overhead imposed by grid middleware on both the throughput of the system and on the turnaround times of a financial grid application. This approach is a step towards producing a middleware independent, comparable, reproducible and fair performance analysis of grid middlewares. The proposed benchmarks are self-sufficient for evaluating any grid middleware with respect to its aforementioned non-functional aspects. The result of such performance analysis can be used by middleware vendors to find the bottlenecks and problems in their design and implementation of the system and by financial application developers to verify implementation of their financial algorithms. Moreover, these benchmarks are derived from the real market data, hence, can also be used by the computational finance community to propose novel parallel algorithms for pricing and hedging of high dimensional options more efficiently. In this paper we explain the motivation and the details of the proposed benchmark suite. To our knowledge, this is the first attempt to make such benchmarks publicly available to both the communities.

As a proof of concept, we describe the implementation details of the benchmark suite using ProActive Grid Middleware and demonstrate the result of initial experiments.

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