

Grid Computing

Experiment Management, Tool Integration, and Scientific Workflows

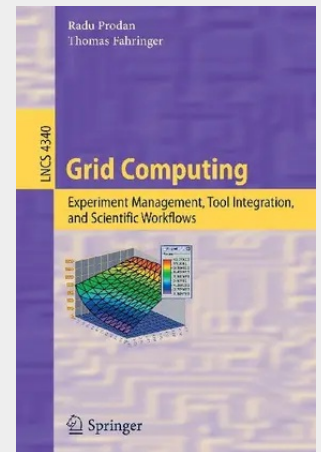
Grid computing has become a topic of significant interest in the scientific community as a means of enabling application developers to aggregate resources scattered around the globe for solving large-scale scientific problems. This monograph addresses four critical software development aspects for the engineering and execution of applications on parallel and Grid architectures.

A new directive-based language called ZEN is proposed for compact specification of wide value ranges of interest for arbitrary application parameters, including problem or machine sizes, array or loop distributions, software libraries, interconnection networks, or target execution machines. Based on the ZEN language, a novel experiment management tool called ZENTURIO is developed for automatic experiment management of large-scale performance and parameter studies on parallel and Grid architectures. This tool has been validated with respect to functionality and usefulness on several real-world parallel applications from various domains, including theoretical chemistry, photonics, finances, and numerical mathematics.

Depending on the ZENTURIO experiment management architecture a generic optimization framework is built up that integrates general-purpose meta-heuristics for solving NP-complete performance and parameter optimization problems in an exponential search space specified using the ZEN experiment specification language. Finally a timely approach is proposed for modeling and executing scientific workflows in dynamic and heterogeneous Grid environments, introducing an abstract formal model for hierarchical representation of complex directed graph-based workflows.

Thus this monograph contributes to various research areas related to integrated tool development for efficient engineering and high performance execution of scientific applications in Grid environments.

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