SYNASC09 - Parallel computing

Distributed Scheduling Policy in Service Oriented Environments

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Abstract—Service oriented architectures become more and more popular with the emergence and consolidation of new paradigms such as Clouds and Grids. In this context scheduling becomes an important and difficult problem as services hide their actual implementation, requirements or efficiency and are spread across multiple institutions and geographical locations. This paper proposes a distributed scheduling approach based on agents where each agent handles a certain domain and manages independently the policies inside it. In its frame several scheduling algorithms are also studied, compared and some results are given.

Description and Execution of Patterns for Symbolic Computations

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Abstract—The principal benefit introduced by distributed system is the ability to use the computation power and processing capabilities of multiple processing nodes in order to solve problems infeasible on a single machine. For symbolic computing these advantages are particularly useful. In order to create a successful distributed system to support symbolic computation is important to have a deep understanding of the way the computer algebra specialists interact with symbolic computing system. In this paper we investigate general processing capabilities of symbolic computing systems related to control flow and we emphasize several execution patterns. The impact that workflow management functionalities have over general execution patterns in symbolic computing are also investigated.

Dynamic Scheduling Algorithms for Workflow Applications in Grid Environment

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Abstract—Implementing efficient dynamic scheduling algorithms is a real challenge but a well designed algorithm can bring a significant performance improvement, regardless of unexpected events that may occur during execution. What is more, analyzing an application's needs and ensuring the most appropriate course of action in case of a delay or failure is bound to offer the best performance for the application in question. This paper presents three dynamic scheduling algorithms for workflows, implemented at application level. The application does satellite image processing, by describing a complex operation as a workflow of elementary operators. The scheduling process described by these algorithms doesn't control the resources directly so it is more natural to consider it closer to Grid applications. The algorithms are responsible for the management of tasks in workflow, such as managing the tasks for parallel execution, managing of data and correlation of events. To fulfill their functions, the scheduling algorithms need information coming from monitoring services available in the execution platform. The platform provides a series of libraries and services as well as a management and execution mechanism which will be used to test each algorithm's efficiency. The comparison between proposed dynamic algorithms and the platform's initial scheduling mechanism highlights the obtained improvements referring to the workflow execution time.

Bounded Parallelism in PowerList and ParList Theories

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Abstract—A very efficient model for recursive, data parallel programs can be one based on PowerList, PowerArray, and ParList theories. It assures simple and correct design of this kind of programs, allowing work at a high level of abstraction. This high level of abstraction could be reconciled with performance by introducing data-distributions into these theories. In this paper, we generalize the data distributions defined on PowerLists by introducing data distributions for parallel programs defined using ParList structures. Using these distributions we also define a possibility to transform ParList parallel programs into PowerList parallel programs, which are more efficient. This is an important advantage since PowerList programs could be efficiently mapped on real architecture (e.g. hypercubes).

Dynamic Resources Allocation in Grid Enviroments

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Abstract—This paper presents DyAG, an innovative solution for dynamic allocation of resources for services workflows in Grid environments. The proposed solution is responsible with the efficient mapping of the services which make up a Business Process Execution Language workflow onto resources, represented by Web Services, from the Grid environment. The presented solution is part of a framework that aims to allow the deployment of large scale workflow enabled scientific applications from a wide range of research fields onto the Grid. A series of allocation policies is considered, but the DyAG also allows the users to dynamically change the policy employed by the scheduler at runtime, through a class loading mechanism. This allows the employment of application profiling techniques in order to finely tune the scheduler in accordance with the characteristics of the environment it is running in, either by changing the various parameters of the policies proposed, or by loading completely new policies.

Performance Improvement of Genetic Algorithms by Adaptive Grid Workflows

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Abstract—In this paper we present improvement of the performance of Grid Direct Acyclic Graph (DAG) workflow genetic algorithm by harnessing the power of High Level Petri-Nets workflow model. Genetic Algorithms are very powerful optimization technique that is easily parallelized using different approaches which makes it ideal for the Grid. The High Level Petri-Net workflowmodel greatly outperforms currently available DAG workflow model available in gLite Grid middleware. Using the flexibility of the High Level Petri-Net workflows we have designed an adaptive workflow that overcomes the heterogeneity and unpredictability of the Grid infrastructure, giving users better and more stable execution times than formerly used DAG workflows. The experimental results obtained by Genetic Algorithm optimization of performance of the Data Warehouse design have shown advantages of the new approach by shortening the optimization time up to 50% for the same CPU time utilization. Another advantage is the increased stability of the time variance of the estimated execution time to approximately 30 minutes for runs on different Grid loads.

A Grid Enabled Quantum Computer Simulator

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Abstract—Simulation of quantum computers using classical computers is a computationally hard problem, requiring a huge amount of operations and storage. Grid systems are a good choice for simulating quantum algorithms, since they provide access to high performance computer clusters. In this paper we present the design of a message passing parallel version of the quantum computer simulator, QCL, deployed as a grid service. After describing the architecture of our grid service and the parallelization strategy for the general single qubit operator, we present the performance measurements for some test cases, showing the speedups obtained.

Fault Tolerance using a Front-End Service for Large Scale Distributed Systems

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Abstract—In this paper we present a solution to ensuring dependability in service-based large scale distributed systems. The proposed solution is based on a set of replicated services running in a fault-tolerant container and a proxy service able to mask possible faults, completely transparent for a client. We demonstrate an architecture which not only masks possible faults but also optimizes the access to the distributed services and their replicas using a load-balancing strategy, whilst ensuring a high degree of scalability. The advantages of the proposed architecture were evaluated using a pilot implementation. The obtained results prove that the proposed solution ensures a high degree of availability and reliability for a wide range of servicebased distributed systems.

Fairness and QoS Enhancement Models and Techniques for Peer-to-Peer Content Sharing Systems

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Abstract—Peer-to-peer content sharing systems are becoming increasingly popular in many types of environments, ranging from well-known file sharing communities to scientific and professional resource sharing communities. Two important objectives in such systems are achieving system-level fairness (i.e. participants should not only maximize their benefits, but also contribute to the well-being of the community) and an improved perceived Quality of Service (QoS) at the level of the individual participants. In this paper we propose several techniques for addressing these objectives from two perspectives: the application layer and the communication architecture layer.

Semantic Annotation based Service Composition for Grid Workflow Description and Execution

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Abstract - The main purpose of the research work presented in this paper was to model and implement an workflow-based architecture for Web service composition that allows the integration of composed Web services in a Grid middleware. The composed Web services are integrated as computational nodes in a workflow description and execution platform. To prove the presented theoretical concepts, a prototype was also implemented based on the gProcess platform [14] in which the Web services are integrated as satellite image operators in workflows used for processing satellite images. The urge for such a research work was driven by the lack of flexibility offered by the static deployed applications and the need of a dynamic approach given by Web services developed and deployed all over around the world. The proposed solution is a semi-automatic Web service composition based on predefined templates and realized in several steps: automatically search in a private registry, perform semantic annotation, automatically bind information of founded services and create a BPEL business process. This solution offers a dynamic approach and allows a high degree of reusability and interoperability in a Grid medium.

Efficient Handling of CSE Simulations on Computing Grids

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Abstract—The scientific computing community lacks of suitable tools that leverage the large resources available on computing grids. In this paper, we contribute with a novel approach to the efficient computation of simulation tasks on grid, thus making these systems available to new scientific communities and to real-world applications. We employ grid technologies to enable the efficient handling of simulation scenarios and we make possible the fast computation of the ones demanding long execution times on supercomputers. For that, we provide valuable mechanisms such as migration of simulations on grids and preview of results, suitable to applications stemming especially from computational sciences domains. We made them available in our framework for applications, GridSFEA. We exemplify the efficiency of our approach and demonstrate the usability of our framework by means of a computational fluid dynamics example: particle separation in drift-ratchet devices. Series of such demanding parallel simulations are computed with GridSFEA, migrated on the DEISA supercomputing grid, and their results are processed remotely with scientific visualization tools. The end-user is involved only in the definition of the simulation task, the rest of the work being accomplished by our framework. The execution overhead is negligible.