An Approach Based on Market Economy for Consistency Management in Data Grids with OptorSim Simulator

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ABSTRACT

Data grids are currently solutions suggested to meet the needs for scale large systems. They provide highly varied and geographically distributed resources of which the goal is to ensure fast access and effective data access. This is to improve the availability and tolerate the breakdowns. In such systems, these advantages are not possible without the use of replication. Use of the technique of replication poses the problem as regards maintenance of the consistency of the same replicas; the strategies of replication of the data and scheduling of the jobs were tested by simulation. Several grid simulators were born. One of the most interesting simulators for our study is the OptorSim tool. In this article, we present an extension of OptorSim by a consistency management module of the replicas in data grids; we propose a hybrid step which combines the economic models conceived for a hierarchical model with two levels.

Keywords: consistency; data grid; market economy model; optimistic approach; OptorSim; pessimistic approach; replication

INTRODUCTION

Data storage and the data gatherings can be processed by various means. In the history of computing, several memory technologies were presented and are largely widespread today. Starting from the simple places of storage like the main memory of a machine, several kinds of data distributing are known. A very important factor of memory technolo-
gies is the time of data access (Xu, Li, & Li, 2002). While based on the various hardware of memory technologies (main memory, hard drive, etc.), the access time changes. In a distributed system holding account of the data distribution at several places of storage and the distribution of the users and thus of the applications, there is always a difference in execution between the local (on the same machine) or remote data of access through network. This difference is related to the access time, to minimize factor, by providing copies (replicas) data in several places. The replicas are not only employed to gain the execution in access time and consequently hide latencies of access but also to deal with the problems that occur in the distributed systems. However, the use of this technique generates a consistency problem. The management and the scheduling of the resources in large-scale systems necessarily consider many parameters and the complex interactions which occur, make the impracticable model analytically.

The work presented in this research contributes to the consistency management of replicas in data grids. It allows proposing an incremental approach to converge replicas towards a global replica of the system by using, for conflict resolution, a strategy based on economic market models in the OptorSim grid simulator (Bell, Cameron, Millar, Capozza, Stockinger, & Zini, 2003). In the second section of this article, we briefly describe the OptorSim simulator of grids. The approaches to consistency management of replicas are described in the third section. The fourth section presents the proposed process based on market economy model for consistency management in grid environments. The various preliminary experiments are discussed in the fifth section. We end this article with a conclusion and some future directions.

**OPTORSIM SIMULATOR**

Resource management and scheduling of resources in large scale systems are complicated and require sophisticated tools to analyze algorithms before applying them to real systems. Many phenomena cause nondeterminism of the test platform. It is customary to simulate what can iterate as necessary experience and see, for example, the influence of a parameter in particular on the results of simulations. As a result, many tools and standards specific to the application have been established. Several simulators have been proposed to study and analyze the behavior of environment types grids and management of their resources, among which, we can cite Bricks (Takefusa, Matsuoka, Nakada, Aida, & Nagashima, 1999), SimGrid (Casanova, Legrand, & Marchal, 2003), GridSim (Buyya & Murshed, 2002), ChicSim (Ranganathan & Foster, 2002), EdgSim (Edgsim, 2003), MicroGrid (Song, Liu, Jakobsen, Bhagwan, Zhang, Taura, & Chien, 2000), GangSim (Dumitrescu & Foster, 2005), and OptorSim (Bell et al., 2003).

The principal motivation of OptorSim was the lack of environment of
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