Chapter 16

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 of scale large systems. They provide highly varied and geographically distributed resources of which the goal is to ensure fast and effective data access. This improves availability, and tolerates breakdowns. In such systems, these advantages are not possible without the use of replication. The use of the technique of replication poses a problem in regards to the maintenance of the consistency of the same data replicas; the strategies of replication of the data and scheduling of jobs were tested by simulation. Several grid simulators were born. One of the most interesting simulators for this study is the OptorSim tool. In this chapter, the authors present an extension of the OptorSim by a consistency management module of the replicas in Data Grids; they propose a hybrid step which combines the economic models conceived for a hierarchical model with two levels. This suggested approach has two vocations, the first allowing a reduction in response times compared to an pessimistic approach, the second gives the good quality of service compared to optimistic approach.

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1 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 machine, several manners of data distributing are known. A very important factor of memory technologies is the time of data access (Xu, 2002). While based on the various hardware of memory technologies (main memory, hard drive, ...), the access time change. In distributed system which holds 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 of latencies of access but also to deal with the problems that occur in the distributed systems. However, the use of this technique generates consistency problem. The management and the scheduling of the resources in large scale systems consider many parameters which must be considered 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, strategy based on economic market models under the OptorSim grid simulator (Bell, 2003). In Section 2 of this paper, we describe in very short OptorSim simulator of grids. The approaches to consistency management of replicas are described in Section 3. Section 4 presents the proposed process based on market economy model for consistency management in the grid environments. The various preliminary experiments are discussed in section 5. We end this paper with a conclusion and some future directions.

2 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 non-determinism 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 which are 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, 1999), SimGrid (Casanova, 2003), GridSim (Buyya, 2002), ChicSim (Ranganathan, 2002), EdgSim (Edgsim, 2003), MicroGrid (Song, 2000), GangSim (Dumitrescu, 2005), OptorSim (Bell, 2003).

The principal motivation of OptorSim was the lack of environment of simulation for data grid treatment applications. The objective of OptorSim is to study the stability and transitory behavior of the replica optimization methods. OptorSim models the interactions of the individual data grid components design (Figure 1) drifts directly of the architecture of the data grid project. OptorSim considers the following concepts:

- The sites provide date processing and/or storage resources
- A Broker Resource for scheduling works
- A router is without treatment or storage resources

Work is carried out on the treatment resources and uses the data stored in the storage resources.