Chapter 6
Dynamic Negotiation Mechanism for Improving Service Quality for Replicas in Data Grids

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ABSTRACT

In order not to be limited in term of calculation, storage and communication, the concept of grid, which does not cease evolving, makes it possible to offer a practical operation of work unified as well as a great storage and computing power. To manage the division in the data grid, technical replication is used, but in spite of their advantages, the competitor access to the data could involve inconsistencies, from where the great challenge to ensure the consistency management between replicas of object. In this chapter, we describe model double-layered adapted to the applications on a large scale and which represents the support of the hybrid approach of consistency management of replicas based on pessimistic and optimistic approaches. This hybrid approach present an adapted mechanism based on the various negotiation forms between virtual consistency agents to be able to reduce the number of conflicts between replicas in data grids.

INTRODUCTION

Replication techniques are used to provide multiple critical copies and to maintain them. In coherent state, they improve the overall system availability and performance. In splitting of replication advantages, there are many problems that must be resolve like (Gray et al. 1996; Xu et al. 2002):

- How do we select and estimate the metrics for taking replication decisions?
• When do we replicate a given object?
• Where do we place the replicas of a given object?
• How do we ensure consistency of all replicas of the same object?
• How do we route client requests to appropriate replicas?

Among these problems, the main critical concerns the consistency problem that needs to maintain the data consistency between a set of replicated data distributed among a set of computer. The main objective of a replica consistency approach is to avoid or even reduce the inconsistency between replicated data.

Many current applications can barely tolerate a certain degree of contradiction between replicas where the strong consistency is not a condition, for examples in the approximate readings from meteorological sensors often suffice when performing predictive modeling of weather conditions, the network security applications or in video conferencing applications (Olston and Widom, 2005). Our principal aim, in this paper, is to propose a hybrid mechanism of negotiation for the decision-making to the presence of the conflicts between the replicas in data grid (Foster and Kesselmann, 2004). This mechanism of negotiation is integrated in the hybrid consistency approach (Belalem and Slimani, 2007) inspired from the two pessimistic and optimistic traditional approaches. The structure of our present paper will as follows: the next section will describe the fundamental principles of pessimistic and optimistic consistency approaches.

Section 3, will dedicated to the description of the model used in our adapted negotiation mechanism. In section 4 section, we describe our mechanism of negotiation proposed for the decision-making to the meeting of the divergences between replicas which cannot be solved and present algorithms of our negotiation process. Section 5 is reserved for the characteristics of our proposed process. Section 6 presents some experiments to position and evaluate our approach compared to the other traditional ones. Finally section 7 will enclose this work by the presentation of the some future tracks.

**APPROACHES OF CONSISTENCY MANAGEMENT**

The Consistency is a relation which defines the degree of similarity between copies of a distributed entities. In the ideal case, this relation characterizes copies which have identical behaviors. Although in the real cases, even when the copies evolve in a different way, consistency defines the threshold of dissimilarity authorized between these copies. We hope of a consistency protocol which ensures the execution of the operations of users, the mutual consistency of copies in accordance with a behavior defined by a model of coherence. The consistency protocol gives an ideal view as if there is only one user and only one copy of the data in the system. Replica consistency management can be achieved, either synchronously, using the so-called pessimistic algorithms, or asynchronously, deploying optimistic ones (Belalem and Slimani, 2007; Saito and Shapiro 2005). Fundamental tussles between pessimistic and optimistic approach are those related to scalability and security. The execution of pessimistic consistency assures that any change in one replica is atomically notified to all other replicas. Therefore, there is an inherent guarantee that all replicas will have the same data all the time, making this approach indispensable in the mission of critical and sensitive applications like the distributed banking application. On the other hand, the optimistic approach is employed for applications (large scale systems, mobile environments and system weakly coupled), which evolves rapidly in terms of response time for example. So that we can say that, the pessimistic approach is interested in consistency more than availability, while the optimistic approach supports the avail-
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