Self Adjustable Negotiation Mechanism for Convergence and Conflict Resolution of Replicas in Data Grids

Ghalem Belalem, University of Oran–Es Senia, Algeria
Zineb Benotmane, University of Oran–Es Senia, Algeria
Khadidja Benhallou, University of Oran–Es Senia, Algeria

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 article, 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.

Keywords: consistency; negotiation; optimistic approach; pessimistic approach; replication; VCA

INTRODUCTION

Replication techniques are used to provide and maintain multiple critical copies. In coherent state, they improve the overall system availability and performance. Despite that replication is advantageous, it has many problems that should be resolved such as [1][2]:

- 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 the replicas of the same object?
• How do we route client requests to appropriate replicas?

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

Many current applications can barely tolerate a certain degree of contradiction among replicas where 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 [3][4]. Our principal aim, in this article, is to propose a hybrid mechanism of negotiation for the decision-making to the presence of the conflicts among the replicas. This mechanism of negotiation is integrated in the hybrid consistency approach [5] inspired from the two pessimistic and optimistic traditional approaches. The structure of our present article will be as follows: the next section will describe the fundamental principles of pessimistic and optimistic consistency approaches.

Section 3, will be devoted the description of the model used in our adapted negotiation mechanism. In Section 4, we will describe our mechanism of negotiation proposed for the decision-making to the meeting of the divergences concerned with 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 will presents some experiment to position and evaluate our approach compared to the other traditional ones. Section 7 briefly presents related pioneering works for the resolution of the conflicts between the divergent replicas; finally section 8 will enclose this work by the presentation of the some future tracks.

**CONSISTENCY MANAGEMENT APPROACHES**

Consistency is a relation which defines the degree of similarity among copies of distributed entities. In the ideal case, this relation characterizes copies which have identical behaviors. Although in 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 users operations , the mutual consistency of copies in accordance with a behavior defined by a coherence model. 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 the optimistic ones [5][6]. 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 the replicas will have the same data all the time. This makes this approach necessary 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 weakly coupled system), 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 availability more than the consistency [6][7].