State-of-the-Art Issues in Distributed Databases

IT IS desirable to have a Distributed Database Management System whose behavior and control is as identical as possible to that used in single site database management systems. Preserving the autonomy of sites which join a DDBMS network is essential to the peace of mind of its managers and users, and more technically, is essential in an environment where sites and communication lines fail. This is a collection of selected papers from the Fifth Berkeley Workshop on Distributed Data Management and Computer Networks. The program committee of that conference selected four papers from those submitted to appear in a special section of this TRANSACTIONS. Each of these papers offers contributions to the state-of-the-art in achieving resilience and robustness in distributed systems.

Two of the papers address the area of redundant copies. Redundant copies in a distributed system provide locality of reference for reads and the potential for parallel processing. At the same time, updating multiple copies requires more coordination to keep the copies identical from a user's viewpoint. The paper by Wong looks at the opportunity for parallelism which is possible when data are replicated in a distributed database. It presents a framework for doing distributed query optimization which can take advantage of this parallelism by thinking of the query processing itself as dynamically changing the data distribution.

Numerous papers have been written on how to update replicated data when not all copies are available for update, proposing backup and voting schemes to increase the probability that an update operation will succeed. The work described in the paper by Parker et al. attacks the problem from a totally different angle. They permit updates even when the network is partitioned, and present techniques for later merging the updates made to the copies during that time.

The paper by Bernstein, Goodman, and Lai addresses the issue of single site image in the area of concurrency control. They suggest a model for proving concurrency control algorithms correct and illustrate it on some distributed database concurrency control algorithms. The basis for their work comes from noting the distinction between the user's set of operations and the operations used by the multiple layers inside the underlying database management system. Proving serializability of transactions at one level together with proving properties of the translation between levels allows them to make conclusions about the properties of action sequences at the other levels of the system.

The paper by Skeen et al. establishes a formal model of crash recovery for a distributed system. Having defined this model and the site and communication failures that can occur, they prove properties of recovery protocols under various failure conditions. They explore under what circumstances resilient protocols can exist.

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