INTEGRITY CONSTRAINTS MAINTENANCE FOR PARALLEL DATABASES

By

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July 2006
To my First Teachers: My Father and Mother
To my wife and lovely kids:
  Sara, Ahmad and Rama
To my lovely sisters and brothers

Feras
This research work proposed a standard framework for maintaining integrity in parallel database systems. A model consisting of two main modules has been successfully implemented. This framework is flexible and can be extended easily as the framework is designed in a modular fashion where each module has a clear function, input and output and interacts easily with the other modules.

A constraint verification method is proposed to check the consistency between the integrity constraints in the constraint base. The proposed method is based on the construction of Modal Records to determine if a newly defined constraint is not contradicting with an existing constraint set.

A constraint simplification approach is proposed to simplify the integrity constraints in the constraint base. Deriving and checking a simplified version of the integrity constraint called integrity tests can gain efficiency. Efficient maintenance of integrity is a critical problem, since checking the validity of a large number of integrity constraints...
constraints against a large database is crucial to the database systems. The derivation of these integrity tests is not trivial, adding to the cost of integrity maintenance.

The strength of the proposed approach is that it combines the advantages of the substitution as well as the theorem proving technique in the previous work. The proposed approach is based on substitution and requires no resolution search. It requires no complex transition axioms to describe the update operations. The proposed method is considered as a general one since it derives complete integrity tests for first order constraints. In addition, it derives sufficient tests for key, referential and semantic integrity constraints. The complete and sufficient integrity tests can be applied before the update operation is performed. Moreover, it can be extended to deal with transition integrity constraints, which are excluded from the previous approaches. Transition integrity constraints are important since they give relationships between the two states that an update or transaction is required to obey.

As the research interest is in parallel database system, this research has proposed a virtual rule partitioning method for maintaining database integrity by dynamically partition the table(s) to accommodate with parallel integrity subsystem. Therefore, there will be no fixed partitions specified during the design process, which result in time consuming for the system to locate the proper partition of data, for fulfilling the requirement of the integrity test. The presented method is benefited from the direct access method because the tuples in each partition are indexed according to the test attribute during the execution of the integrity test. The test attribute is the attribute of the generated test that is substituted by the submitted update operation.
Abstrak tesis dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENYELENGGARAAN KEKANGAN INTEGRITI UNTUK PANGKALAN DATA SELARI

Oleh

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Kajian ini bertujuan untuk memberikan model umum yang menyeluruh dalam penyelenggaraan integriti pangkalan data selari. Sebuah model yang terdiri dari dua model utama telah berjaya dibangunkan. Rangkakerja ini adalah fleksibel dan mudah dilanjutkan sebagaimana rangkakerja direka dalam fesyen modular di mana setiap modul mempunyai fungsi modul yang jelas, input dan hasil serta berinteraksi dengan mudah antara modul yang lain.

Kaedah penyemakk kekangan dicadangkan untuk menyemak konsistensi antara kekangan integriti dalam kekangan asas. Keada yang dicadangkan adalah berasaskan pada pembinaan Modal-modal Rekod untuk mengenalpasti samaada kekangan yang baru dihasilkan tidak bertentangan dengan set kekangan yang wujud.

Pendekatan permudah kekangan dicadangkan untuk memudahkan kekangan-kekangan integriti dalam kekangan asas. Perolehan dan penyemakan adalah versi yang mudah bagi kekangan integriti yang dipanggil pengujian integriti yang boleh memperolehi keberkesanan. Pengelengaraan yang berkesan bagi integriti adalah
masalah yang kritikal, sejak penyemakan kesahihan nombor yang besar bagi kekangan integriti bertentangan dengan pangkalan data yang besar adalah genting kepada sistem pangkalan data. Asalan bagi pengujian integriti adalah tidak penting dan ia menambahkan kos penyelenggaraan integriti.

Kekuatan kajian ini adalah pada pembangunan kaedah yang menggabungkan kelebihan bagi penggantian dan begitu juga pada pembuktian teorem. Kajian ini berdasarkan kaedah pengantian yang tidak memerlukan carian resolusi. Ia juga tidak memerlukan transaksi aksiom yang komplek untuk menerangkan operasi kemaskini. Kaedah yang dicadangkan ini, boleh dianggap sebagai kaedah umum kerana ia menghasilkan ujian-ujian integriti yang lengkap untuk kekangan tahap pertama. Tambahan lagi, ia menghasilkan ujian-ujian yang mencukupi untuk kekunci, rujukan, dan semantik kekangan integriti. Ujian-ujian yang lengkap dan mencukupi boleh dilaksanakan sebelum operasi kemaskini dilaksanakan. Lagipun ia boleh dilanjutkan untuk berurusan dengan transaksi kekangan integriti, yang dikecualikan dari kaedah sebelum ini. Transaksi kekangan integriti adalah penting kerana ia memberi hubungan antara dua keadaan di mana kemeskini atau transaksi perlu dipatuhi.

Dalam sistem pangkalan data selari ini, kajian ini mencadangkan satu kaedah peraturan pembahagian maya untuk penyelenggaraan pangkalan data yang secara dinamik membuat pembahagian jadual untuk memenuhi integriti sub-sistem selari. Oleh itu, tiada pembahagian tetap pada proses rekabentuk yang mana boleh memakan masa sistem dalam menempatkan pembahagian data yang sesuai bagi memenuhi keperluan ujian integriti. Kaedah yang dibentangkan mendapat kebaikan dari kaedah pencapaian terus kerana tuples setiap pembahagian diindekskan
berdasarkan ujian atribut semasa perlaksanaan ujian integriti. Atribut pengujian ialah atribut dalam ujian yang dijanakan yang digantikan oleh operasi pengemaskinian yang dihantar.
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Feras Ahmad Al-Hanandeh

July 2006
I certify that an Examination Committee has met on 25 July 2006 to conduct the final examination of Feras Ahmad Hamed Hanandeh on his Doctor of Philosophy thesis entitled "Integrity Constraints Maintenance for Parallel Databases" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

FERAS AHMAD HANANDEH

Date:
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