

DIAGONAL REPLICATION TECHNIQUE FOR HIGH
DATA AVAILABILITY IN DISTRIBUTED
DATABASE SYSTEMS

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DEDICATION

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I would like to express my most deep appreciation to the ever-valued chairman, Prof. Mustafa bin Niaz Daria for his contributions, guidance, ideas, and love towards my thesis, and also thank to the committee member Assoc. Prof. Mohd Nurul Saari bin Yusoff.

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DEDICATION

This work is dedicated first to God, who provided me strength and patience.

I would like to express my most deep appreciation to the committee chairman, Prof. Mustafa bin Mat Deris for his contribution, guidance, ideas, and time towards my thesis, and also thank to the committee member, Assoc. Prof. Muhammad Suzuri bin Hitam.

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September 2005

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In a distributed database systems environment, database replication is the most widely used concept to offer high data availability, fault tolerance mechanism, and enhanced system performance. In such system, a mechanism is required to maintain the consistency of the replicated data, determine the number of replication required and where the replicated are to be stored. This is largely due to the limitation in storage capacity.

This research presents a new technique called Diagonal Replication on Grid (*DRG*) in which will result in high data availability with optimal number of replication required.

In *DRG*, sites are logically organized in a two-dimensional grid structures. The accessibility of a data objects on a quorum i.e. read or write quorum therefore comes

from diagonal sites. Since data objects are only replicated to the diagonal sites, it minimizes the number of database update operations. Analysis are performed on communication costs, data availability and system performance through analytical modeling where the number of sites considered ranges from 25 to 81.

As opposed to Tree Quorum and Grid Structure technique, *DRG* requires significantly lower communication costs to operate, but provides higher system availability, which is preferred for a large system.

Abstrak tesis yang dikemukakan kepada Senat Kolej Universiti Sains dan Teknologi Malaysia (KUSTEM) sebagai memenuhi keperluan ijazah Master Sains

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Di dalam persekitaran sistem pangkalan data teragih, replikasi merupakan pendekatan yang paling meluas digunakan bagi menyediakan ketersediaan yang tinggi, toleransi-kesalahan, dan peningkatan prestasi di dalam sistem. Bagi mengatasi masalah storan, satu mekanisma diperlukan untuk mengekalkan konsistensi data yang direplika, dan untuk menentukan bilangan dan lokasi data yang perlu direplika. Kajian ini mencadangkan satu teknik baru yang dinamakan "*Diagonal Replication on Grid (DRG)*" bagi menghasilkan ketersediaan data yang tinggi dengan hanya menggunakan jumlah replika yang optima.

Di dalam teknik ini, site di susun secara logical dalam struktur grid dua dimensi. Oleh kerana data hanya direplika di *diagonal site*, ianya mampu meminimakan bilangan operasi pengemaskinian pangkalan data. Analisis ini telah dilakukan berdasarkan kos

komunikasi, ketersediaan data dan prestasi sistem melalui model analitikal di mana bilangan site dari 25 hingga 81.

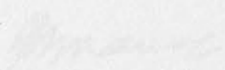
Jika dibandingkan dengan teknik *Tree Quorum* dan Struktur Grid, *DRG* terbukti memerlukan kos komunikasi yang paling rendah bagi setiap operasi, disamping mengekalkan ketersediaan data yang tinggi, yang mana sesuai bagi sistem yang besar.

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