

HYPER Database System

Hybrid OLTP&OLAP High Performance Database System

Reference Number

B70096

Background

Historically, database systems were mainly used for online transaction processing. Typical examples of such transaction processing systems are sales order entry or banking transaction processing. These transactions access and process only small portions of the entire data and, therefore, can be executed quite fast. According to the standardized TPC-C benchmark results the currently highest-scaled systems can process more than 100.000 such sales transactions per second.

About two decades ago a new usage of database systems evolved: Business Intelligence (BI). The BI-applications rely on long running so-called Online Analytical Processing (OLAP) queries that process substantial portions of the data in order to generate reports for business analysts. Typical reports include the aggregated sales statistics grouped by geographical regions, or by product categories, or by customer classifications, etc.

Origin

Technische Universität München

Industrial Sector

Information & communication

Key Words

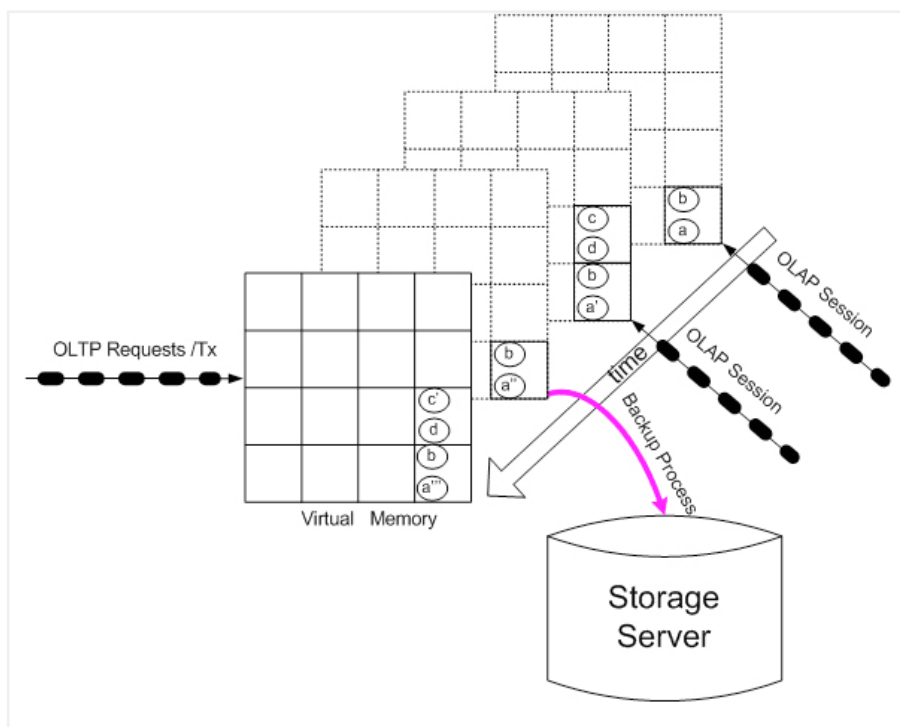
database system, OLTP, OLAP

Patent Status

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The two areas of online transaction processing (OLTP) and online analytical processing (OLAP) present different challenges for database architectures. Currently, customers with high rates of mission-critical transactions have split their data into two separate systems, one database for OLTP and one so-called data warehouse for OLAP. While allowing for decent transaction rates, this separation has many disadvantages including data freshness issues due to the delay caused by only periodically initiating the Extract Transform Load-data staging and excessive resource consumption due to maintaining two separate information systems.

Innovation

We present an efficient hybrid system, called HyPer, that can handle both OLTP and OLAP simultaneously by using hardware-assisted replication mechanisms to maintain consistent snapshots of the transactional data.

HyPer is a main-memory database system that guarantees the ACID properties of OLTP transactions and executes OLAP query sessions (multiple queries) on the same, arbitrarily current and consistent snapshot.

The utilization of the processor-inherent support for virtual memory management (address translation, caching, copy on update) yields both at the same time:

- unprecedented high transaction rates as high as several 100000 per second
- ultra-low OLAP query response times of as low as 10 ms –

all on a commodity desktop server. Even the creation of a fresh, transaction-consistent snapshot can be achieved in 10 ms.

Commercial Opportunities

The invention provides a main-memory database system that

- processes OLTP transactions at rates of tens of thousands per second, and, at the same time,
- processes OLAP queries on up-to-date snapshots of the transactional data
- guarantees the ACID properties
- creates Transaction Consistent backup archives of the entire database on non-volatile storage.

Developmental Status

The performance evaluation of the HyPer prototype is based on the standardized TPC-C benchmark. This benchmark "simulates" a sales order processing (order entry, payment, delivery) system of a merchandising company. The benchmark refers to the core functionality of such a commercial merchandiser like Amazon or Würth or Otto Versand. In addition, the benchmark incorporates the query suite of the TPC-H benchmark – rewritten for the TPC-C database schema. Thereby, the two most prominent benchmarks for OLTP (TPC-C) and for OLAP (TPC-H) run in parallel on a single HyPer installation and produce unprecedented performance.

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