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GUEST EDITORIAL: REAL-TIME DATABASE SYSTEMS

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An increasing number of database applications today are characterized by the requirement to access and manipulate data in a timely manner. Among those application areas are: airline reservation, banking, the stock market, investment analysis, computer-integrated manufacturing, and command and control. The requirement for timely transaction response in such applications has resulted in a new research area, called real-time database systems (RTDBSs). RTDBSs have inherited many properties from both real-time systems and database systems. Like a conventional real-time system, the update transactions and queries processed in a RTDBS have timing constraints, typically in the form of deadlines. What makes a RTDBS different from a conventional real-time system is the requirement to support appropriate transactional consistency (not necessarily full serializability) while maintaining timeliness of data (temporal consistency).

Due to its potential advantages, RTDBS research has been an active area for the last couple of years. Current research efforts in RTDBSs focus primarily on integration of scheduling concepts from database systems and real-time systems. This special issue provides a collection of papers addressing several research issues in RTDBSs. These papers have been selected from many high-quality manuscripts submitted to this special issue.

The paper by Thomas, Seshadri, and Haritsa provides a new database system architecture that allows real-time transactions and standard transactions to execute simultaneously and choose different concurrency control schemes. It is shown in the paper that the proposed architecture maintains data integrity and that it is possible to improve performance of standard transactions without sacrificing the interests of the real-time transactions.

The paper by Datta, Mukherjee, Viguier, and Bajaj introduces a dynamic admission control and scheduling policy for RTDBSs. The policy provides overload management and bias control to prevent discriminatory behavior towards particular transaction classes. The experimental results obtained using a simulation model demonstrate the effectiveness of the proposed policy.

The paper by Aranha et al. reports on the implementation of a real-time DBMS, called RT-Genesis. RT-Genesis was developed by modifying a commercial relational DBMS to accommodate queries and transactions with timing requirements. The paper also includes the results of a performance study of various concurrency control, buffer management, and scheduling algorithms implemented on RT-Genesis.

Bestavros and Braoudakis present the advantages offered by a new concurrency control approach, called speculative concurrency control, for RTDBSs. They provide a number of algorithms based on this approach and compare them to some previously proposed real-time concurrency control algorithms using simulation.

Finally, the paper by Chen and Gruenwald addresses the issues concerning scheduling nested transactions in a RTDBS environment. It presents several techniques for propagation of timing constraints of a transaction to its subtransactions. Performance results of the proposed techniques obtained through simulation experiments are also provided in the paper.

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