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World Quantum Day 2022

QC4DB: Accelerating Relational Database Management Systems via Quantum Computing

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QC4DB: Accelerating Relational Database Management Systems via Quantum Computing

- **Project Website@Quantentechnologien**
- Project funded by BMBF
  - Duration 3 years, 1.8M Euros
- Topics
  - Query Optimization
  - Optimizing Transaction Schedules

  of an open source relational database management system
- Partners
  - University of Lübeck (Coordinator Sven Groppe)
    - Hardware-Acceleration of Databases
    - Website: https://www.ifis.uni-luebeck.de/~groppe/
  - Quantum Brilliance GmbH
    - Room Temperature Diamond Quantum Accelerators
    - Website: https://quantumbrilliance.com/

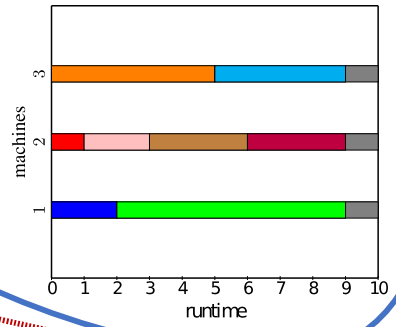
Planned Contributions

Query Optimization:

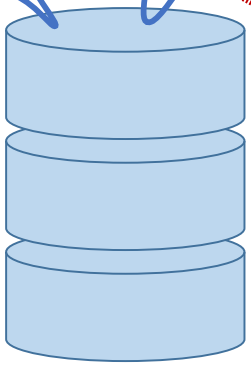
$$\bowtie_{i=1}^{n} R_i \quad ? \quad \begin{array}{c} (R_1 \bowtie R_2) \cdots \bowtie R_n \\ \vdots \\ (R_1 \bowtie R_n) \bowtie (\cdots) \end{array}$$

Transaction Schedule Optimization:

$$\{T_1, \ldots, T_m\} \quad ?$$



Open Source Relational Database Management System (RDBMS), e.g. PostgreSQL, MySQL



Dynamic Programming
Random Walk
Linear Program-ming
...
Machine Learning
Genetic Algorithm
Simulated Annealing

Open Challenges for QC for Databases

- Are QC counterparts of basic algorithms used in query optimizations suitable for speeding up databases?
- What should be the properties of a quantum computer (e.g. #qubits, latencies of gates) to achieve certain speedups?
- How to combine classical and quantum computing algorithms to achieve good speedups with few qubits?
  (...for running database optimizations on current available quantum computers...)
- What other (database) domains besides query and transaction schedule optimizations benefit from quantum computers?
  (In short: those based on mathematical optimization problems, but also other...?)

We are open for **collaborations**:
Please contact Prof. Dr. Sven Groppe ✉ groppe@ifis.uni-luebeck.de