

The Research Group
Software Languages Lab

has the honor to invite you to the public defence of the PhD thesis of

Tim Baccaert

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

On the Limits of Efficient Database Consistency

Supervisor:

Prof. dr. Bas Ketsman (VUB)

The defence will take place on

Monday, October 19, 2026 at 5 pm

VUB Etterbeek campus, Pleinlaan 2, Elsene,
in auditorium D.2.01

Members of the jury

Prof. dr. Geraint Wiggins (VUB, chair)

Prof. dr. Elisa Gonzalez Boix (VUB)

Prof. dr. Joost Vennekens (VUB)

Prof. dr. Frank Neven (UHasselt)

Prof. dr. Christoph Koch (École Polytechnique
Fédérale de Lausanne, CH)

Dr. Nofar Carmeli (Inria, FR)

Curriculum vitae

In 2021, Tim Baccaert obtained a master's degree in Computer Science, with greatest distinction, from the Vrije Universiteit Brussel. That same year, he started his PhD under the supervision of Prof. dr. Bas Ketsman.

His research interests are in the theory of databases, transaction processing and distributed systems. He coauthored one journal paper, two international and peer-reviewed conference papers, and a single international workshop paper. He also presented this work at several international conferences.

Abstract of the PhD research

Modern database systems are deployed in wildly different computing environments, from geo-distributed data centers to embedded systems. Despite this variety, all database systems are expected to ensure consistency of the data they store. We study two particular areas in which database systems have had difficulty scaling, despite hardware advances.

First, we study the theoretical limits of transaction processing systems, which are notoriously difficult to scale when there is high contention for shared resources. We show that optimally scheduling transactions with respect to their scheduling makespan, or the difference between the schedule's start and stop time, is an NP-complete problem. We then provide a polynomial time algorithm for transaction sets that contend for a single shared resource, and contribute several upper bounds on the makespan. Additionally, we derive approximation algorithms with an approximation ratio proportional to the transaction set size divided by the longest transaction's length.

Secondly, we study when it is strictly required for asynchronous distributed databases to utilize coordination in order to ensure consistency. We provide a generalization of the Consistency as Logical Monotonicity (CALM) theorem, which states that a problem has a consistent, coordination-free distributed implementation if and only if the problem is monotone. We extend the result so that it applies for problems that are non-deterministic such as leader election. We also make the theorem applicable to a wider range of systems, making the only-if direction less delicate. Lastly, we apply this generalized theorem to show that the classes of polynomial time problems and coordination-free problems are not equal.