



Intelligent Realtime 3D Simulations

Patrick Lange, Gabriel Zachmann

University of Bremen, Germany

cgvr.informatik.uni-bremen.de

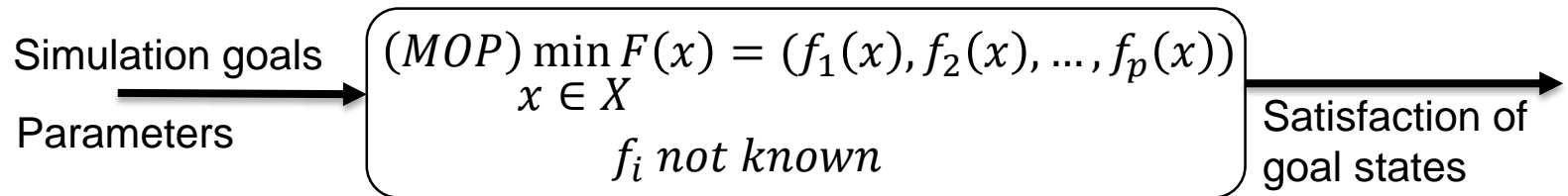
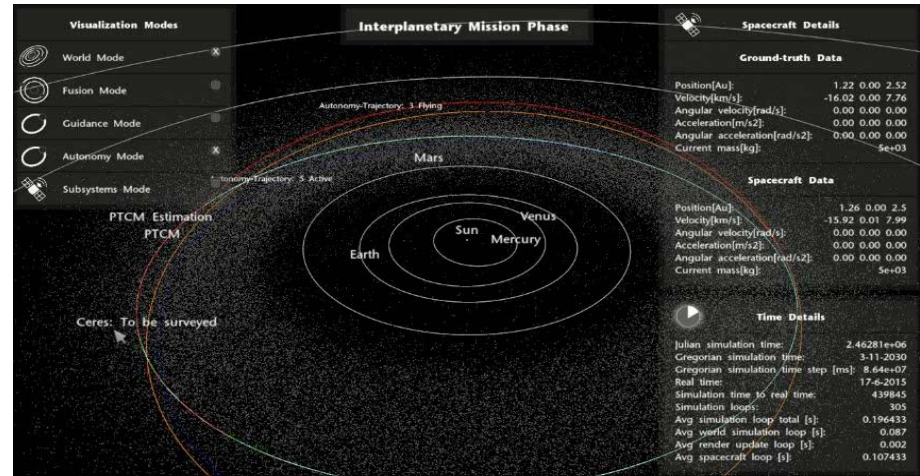
ACM SIGIM PADS – Ph.D. Colloquium

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Motivation: Virtual Testbeds

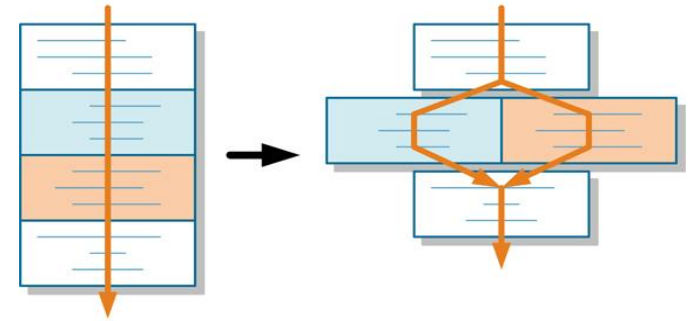
- Complex simulation
 - Performance requirements \geq realtime
 - Engineering constraints (complexity, time-to-market)
 - Multiobjective optimization

- Simulation-based feasibility studies (blackbox simulation)
 - Mathematical multiobjective optimization problem can not be formulated
 - Finding a tradeoff set of input parameters necessary



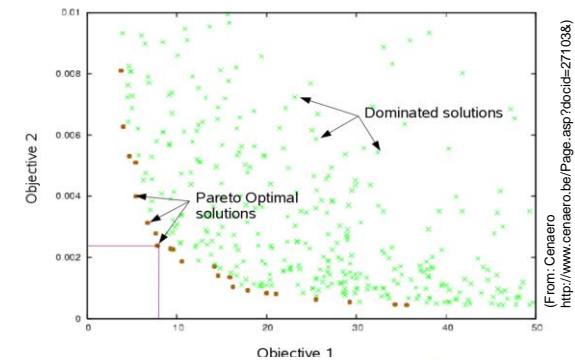
1. Performance: Parallelization

- Generation, management and distribution of the global simulation state in wait-free manner



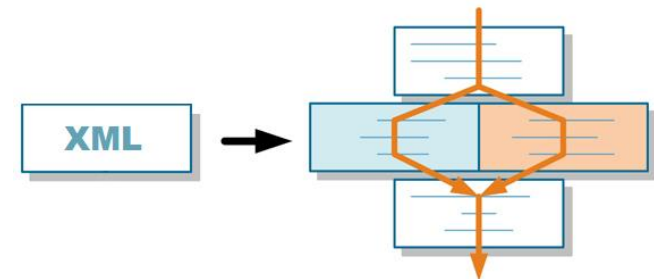
2. Quality: Multiobjective optimization

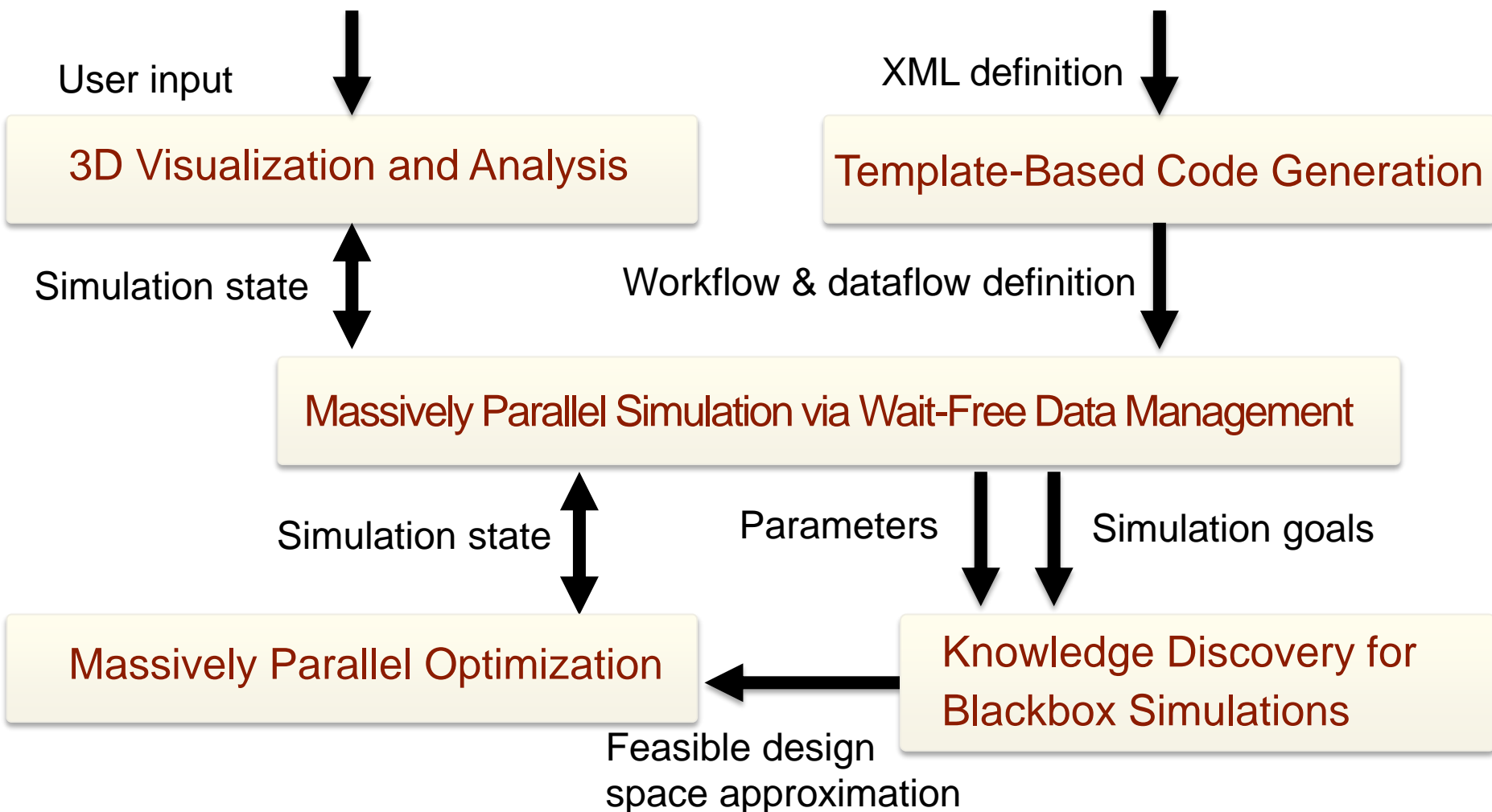
- Approximation of the feasible design space



3. Engineering: Code generation

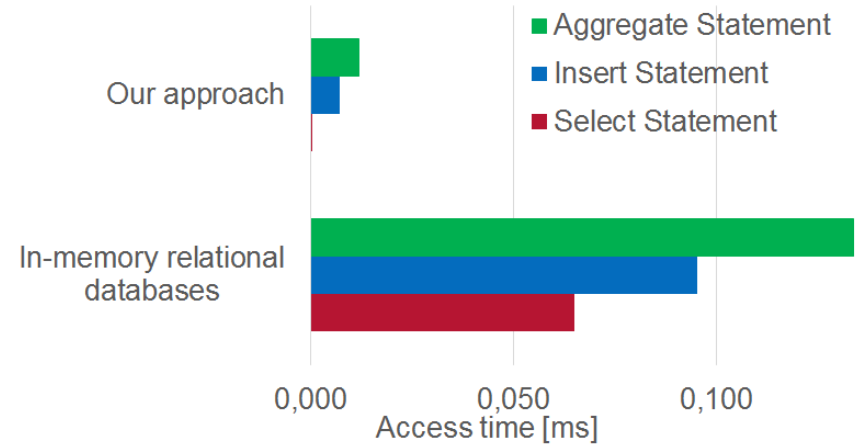
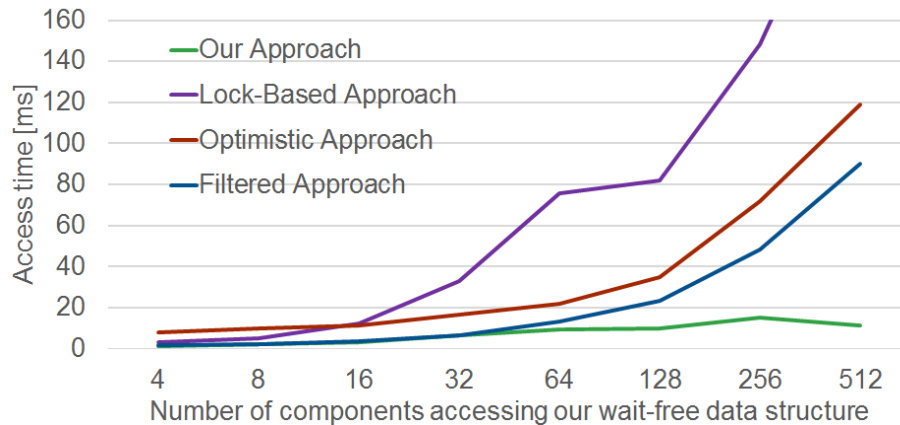
- Reducing the time and errors in the virtual testbed implementation





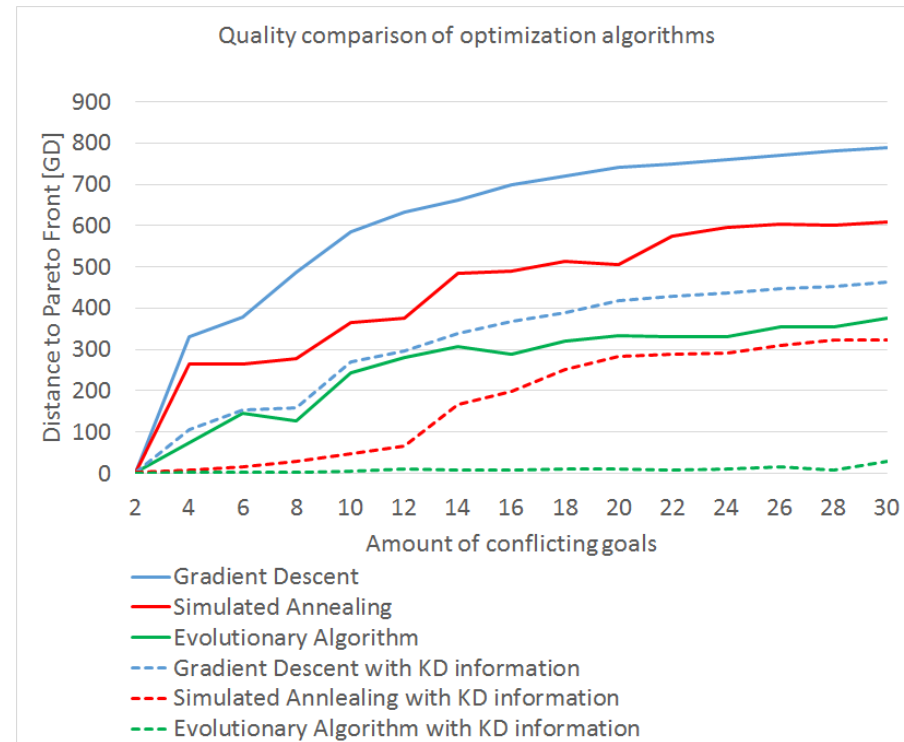
1. Massively parallel simulation via wait-free data management

- Non-locking read and write operations
- Supports relational database access queries
- Hash map design based on memory cloning and atomic operations



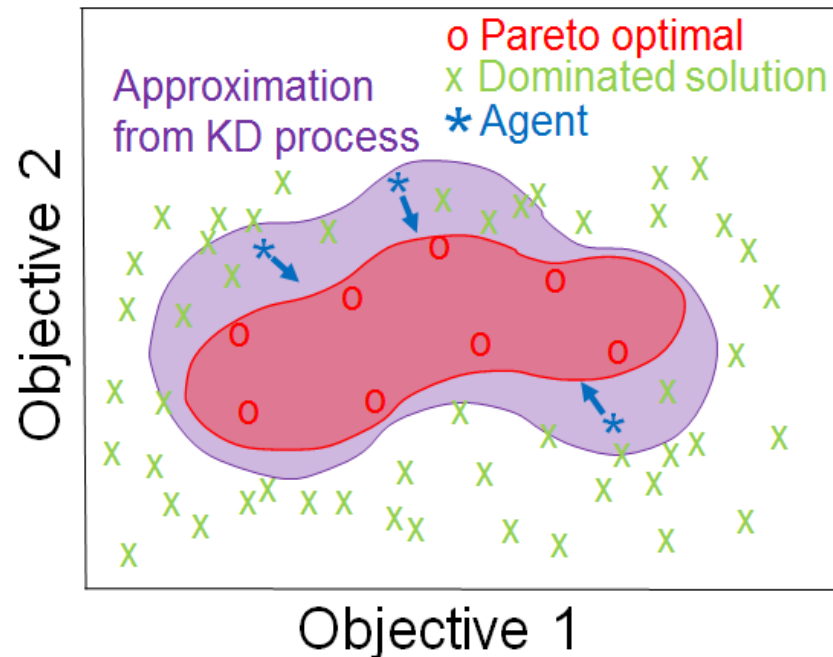
2. Knowledge discovery process for multiobjective optimization in blackbox simulation

- Discovers hidden relationships between parameters in simulation workflow
- Reduces simulation samples via spline-based objective function representation
- Approximates the feasible design space and Pareto gradient information

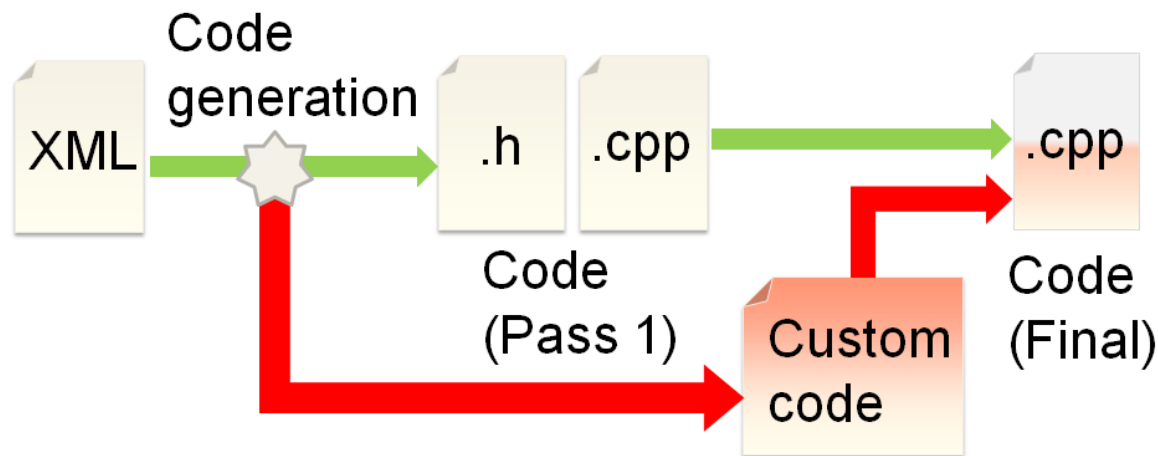


3. Massively Parallel Optimization

- Massively parallel multi-agent system optimizes all goals in parallel
- Fast agent communication via wait-free data exchange
- Adaptive parameter adjustment within agent structure



4. Engineering and design of concurrent simulation and optimization applications
 - Template-based code generation for our wait-free hash map based simulation and optimization framework
 - Automatic generation of dataflow and workflow
 - Passive partial class generator concept for autonomous vehicle virtual testbeds





Thank you for your attention

Questions?

Patrick Lange, Rene Weller, Gabriel Zachmann
{lange,weller,zach}@cs.uni-bremen.de



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