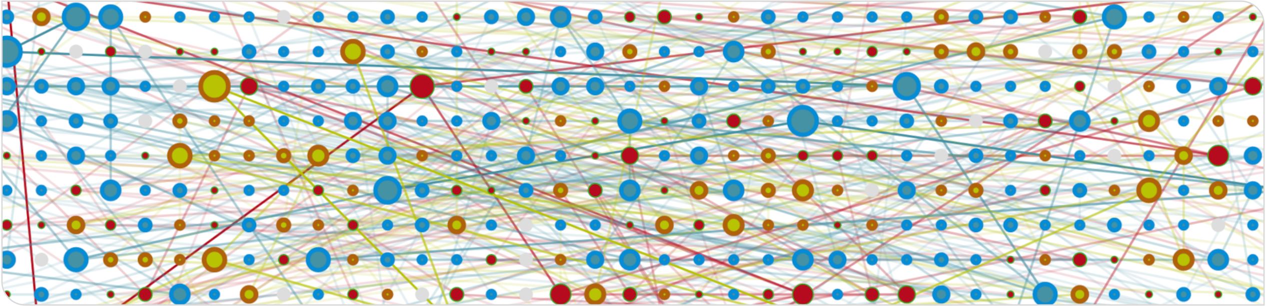
# Skalierbarkeit und Diversifikation in modernem SAT Solving

**Seminar Kick-Off**

Markus Iser, Dominik Schreiber | 27. Oktober 2021



# Organisatorisches

- Ausführlicher Vortrag (30 min. + 15 min. Fragen), keine Ausarbeitung
- 2-3 Papiere aus einem gemeinsamen Themenblock einordnen, kommentieren, vergleichen
- Unterstützung und Beratung von Betreuerseite möglich
- *n* Vortragstermine (für kleine *n*) nach Absprache

markus.iser@kit.edu

dominik.schreiber@kit.edu

# Topics: The Big Picture

- How can we exploit modern computer architectures for SAT solving?
- Which innovative SAT solving paradigms have emerged in the past few years?
- How can we understand and exploit statistical runtime properties of diverse SAT solvers?

# A. Parallel & Distributed SAT

## 1. Parallel SAT Fundamentals

2009, Audemard & Simon, “Predicting Learnt Clauses Quality in Modern SAT Solvers”

2014, Audemard & Simon, “Lazy Clause Exchange Policy for Parallel SAT Solvers”

2017, Le Frioux et al., “PaInleSS: a Framework for Parallel SAT Solving”

## 2. GPU-accelerated SAT Solving

2021, Osama et al., “SAT Solving with GPU Accelerated Inprocessing”

2021, Prevot et al., “Leveraging GPUs for Effective Clause Sharing in Parallel SAT Solving”

## 3. Distributed SAT “as a Service”

2020, Heisinger et al. “Distributed Cube and Conquer with Paracooba”

2021, Schreiber & Sanders, “Scalable SAT Solving in the Cloud”

2021, Ozdemir et al. “SAT Solving in the serverless Cloud”

# B. More Powerful Proof Systems

## 4. Binary Decision Diagrams

2006, Sinz & Biere, “Extended Resolution Proofs for Conjoining BDDs”

2006, Jussila et al., “Extended Resolution Proofs for Symbolic SAT Solving with Quantification”

2021, Heule & Bryant, “Generating Extended Resolution Proofs with a BDD-Based SAT Solver”

## 5. Propagation Redundancy

2017, Heule et al., “PRuning Through Satisfaction”

2019, Heule et al., “Encoding Redundancy for Satisfaction-Driven Clause Learning”

2019, Heule et al., “Strong Extension-Free Proof Systems”

2021, Kiesl et al., “Simulating Strong Practical Proof Systems with Extended Resolution”

# C. Statistical Evaluation of SAT Solvers

## 6. Optimal Configurations per Instance Class

2016, Audemard & Simon, “Extreme Cases in SAT Problems”
2018, Elffers et al., “Seeking Practical CDCL Insights from Theoretical SAT Benchmarks”

## 7. Evaluation of Runtime Experiments

2010, Nikolić, “Statistical Methodology for Comparison of SAT Solvers”
2012, Xu et al., “Evaluating Component Solver Contributions to Portfolio-Based Algorithm Selectors”
2015, Ansótegui et al., “On the Classification of Industrial SAT Families”

# D. Per-Instance Algorithm Selection

Background literature: 2019, Kerschke, “Automated Algorithm Selection - Survey and Perspectives”

## 8. Instance-specific Algorithm Selection

2011, Xu et al., “SATzilla: Portfolio-based Algorithm Selection for SAT”
2013, Collauti et al., “SNNAP: Solver-based Nearest Neighbor for Algorithm Portfolios”

## 9. Automatic Configuration of SAT Solvers

2015, Falkner et al., “SpySMAC: Automated Configuration and Perf. Analysis of SAT Solvers”
2015, Lindauer et al., “AutoFolio: An Automatically Configured Algorithm Selector”