The SCIP Optimization Suite - Past, Present, and Future

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Abstract: In this talk, we give an overview of the SCIP Optimization Suite, which currently consists of five software packages:

SCIP is currently one of the fastest non-commercial solvers for mixed integer programming (MIP) and mixed integer nonlinear programming (MINLP). It is also a framework for constraint integer programming and branch-cut-and-price. It allows for total control of the solution process and the access of detailed information down to the guts of the solver.

SoPlex is a Linear Programming (LP) solver based on the revised simplex algorithm. It features preprocessing techniques, exploits sparsity, and offers primal and dual solving routines. It can be used as a standalone solver reading MPS or LP format files as well as embedded into other programs via a C++ class library.

Zimpl is a modelling language that allows to translate the mathematical model of a problem into a linear or nonlinear (mixed-) integer mathematical program.

UG is a generic framework to parallelize branch-and-bound based solvers (e.g., MIP, MINLP, ExactIP) in a distributed or shared memory computing environment. It exploits the powerful performance of state-of-the-art "base solvers", such as SCIP, CPLEX, etc. without the need for the base solver to be parallelized.

GCG is a generic branch-cut-and-price solver for mixed integer programs. After the standard presolving process of SCIP, GCG performs a Dantzig-Wolfe decomposition of the problem to obtain an extended formulation of the problem. The decomposition is based on a structure either provided by the user or automatically detected by one of the structure detectors included in GCG .

We start with a discussion of the constraint integer programming concept and how it influenced the design of SCIP. Then, we show various projects in which SCIP has been used and how they gave rise to new developments within the SCIP Optimization Suite. We close with an overview over current projects and research directions.

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