The CP-SAT solver

CP-SAT is a discrete optimization solver built on top of a SAT engine.

It is available within the OR-Tools open-source repository

- Website: https://developers.google.com/optimization
- Github repository: https://github.com/google/or-tools

It has won multiple gold medals at the MiniZinc challenge:
https://www.minizinc.org/challenge.html since its debut in 2017.

The **CP-SAT** solver is architectured around five components:

- The base layer is a clause learning SAT solver.
- Above the SAT layer sits a Constraint Programming (CP) module with Boolean, integer and interval variables, and standard integer, scheduling and routing constraints.
- Alongside the CP solver, a simplex provides a global linear relaxation. Its integration with the CP and SAT layers enable the CP-SAT solver to solve MIP problems with the same techniques as (commercial) MIP solvers: relaxation, cuts, heuristics and duality based techniques.
- Both the CP and MIP modules rely on a unified protobuf representation of the model that can serve as a file format, as well as an intermediate representation of the model during all phases of the solve (input format, presolved model, LNS fragment, Local Search).
- On top, the search layer implements a robust information-sharing portfolio of specialized workers that offers both good and fast solutions, and superior optimality proving capabilities.

Resources:

- github recipes
- CP-SAT primer
- How CP-SAT works
- CPAIOR 2020 masterclass
- Scheduling seminar