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# Scalable Satisfiability-driven Problem Solving

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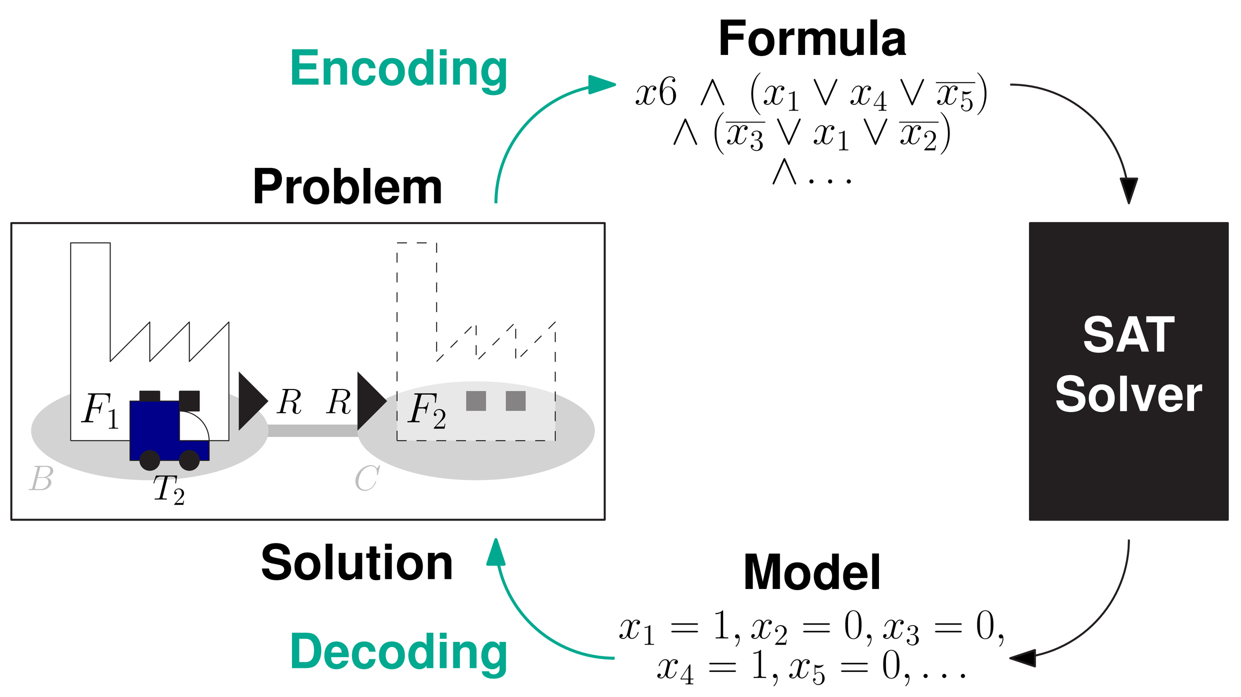
## 0. Background

### The Propositional Satisfiability Problem

Given a **propositional formula** $F$, assign a value (`true` or `false`) to each of its variables in such a way that $F$ evaluates to `true`, or report that such an assignment ("model") does not exist.

**— Solving Problems via SAT —**

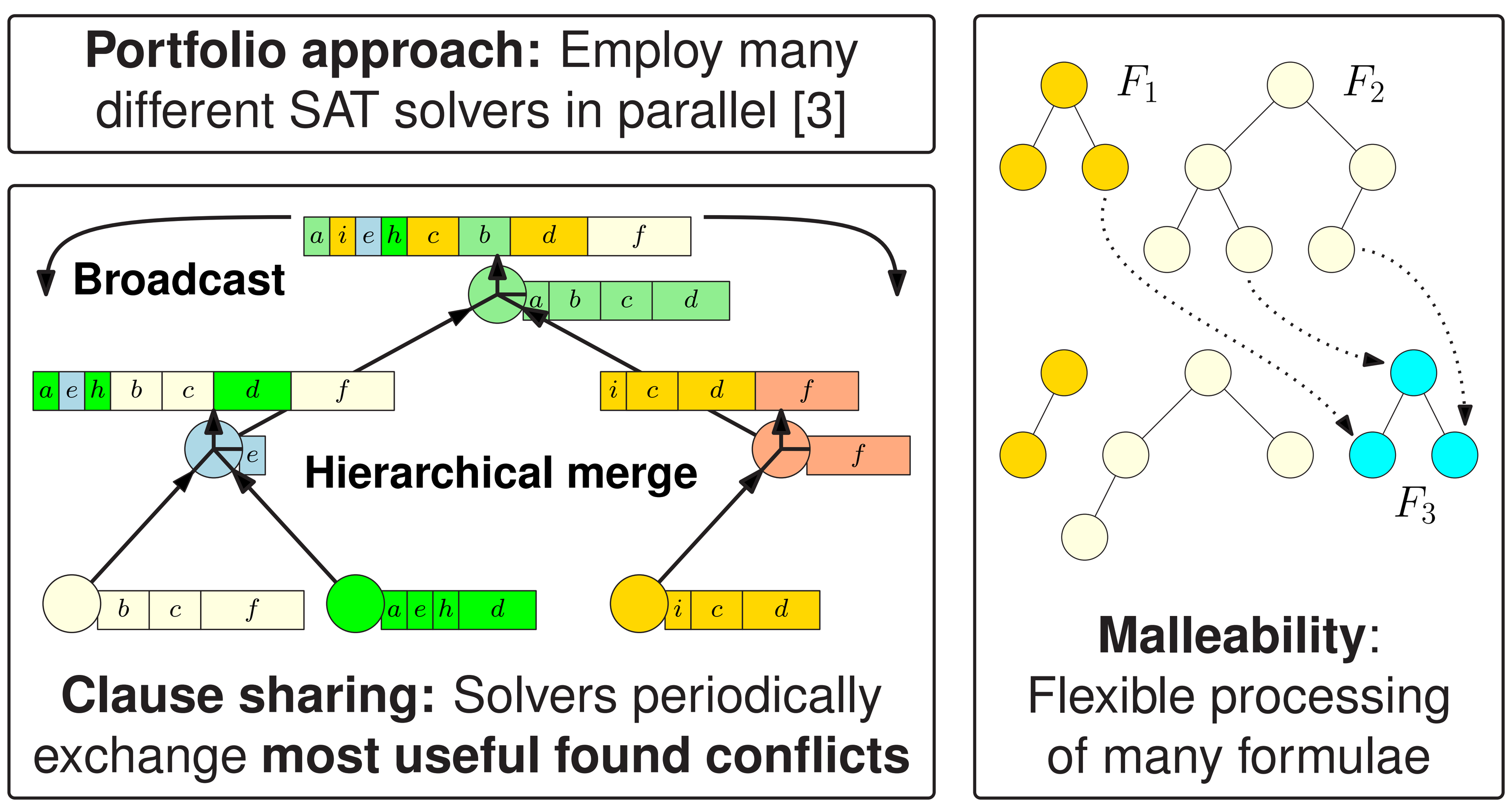



**Applications**: Planning & Scheduling, Explainable AI [1], Theorem Proving, Software & hardware verification, …

## I. Scalable Satisfiability Solving [2]

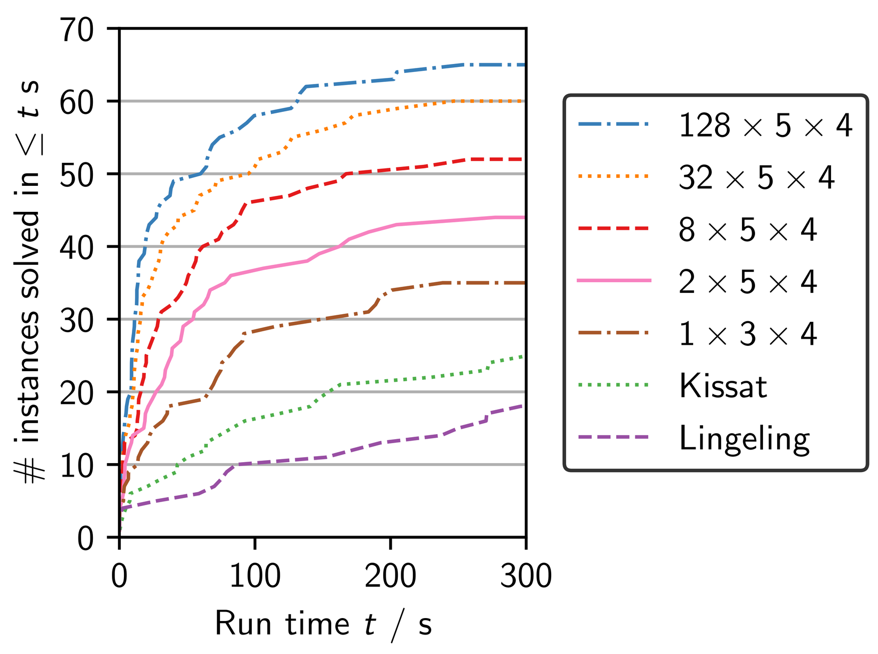
- Exploit **large clusters** (> **1000 cores)**
- Substantially **reduce scheduling latencies** for interactive solving

**— Our Approach: Mallob —**




**— Results —**

- Speedups observed for **up to 2560 cores**
- Winner of International SAT Competitions' Cloud Tracks 2020, 2021
- **Malleable scheduling**: Minimal latencies (≤10 ms), improved **resource efficiency**

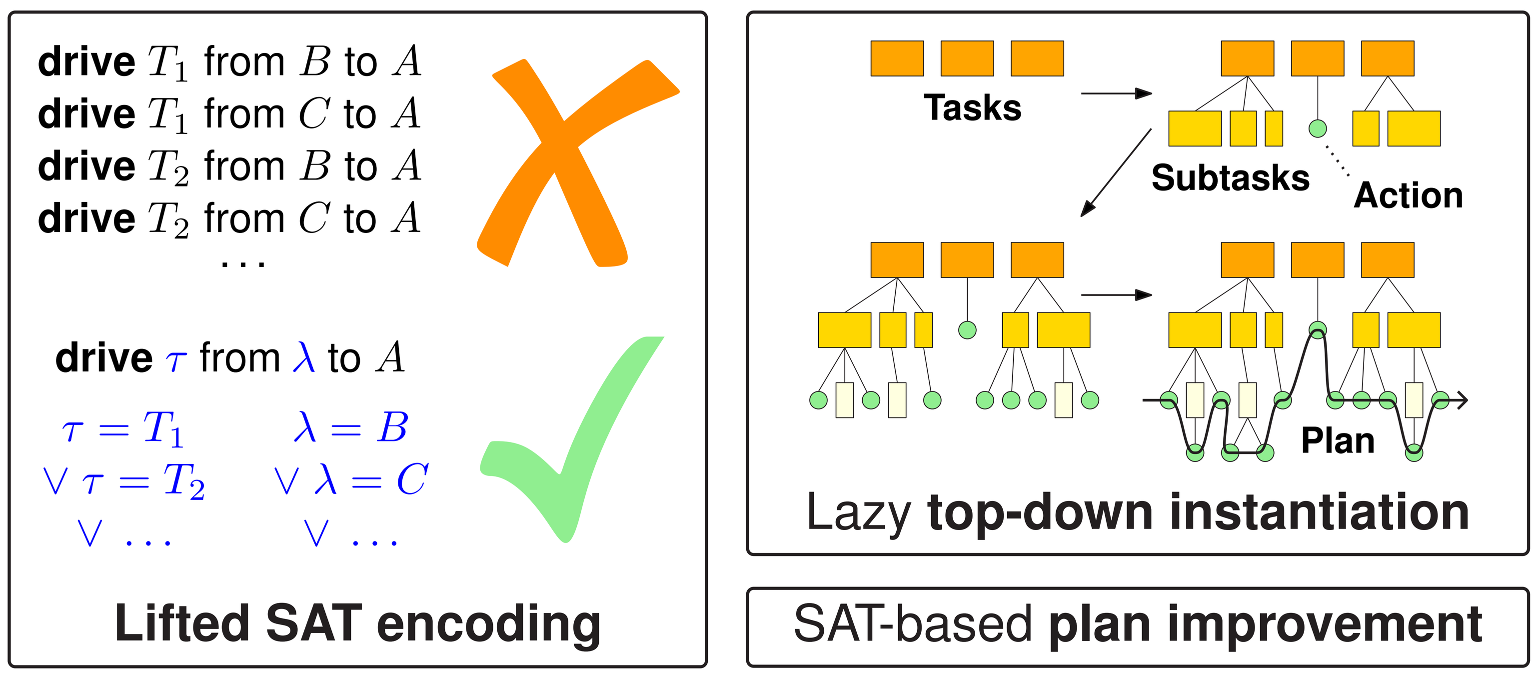



## II. A Scalable Encoding for AI Planning [4]

### Totally-Ordered Hierarchical Task Network Planning

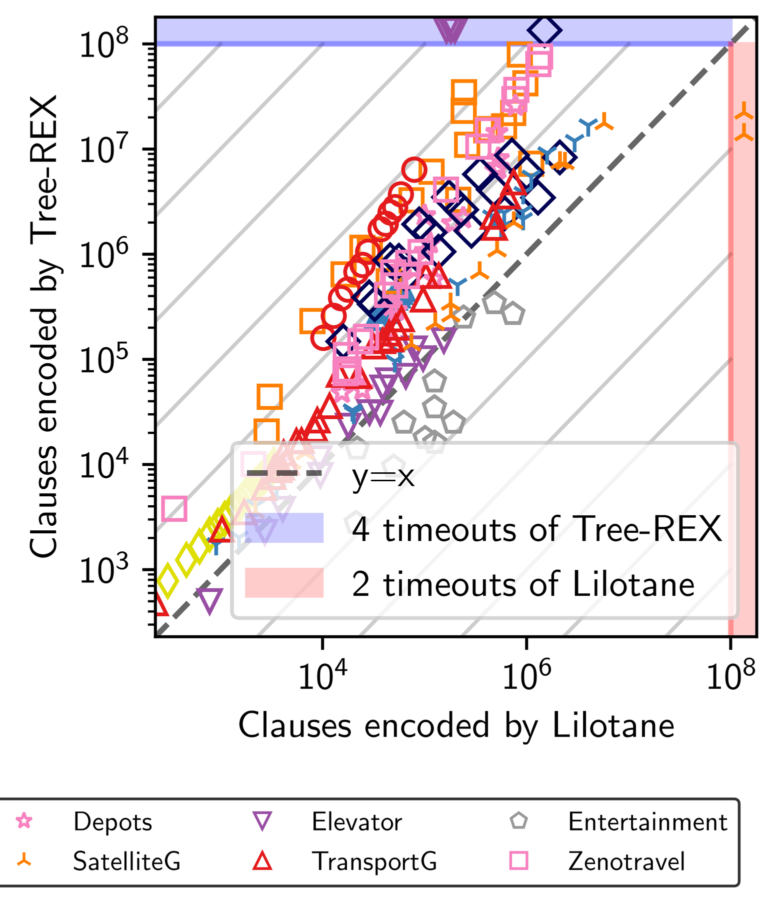
- Problems feature parametrized **tasks** and their decompositions
- **Applications:** Coordination of robots [5], video game AI, web service composition, …
- Previous SAT-based planners: **Expensive preprocessing** enumerates all possible operations ⇒ **Blowup** in problem size

**— Our Approach: Lilotane —**




**— Results —**

- **Smaller formulae** than [6, 7]
- Reduced memory footprint
- Merits of grounding rarely outweigh its problems (see "Entertainment")
- **Competitive**: 2nd place in Total Order track of International Planning Competition 2020
- Produces **high quality** plans even before plan improvement





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