PARIS: Planning Algorithms for Reconfiguring Independent Sets

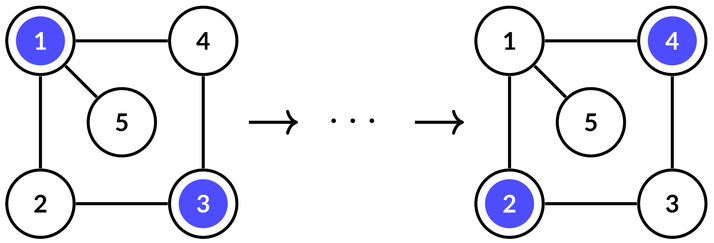
R. Christen, S. Eriksson, M. Katz, C. Muise, A. Petrov,
F. Pommerening, J. Seipp, S. Sievers, D. Speck

Combinatorial Reconfiguration (CoRe)

- **Problem**: Transforming one solution into another with small changes
- **Changes**: Transformations **preserve the solution space**
- **Example**: Reconfiguring a network while maintaining household connections

Independent Set Reconfiguration (ISR)

- **ISR Problem**: A prominent representative of combinatorial reconfiguration
- **Independent Set**: A set with non-adjacent vertices
- **Objective**: Transforming an initial to a goal independent set
- **Permitted Changes**: Token Jumps – Maintaining independent set status



ISR as Classical Planning

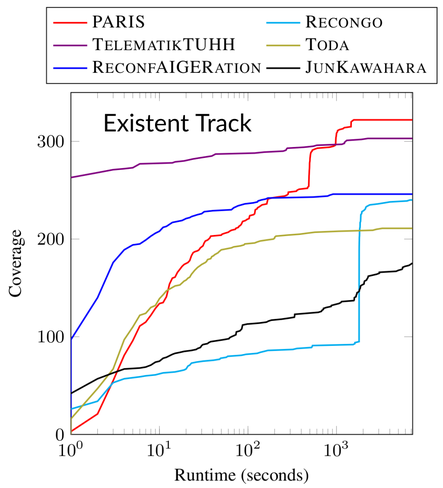
Contribution: Formulating the ISR problem as a classical planning problem

- **State variables**: Describe world states
  ⇝ Used to represent the graph and token positions
- **Discrete actions**: Specify world dynamics
  ⇝ Used for pick-up and place actions (IS condition encoded as precondition)
- **Objective**: Find a sequence of actions (plan) from initial state to goal
  ⇝ Corresponds to a reconfiguration sequence to solve the given problem

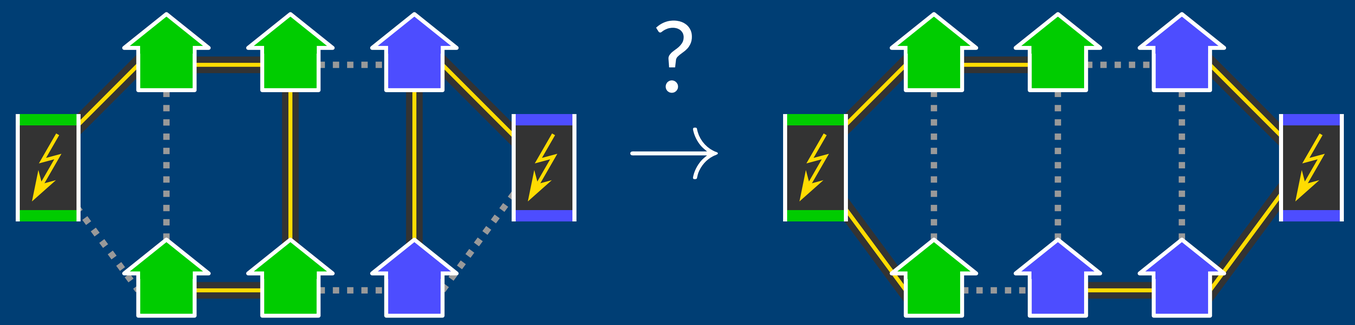
Empirical Results

- **PARIS Solver**:
  - Multiple planning techniques
  - E.g. heuristic and symbolic search
- **1st CoRe Challenge**:
  - PARIS won several tracks

PARIS	existent	shortest	longest
Single	1	3	1
Portfolio	1 3	2	1 3



Automated Planning Meets Combinatorial Reconfiguration: A Perfect Match



Full paper.