A CONSISTENCY ANALYSIS METHOD FOR TRAFFIC SEQUENCE CHARTS

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About the Author

- **2010 – 2015:** Studying computing science at C.v.O. University of Oldenburg
    - Focus on software engineering and theoretical computer science

- **2015 – 2016:** Research employee at C.v.O. University of Oldenburg

- **2016 – 2022:** OFFIS Institute for Information Technology, Oldenburg
    - System Concepts and Design Methods
    - **2018:** start work on thesis

- **Since 2022: DLR Institute for Systems Engineering for Future Mobility**, Oldenburg
    - Former OFFIS Transportation division
   - System Concepts and Design Methods

Research Interests

- Systems Engineering for CPS

- Model checking

- Traffic Sequence Charts

Traffic Sequence Charts (TSCs)

- TSCs are a concise specification language for traffic scenarios, where
  - traffic situations are described as invariants
  - scenarios are described by seamless sequences of such invariant nodes
  - complex scenarios can be build using parallel composition and choice
  - timing constraints can be easily annotated

- Implication-stylespecification pattern for requirements
  - *Pre-chart* implies *consequence*

- TSCs translate to mathematical formulae in multi-sorted real-time logic

invariant node

choice   parallel composition   sequence of invariant nodes
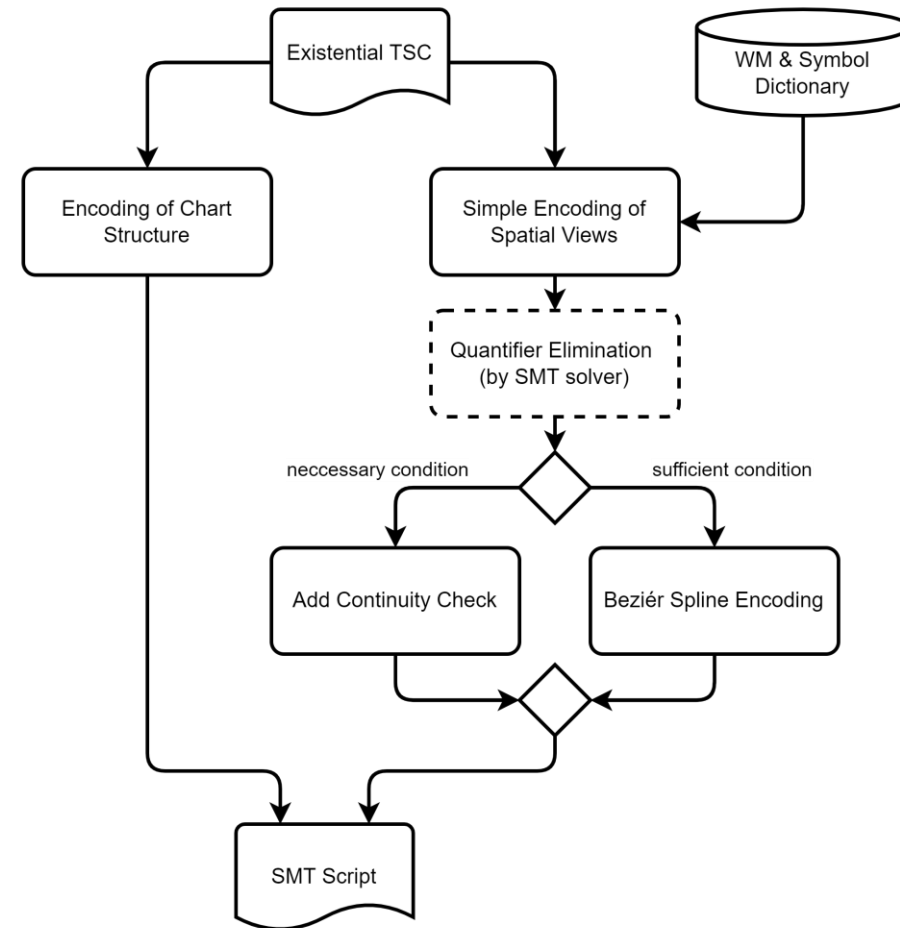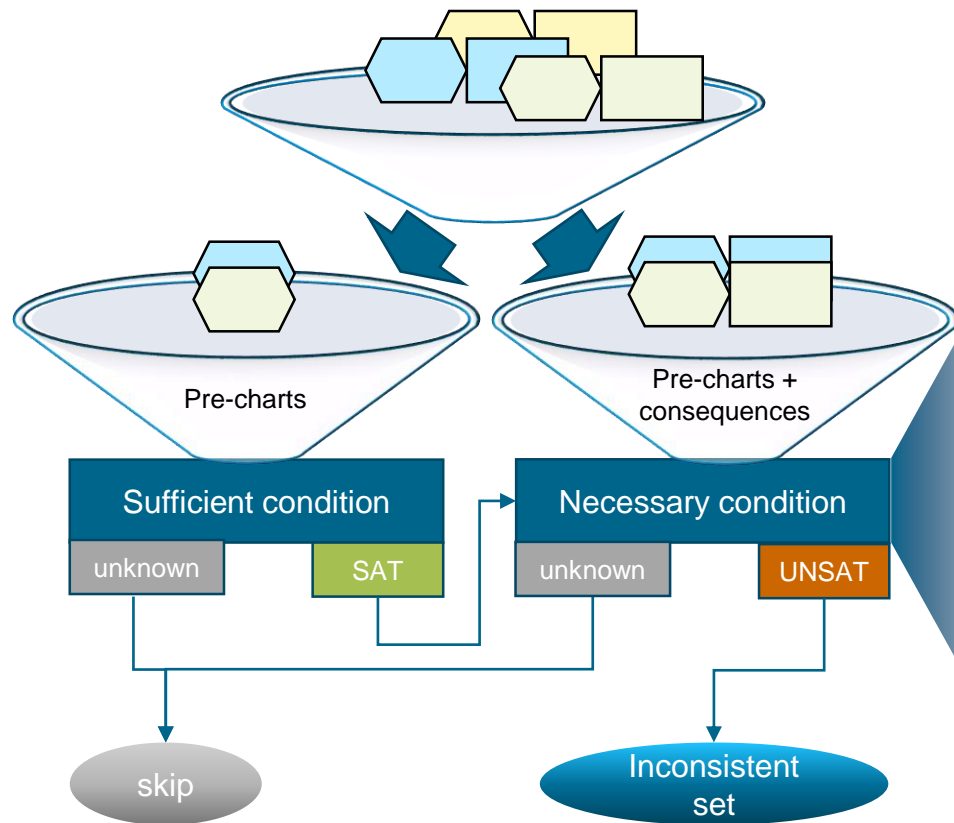
pre-chart   consequence
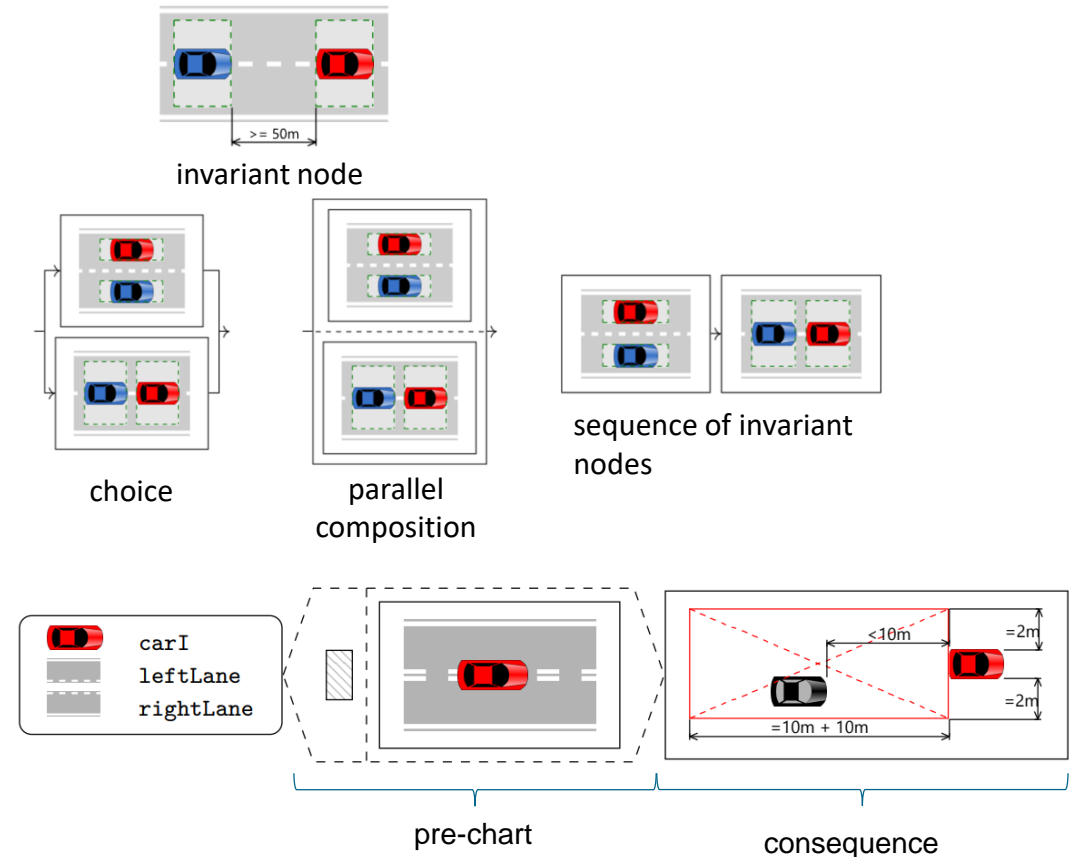
Research Outline

1. How can consistency for traffic sequence charts be defined formally?

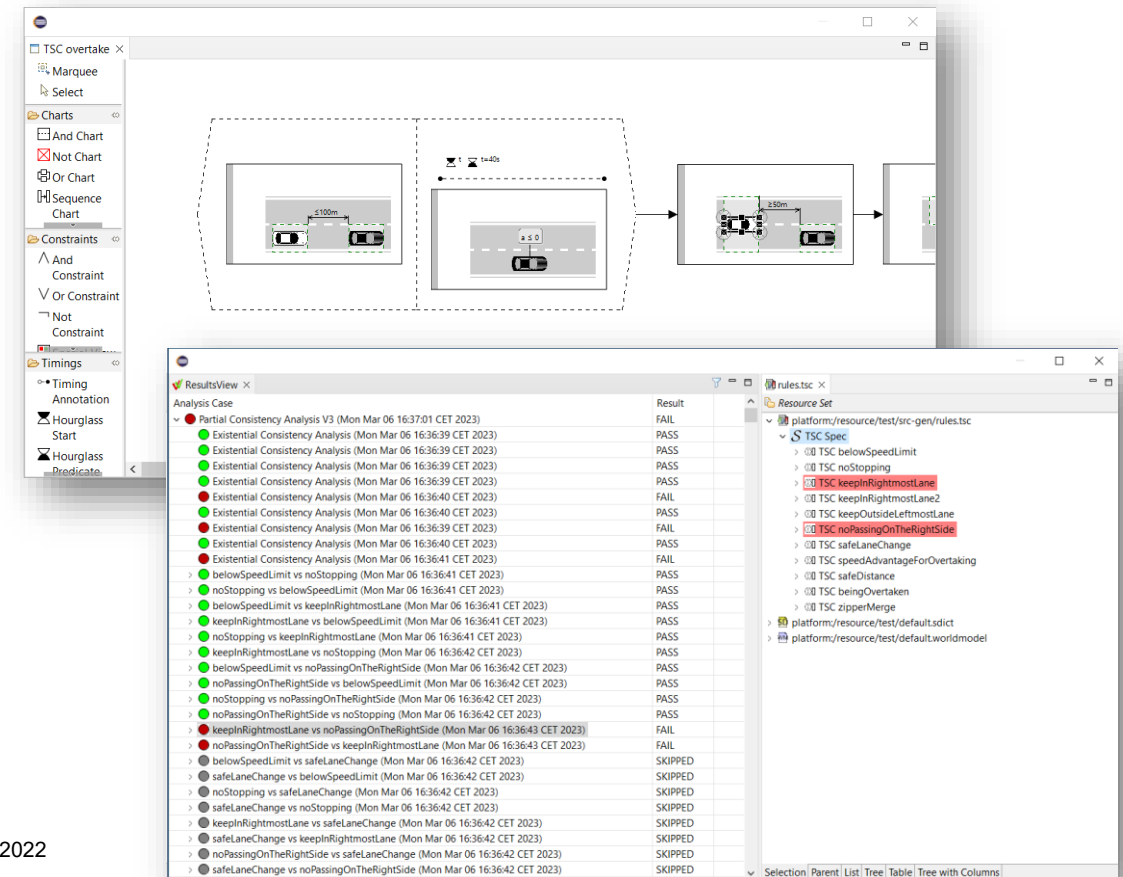2. How can a consistency check be automated?
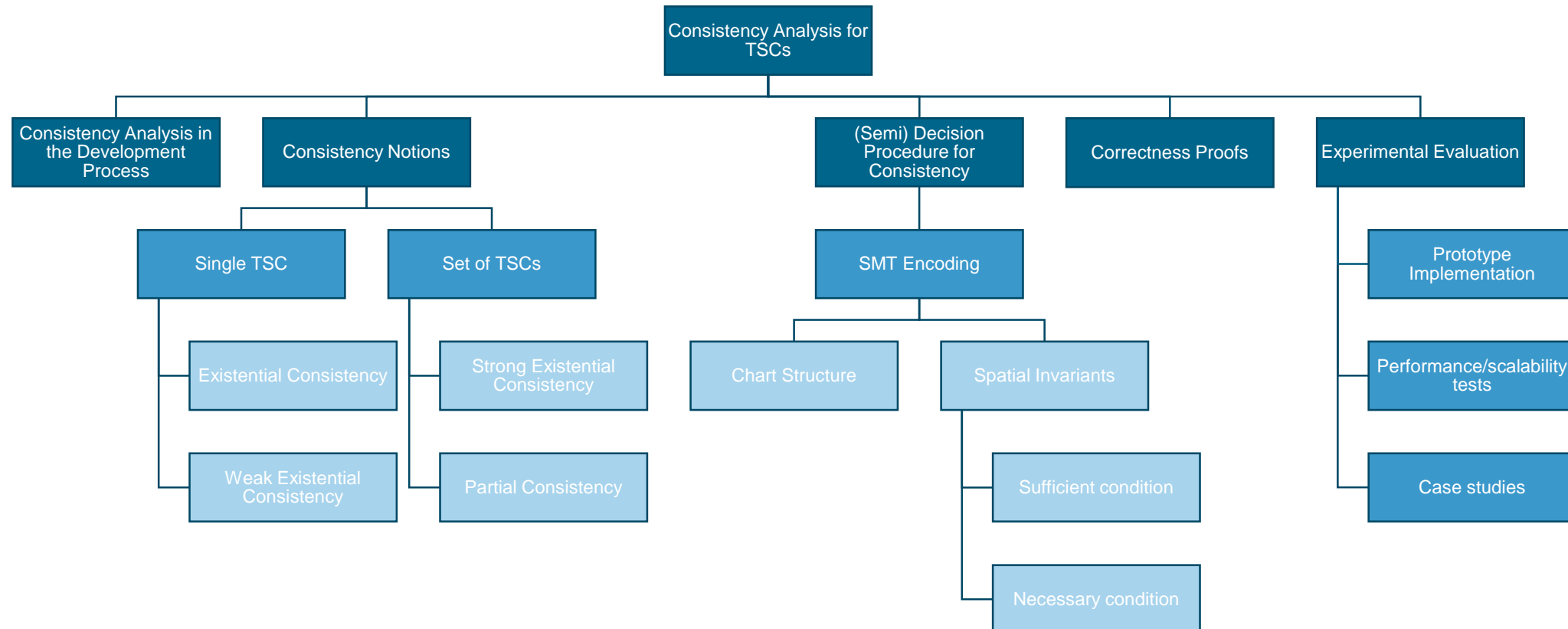
Consistency Analysis Method

Evaluation Results

- Prototype implementation

- Scalability experiments
  - Scalability of SMT encoding
  - Results in Becker et al. 2022

- Case study
  - Based on Esterle et al. 2020
  - 9 TSCs in total
    - Analysis finds 3 pairwise inconsistent TSCs
  - Runtime < 1.5 min
    - subsets > 3 can be pruned

K. Esterle, L. Gressenbuch, and A. Knoll, "Formalizing traffic rules for machine interpretability," IEEE, 2020.
J.S. Becker et al., "Simulation of Abstract Scenarios: Towards Automated Tooling in Criticality Analysis," SATW, 2022