DFG SPP 1183 Organic Computing

Formal Modeling, Safety Analysis, and Verification of Organic Computing Applications

SAVE ORCA

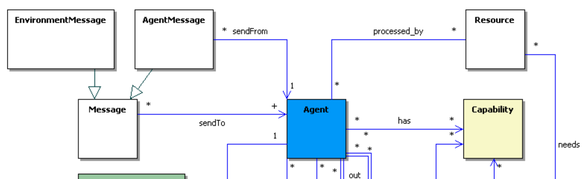
Goal: ➢ Integrated design framework for the development of highly reliable and adaptive Organic Computing applications

Scope: ➢ Highly dynamic systems with self-x properties

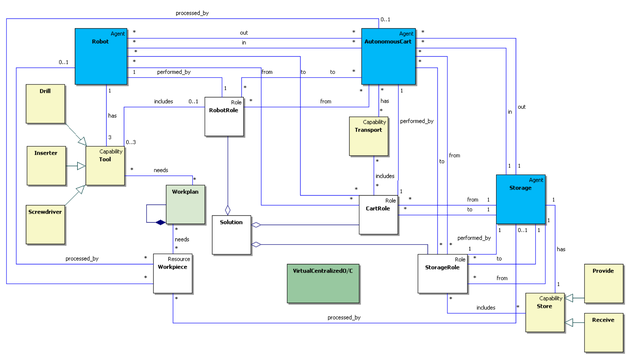
Challenges:
- ➢ Decentralisation
- ➢ Unpredictability vs. Dependability
- ➢ Engineering self-x

Software Engineering

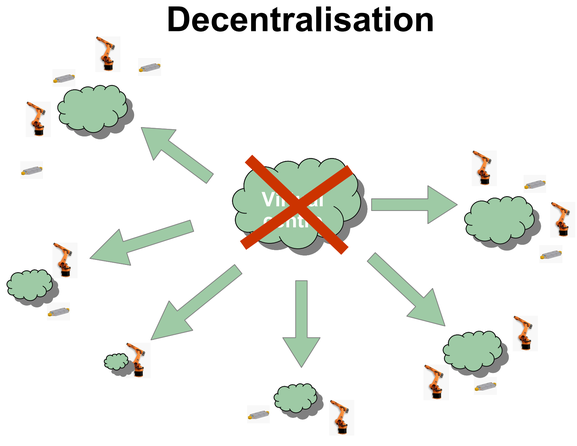
Domain Meta Model



Instantiated Model

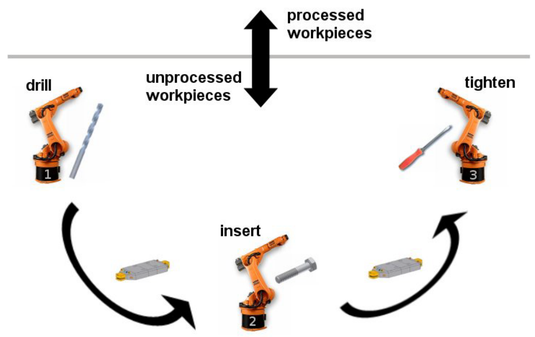


Decentralisation

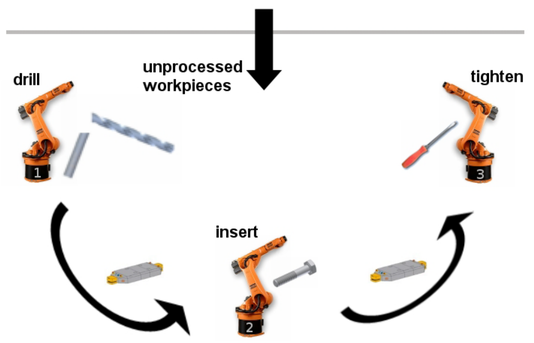


Self-x features

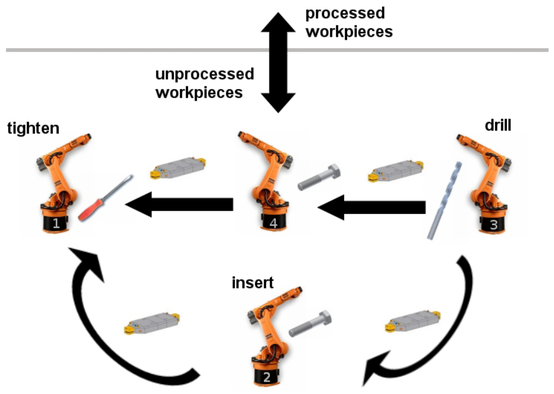
Self-configuration



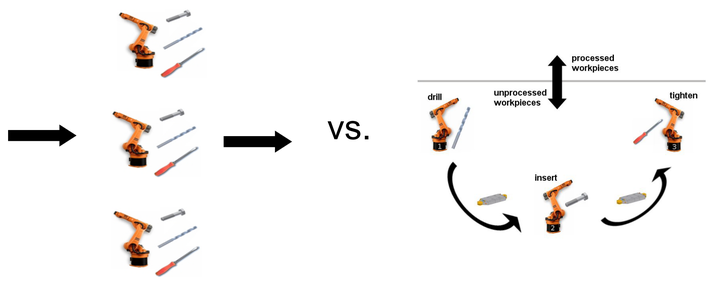
Self-healing



Self-adaptation

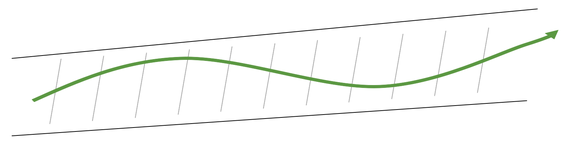


Self-optimisation



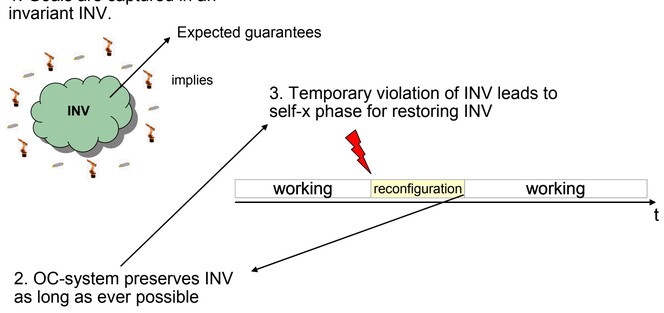
Formal Methods

Behavioural Corridors



Restore Invariant Approach

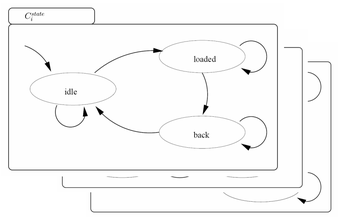
1. Goals are captured in an invariant INV.



4. Failure if restoring of INV is no longer possible

Functional Correctness

→ Interactive verification
→ Model checking



Qualitative Analysis

→ Fault Tree Analysis
→ Adaptive DCCA (ADCCA)

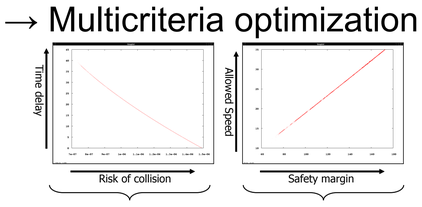
$SYS^{+} \models \mathbf{E}(\neg(\Gamma \setminus \Delta)\ \mathbf{until}\ \mathbf{EG}\ (\neg(\Gamma \setminus \Delta) \wedge H))$

Quantitative Analysis

→ Quantitative ADCCA

$$P \leq \Sigma_{CS \in CSS} \prod_{fm \in CS} P(fm)$$

→ Multicriteria optimization



→ Probabilistic model checking

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