

Context

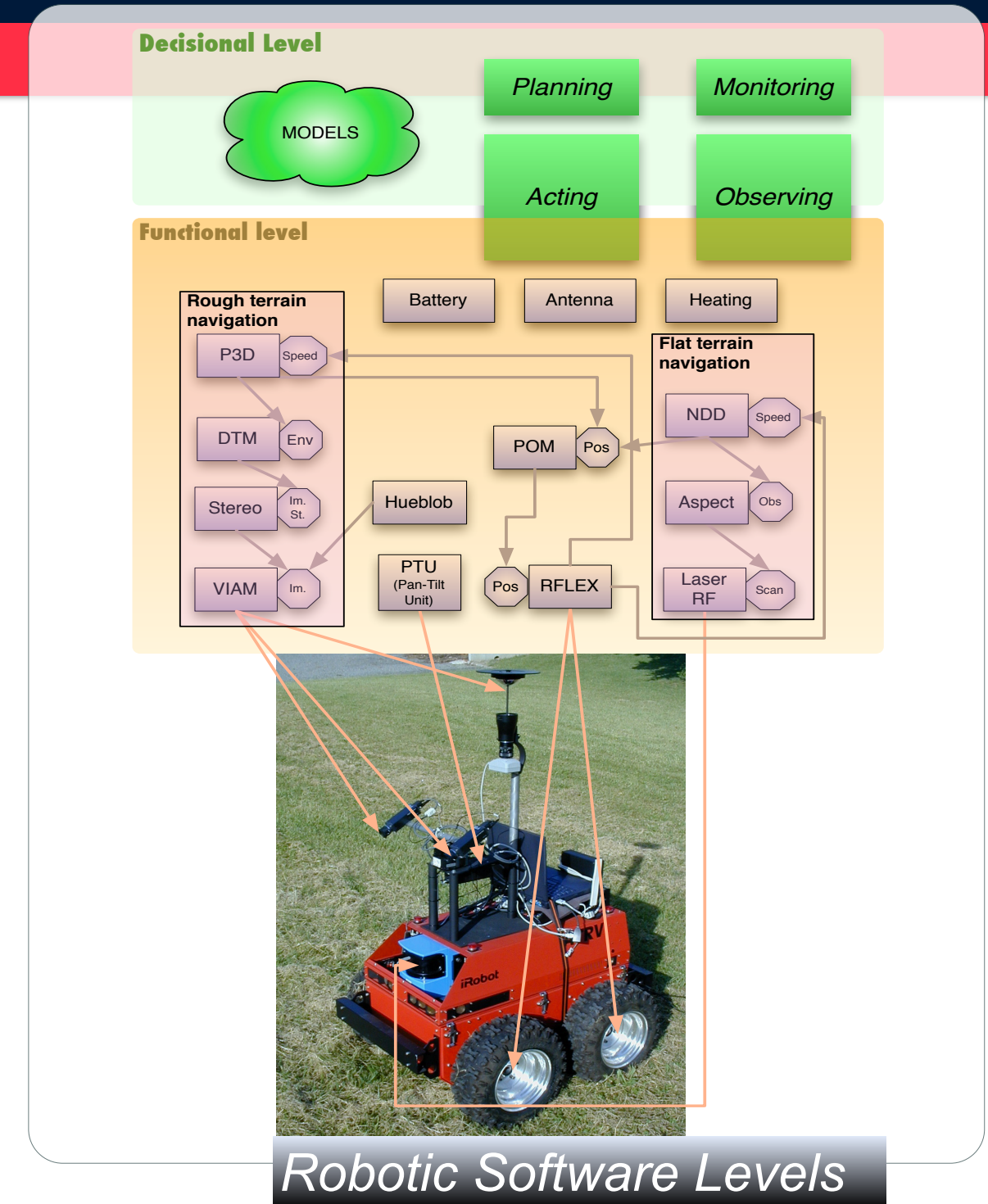
- Increasing involvement of robots in human environments -> Reliability?
- Poor connection between robotic functional software and formal methods
- Non-formal frameworks
- Ad-hoc, non automatic modeling
- Scalability issues

Approach

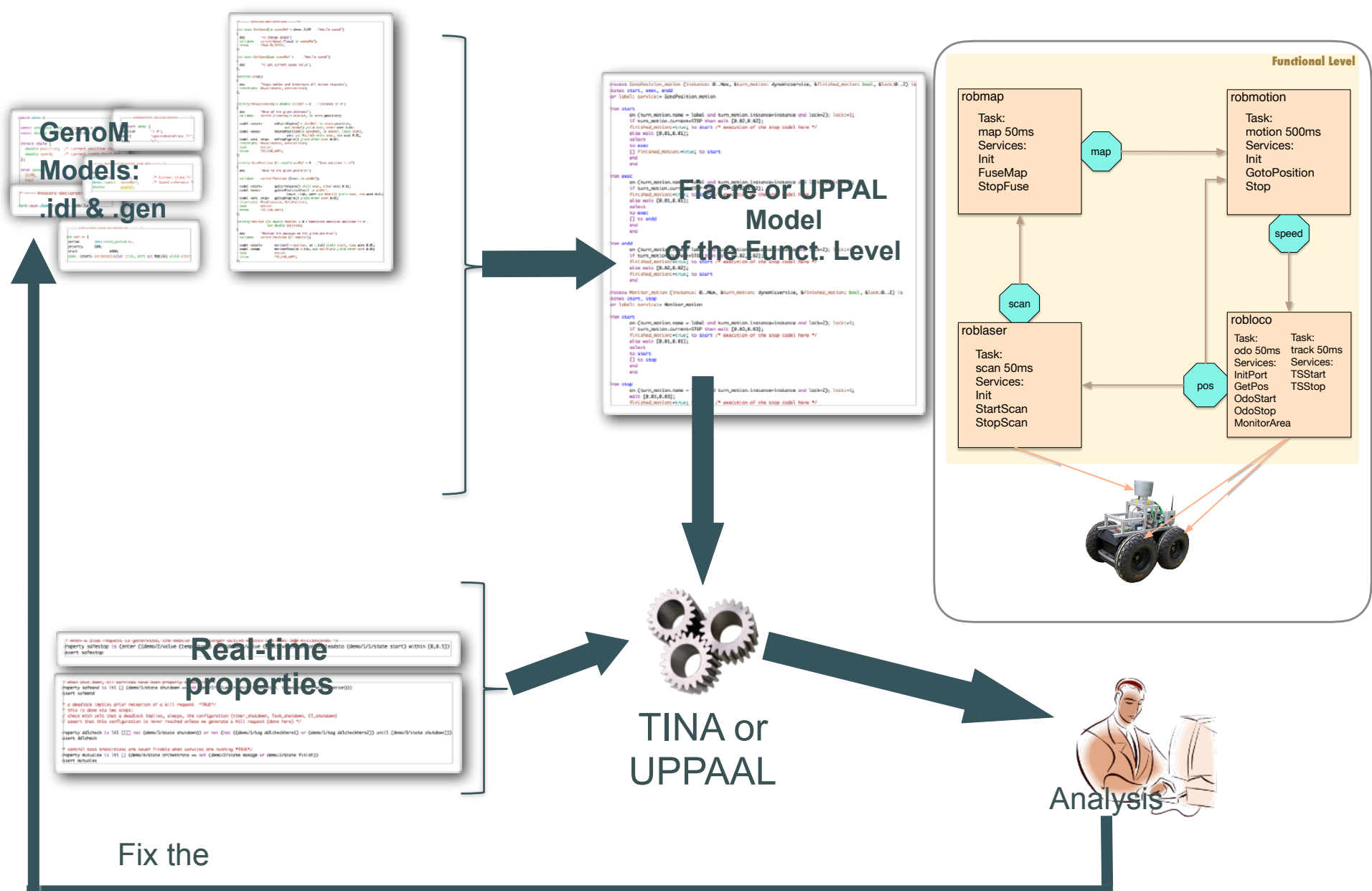
- Automatically bridge **GenoM** with V&V frameworks
- Use the generated models to verify important properties

GenoM to Fiacre/TINA & UPPAAL

- Develop templates GenoM->Fiacre & GenoM->UPPAAL
- Use TINA & UPPAAL to verify:
 - Behavioral properties: e.g. a sent request is eventually served
 - Timed properties: e.g. quantify the time between ports updates



Robotic Software Levels



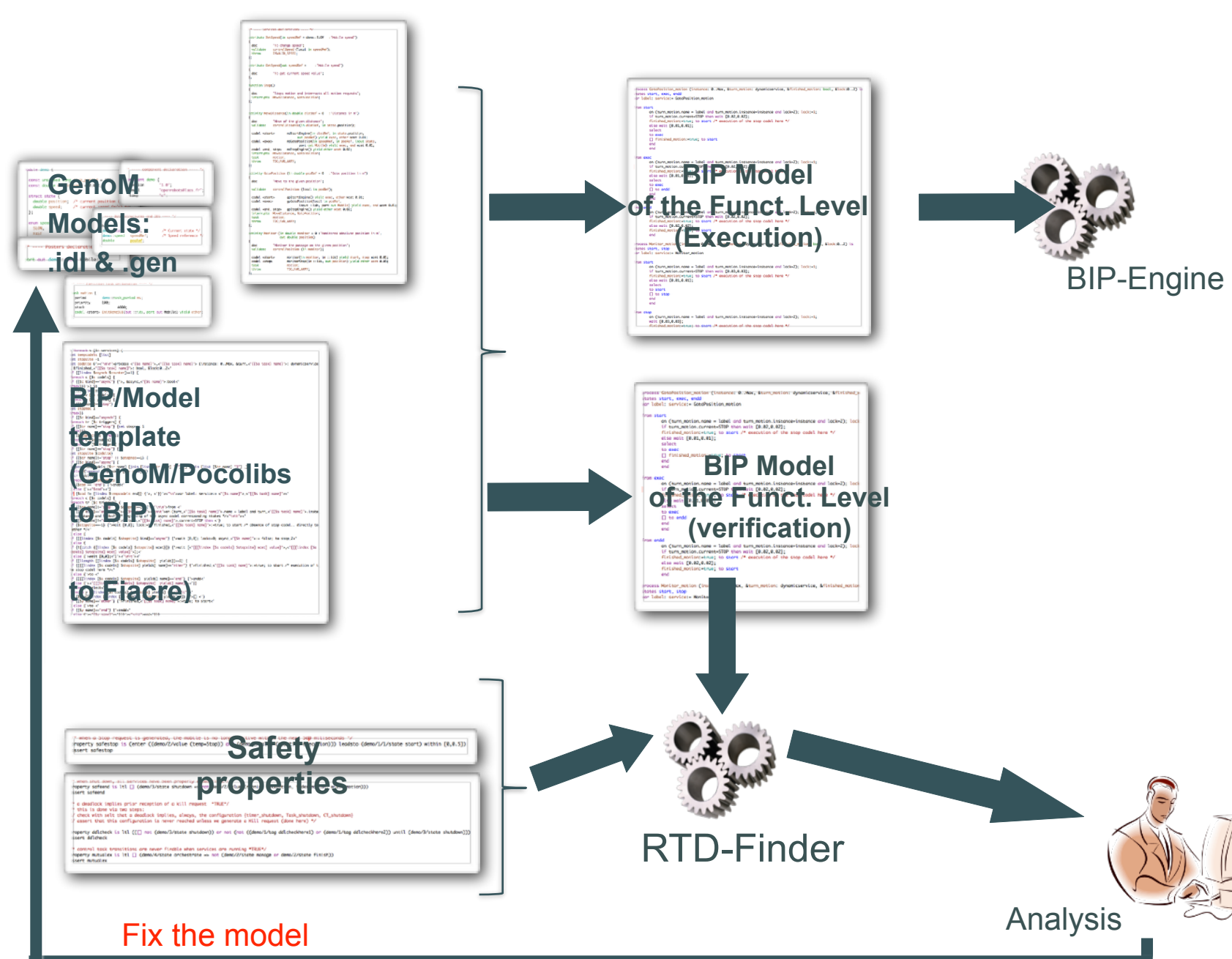
GenoM to Fiacre & UPPAAL Workflow

GenoM to UPPAAL SMC

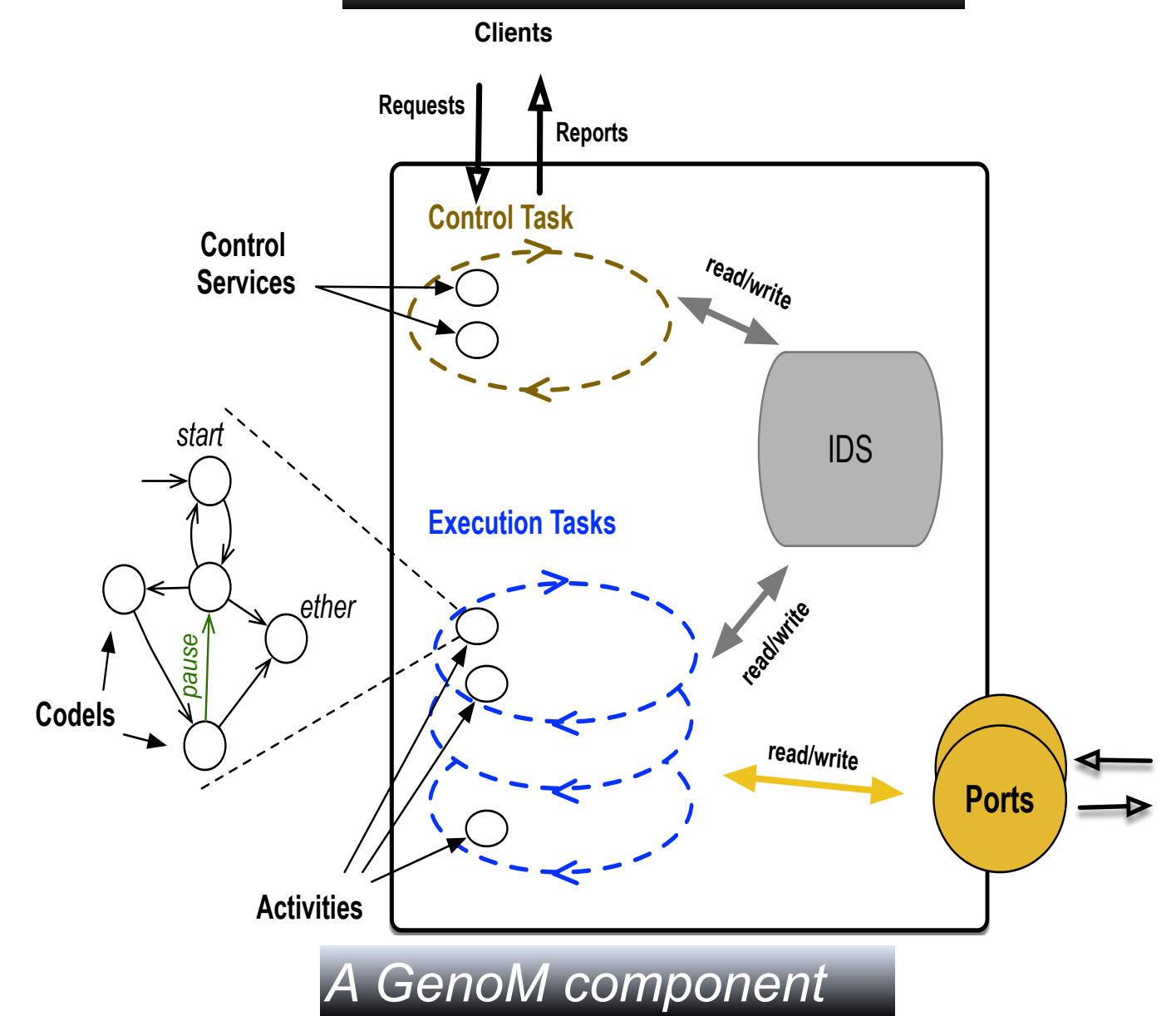
- Develop templates GenoM->UPPAAL-SMC
- Use SMC on models that do not scale to estimate the probability of satisfying important properties

GenoM to BIP

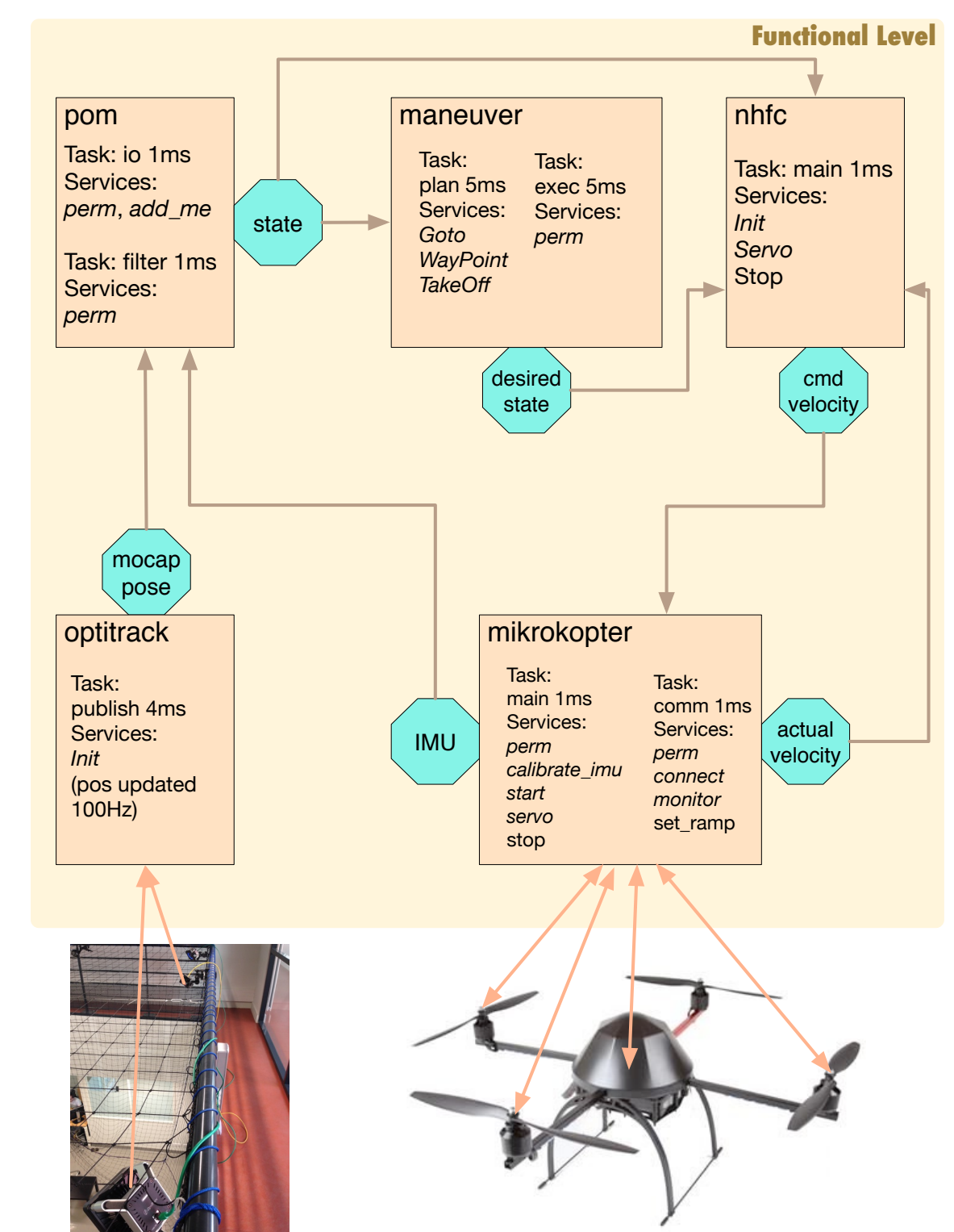
- Develop templates GenoM->BIP
- Run the generated models using the BIP engine and enforce desired properties online



GenoM to BIP Workflow



A GenoM component



Quadcopter navigation: Does not scale
Properties satisfied with 99% pr (SMC)

Papers

- Model-Checking Real-Time Properties on The Functional Layer of Autonomous Systems**
M. Foughali, B. Berthomieu, S. Dal Zilio, F. Ingrand, A. Mallet
At ICFEM 2016, November 14-18, Tokyo, Japan
- Toward a Correct-and-Scalable Verification of Concurrent Robotic Systems: Insights on Formalisms and Tools**
M. Foughali
At IEEE ACSD 2017, June 25-30, Zaragoza, Spain