

# Take the Next Step in Test Automation with MBT

From handcrafting scenarios to systems modeling and test generation

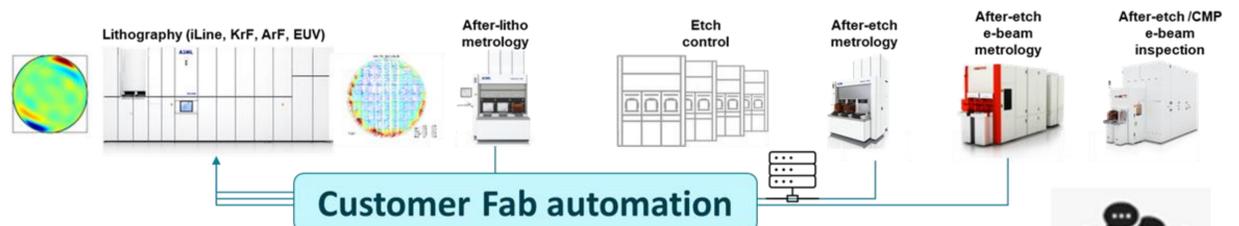
## Overview

From 2023 to 2025, TNO-ESI and ASML collaborated in a **public-private partnership** to develop a **model-based testing (MBT)** methodology aimed at **improving efficiency and effectiveness of system(-of-systems) testing processes** in industry. The method is supported by **open-source tooling** that offers a **collaborative modeling framework**, with capabilities for **simulation** and **automatic generation of test scripts** in various languages such as Cucumber, Robot, JUnit, and GTest. After **successful validation** through several pilots, the methodology and tools are being **matured for adoption** into a new way of working.



### TESTING CHALLENGE

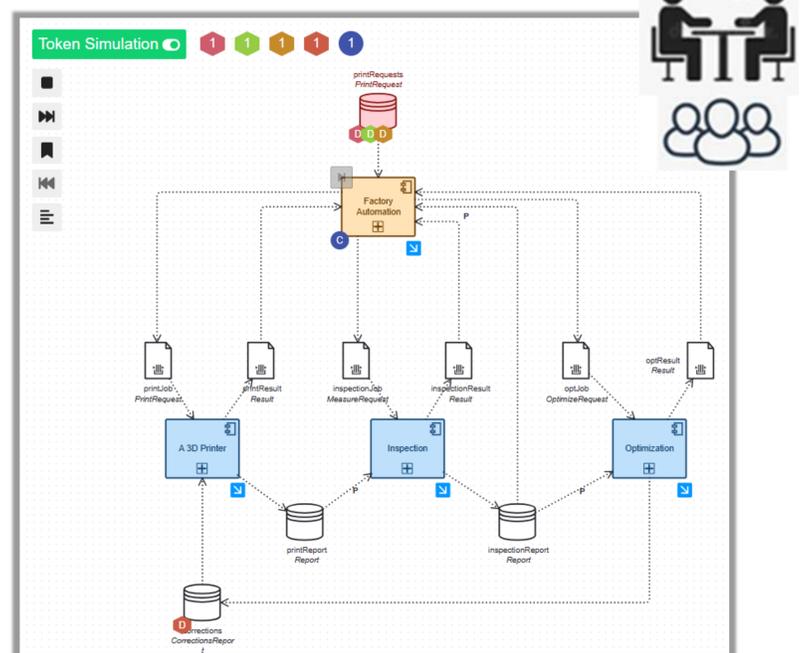
How to enable faster time to market with promised quality and lower costs?



## Collaborative Specification with BPMN4S

### Modeling and Simulation of Systems in Context

- Extends BPMN2.0 with systems modeling concepts
- Intuitive graphical notation with formal semantics
- Automated model validation and verification
- Reference models of systems in context as living documentation
- Featured models supporting product-line variability
- Concrete and symbolic data modeling
- Shared understanding through domain models and simulation
- Scale complexity with hierarchy and refinements



## Automated Generation of Test Scripts

### From BPMN4S specifications

- Requirements as symbolic assertions
- System configurations as model parameters
- Product risks as test purposes
- Test generation for all relevant system configurations
- Insights into specification coverage
- Replay test scenarios in simulation
- Customize generation of test scripts in a variety of languages



## Ongoing Research

### Focus testing efforts where it matters

Reason about product risks and priorities  
Exploit knowledge in usage profiles, test execution logs and defects

### Further enhance collaboration

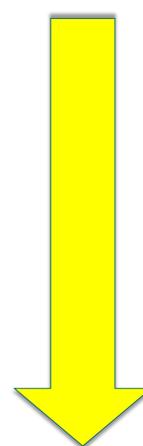
Version management, reviewing, model comparisons

### Faster root-cause analysis

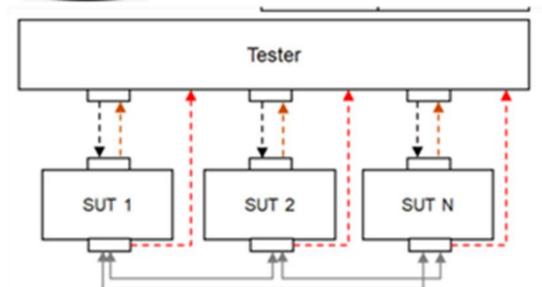
Model-assisted root-cause analysis of failing tests  
Coverage analysis and test reporting

### Higher coverage with online model-based testing

On-the-fly test generation and execution  
More representative testing of real-world dynamics



## Offline MBT



Partners:



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