

RobMoSys: Better Models, Tools and Software for Robotic Systems

- *Composable Models and Software for Robotics Systems*
- *Towards an EU Digital Industrial Platform for Robotics*

Tutorial at ACM / IEEE 21st Int. Conf. On Model Driven Engineering Languages and Systems (MODELS)

<https://robmosys.eu>
<https://discourse.robmosys.eu>
<https://robmosys.eu/wiki>



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 732410.

Schedule

09:00 – 09:20 (15+5min)

[Introduction to RobMoSys and how to get access into RobMoSys](#)

Christian Schlegel

09:20 – 09:50 (20+10min)

[Modeling Principles and Modeling Foundations in RobMoSys](#)

Christian Schlegel

09:50 – 10:30 (40min)

[Eclipse-Based RobMoSys Tooling: SmartMDSD Toolchain Hands-On Session](#)

Alex Lotz, Dennis Stampfer

10:30 – 11:00

Coffee Break

11:00 – 11:30 (20+10min)

[Eclipse-Based RobMoSys Tooling: Papyrus4Robotics and Tooling Interoperability](#)

Huascar Espinoza

11:30 – 12:00 (20+10min)

[Modelling Motion, Perception and World Model Stacks](#)

Herman Bruyninckx

12:00 – 12:30 (30min)

[Structured dialog and discussion](#)

Christian Schlegel, Herman Bruyninckx, all



To get a quick overview...

- where do you come from?
 - industry?
 - academia?
 - ...?
- what is your application domain?
 - robotics?
 - automotive?
 - IoT / I4.0?
 - no specific one
 - ...?
- what is your expertise?
 - foundations of (meta-)modeling, model processing, ...?
 - model-driven tools, code generation, ...?
 - software engineering, code excellence, ...?
 - ...?
- what is your link to RobMoSys?
 - already involved
 - heard about it or know it and want to know more
 - do not know anything yet but tutorial sounds interesting

What is this tutorial about?

The EU H2020 RobMoSys Project aims to coordinate the whole robotics community's best and consorted effort to realize a step change towards a European ecosystem for open and industry-grade model-driven software development for robotics.

This tutorial introduces the principles and model-driven approaches for robotics envisioned in RobMoSys. It explains by the means of an Eclipse-based tooling how the modeling principles become accessible to different roles like component suppliers, system builders, experts for task plots, and others and how models are being transformed into composable software artefacts.

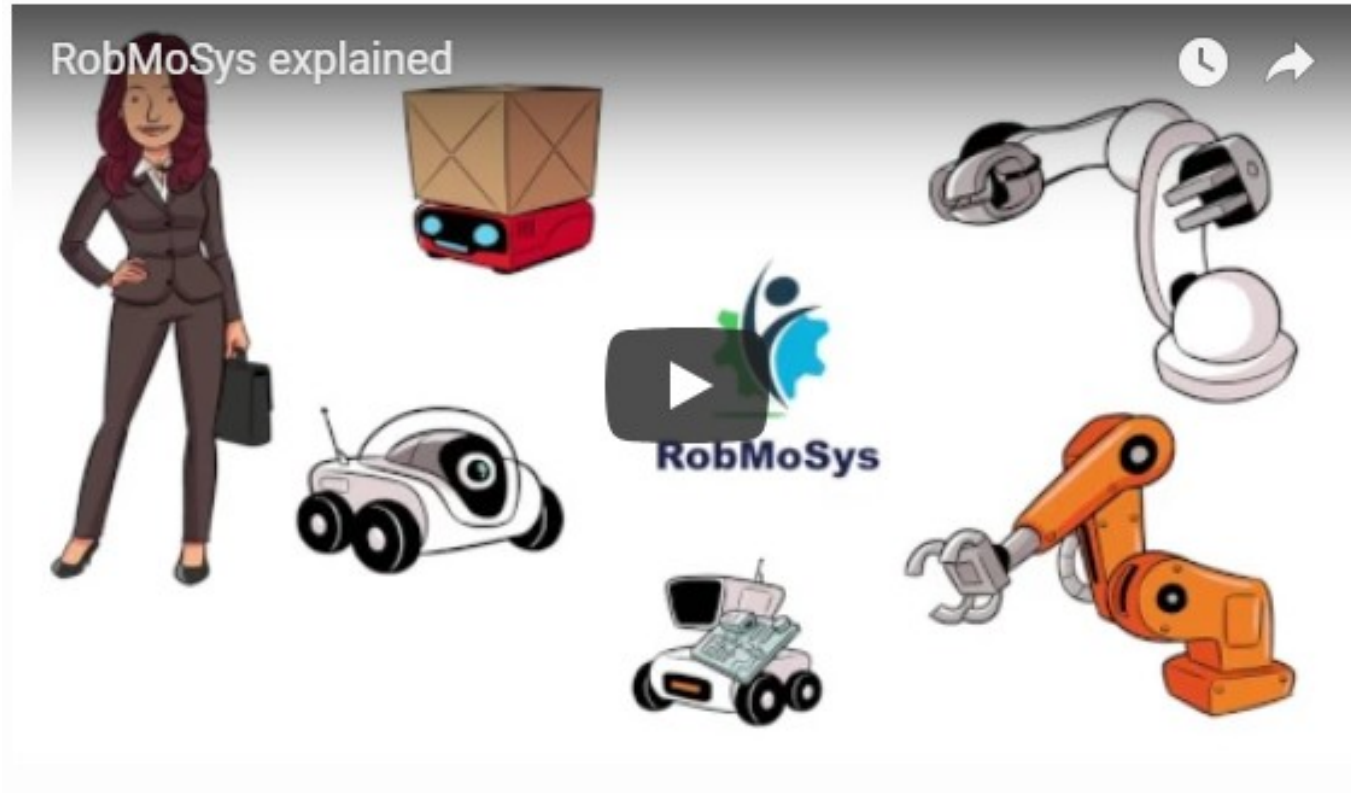
A major goal of this tutorial is to give RobMoSys exposition in the “generic” MDE community and attract more researchers towards robotics problems. This is also about explicating the special needs of robotics and discussing these with the MDE community.

RobMoSys is not just another project...

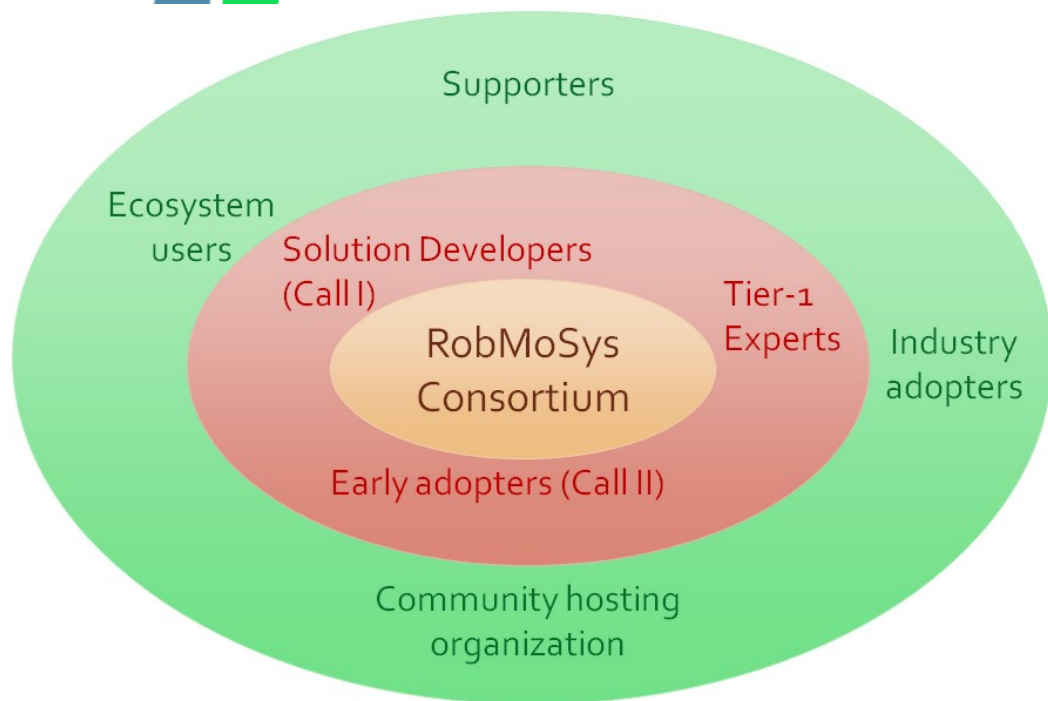
- RobMoSys as community **moderator**
- **Join forces** to address the most challenging questions together
- Be **most inclusive**
- “Build a positive **atmosphere** and team spirit in the **community**”
- Release cycles and accessibility: **transparency has priority** over completeness (shown e.g. via our wiki and our discourse platform)



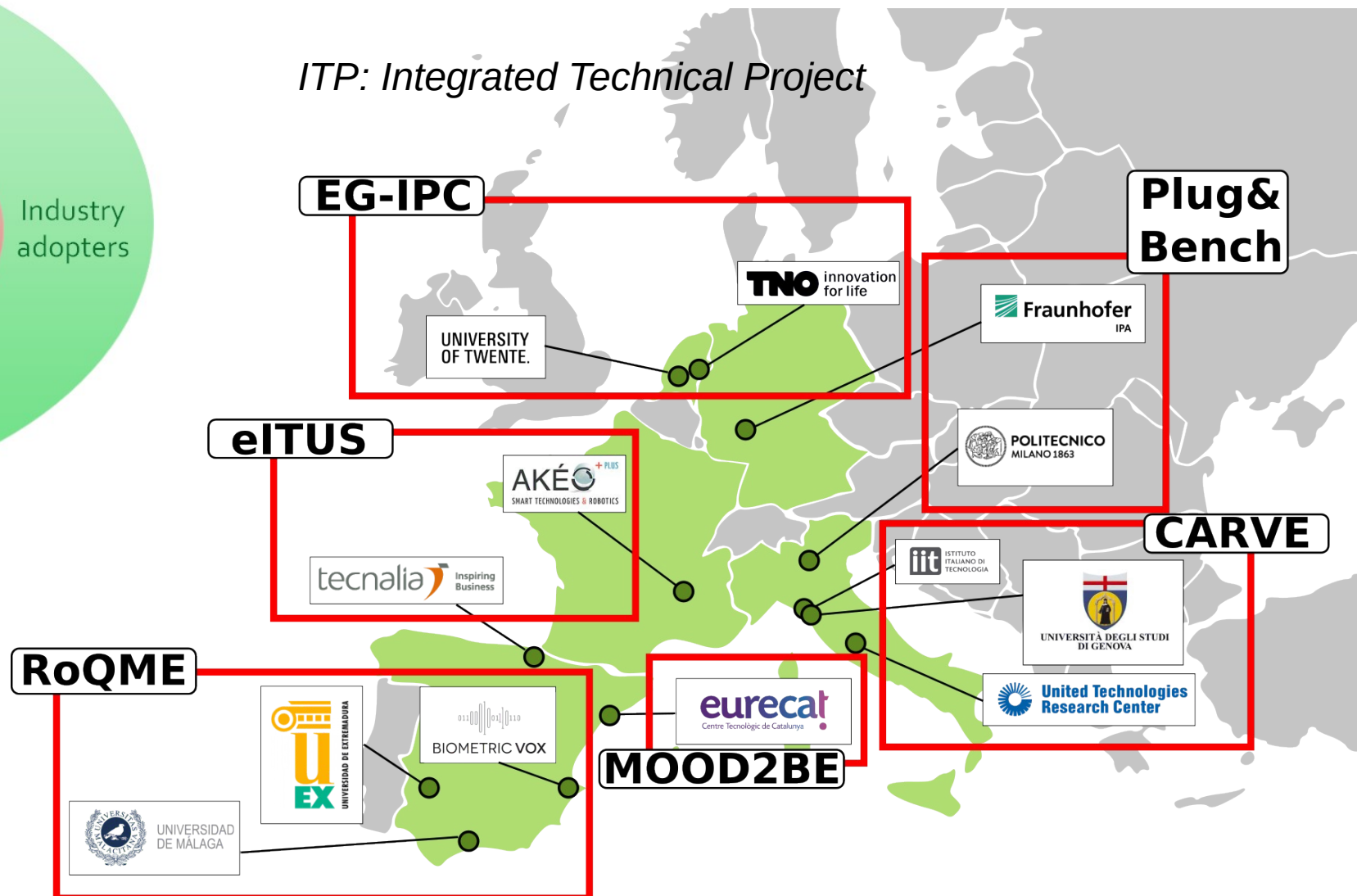
RobMoSys in a minute...



<https://youtu.be/8GUSDtNoGRM>



ITP: Integrated Technical Project



Enable success stories and finally produce success stories

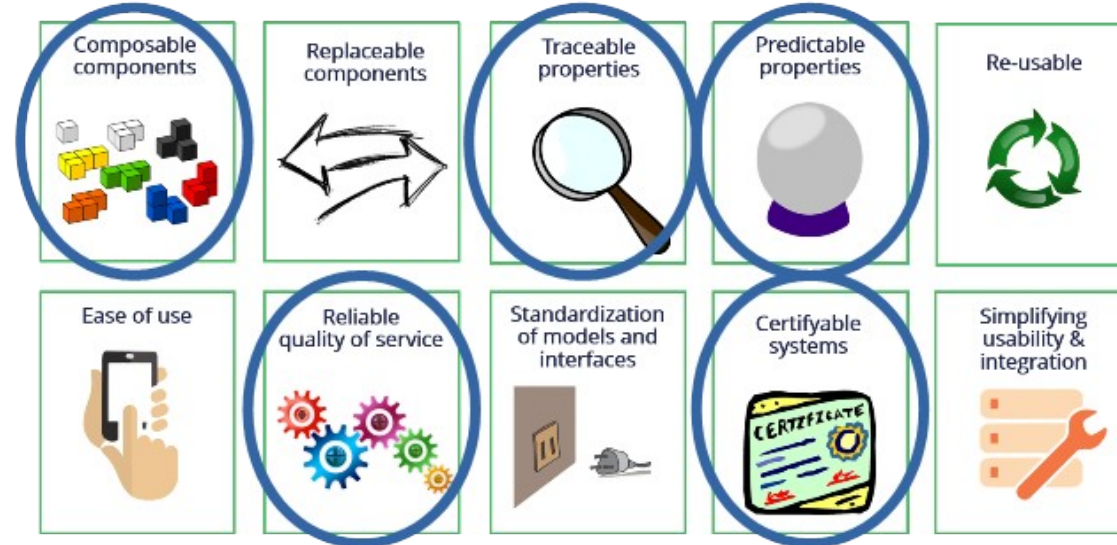
Technical User Stories and Benefits for Robotics and Beyond



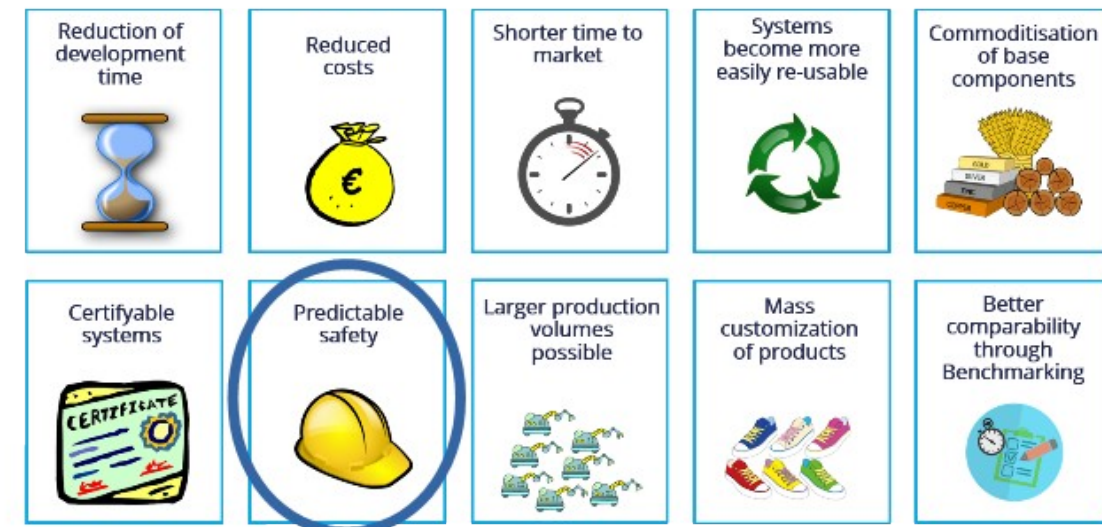
RobMoSys

- Composable commodities for robot navigation with traceable and assured properties
- Description of building blocks via model-based data sheets
- Replacement of components and again matching all the attached constraints (requirements, system, building blocks)
- Composition of components and managing all the dependencies, e.g. mounting a camera on a manipulator
- Quality-of-service and management of resource shares
- Determinism when you change the processing platform, e.g. keep cause-effect-chains valid
- Free from hidden interference when you add further components to a system
- Management of non-functional properties and tool-supported trade-off
- Manage gap between design time assumptions and run time situation via e.g. sanity checks
- System analysis tools for what-if questions, trade-off analysis, etc.
- Task modeling for task-oriented robot programming
- Safety and shift from fail-safe to safe-operational
(not *"the following things cannot happen"* but *"the system only behaves like that"*)
- How to configure coordinate systems?
- How to inject schedules and manage budgets?
- How to partition synchronous islands (local sync, global async)?
- How to present composable computation models (budget, resource shares) to robotics experts?
- How do uncertainties propagate through chains of computation, motion, etc.?
- How to always reach a safe state (mode transitions)?
- ...

Technical Perspective



Commercial Perspective



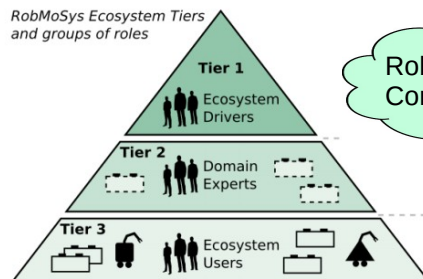


RobMoSys

RobMoSys Roadmap – The Big Picture

- Meta-Models
- Models
- Tooling
- Building Blocks
- Pilot Applications

RobMoSys Ecosystem Tiers and groups of roles

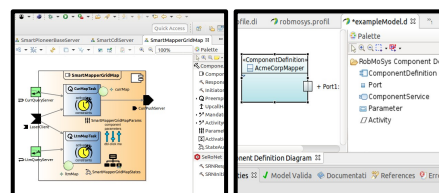


today

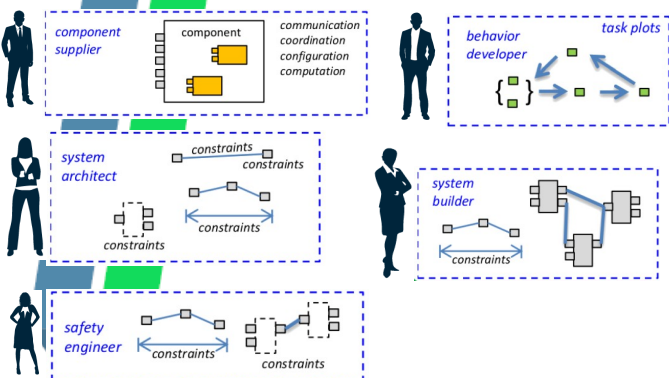
*well perceived, accepted, first adoptions, ...
first part of story successful*

*enabler for success stories which now
need to become a tangible real thing*

- populate the ecosystem with content
- make technical user stories a reality
- show benefits for robotics and beyond
- make step change tangible
- achieve take-up and trust



SmartMDS Toolchain Papyrus4Robotics



Open Call 1
6 projects running
03/2018 – 02/2019

Open Call 2 Open
01.02.19 – 30.04.19

Open Call 2 Projects Running

sustainable

2017

2018

2019

2020

EU Digital Industrial Platform for Robotics



Become Part of RobMoSys...

- **RobMoSys Web Page => <https://www.robmosys.eu>**
 - access point which guides you to more information according to your role and interest
 - role-specific entry points will be improved with respect to Open Call 2
- **Subscribe to Newsletter**
 - easiest way to follow at a high level of abstraction
 - be kept informed about major milestones and activities
- **RobMoSys Wiki => <https://www.robmosys.eu/wiki>**
 - first reference for in-depth information about the approach etc.
 - additional content to reflect the current state of the overall big picture and the according available baseline follows during the course of the preparation of the Open Call 2
 - additional content will also make it easier to find role specific / interest specific information
- **Discourse Platform => <https://discourse.robmosys.eu>**
 - the community platform to talk about models, tools, software for robotics, just get involved
- **Open Call 2**
 - cascade funding for ITPs (integrated technical projects)
 - 01.02.2019 opening of the RobMoSys Open Call 2, open for 3 months until 30.04.2019
 - after proposal review, selection, contracting: start of selected ITPs autumn 2019
 - Brokerage day 13.02.2019, Munich City Center
- **Try it out**
 - tooling, building blocks, simulation, real robots, ..