Introduction to RobMoSys: Composable Models & Software for Robotics Systems

Ansgar Radermacher, Huáscar Espinoza

CEA (Project Coordinator)

RoMoSys in a Nutshell

- **RobMoSys**: Composable Models and Software for Robotic Systems
- In response to **H2020** Project – ICT-26-TOPIC : System abilities, development and pilot installations
- SubTopic c: **Innovation Action** on systems development technology.
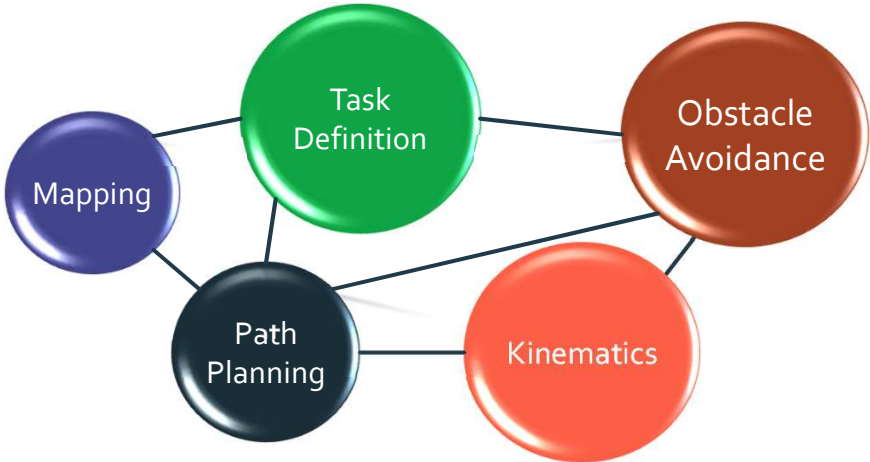
  The "**System development tools**" sub-call

- **Start Date 01/01/2017**
- **End Date 31/12/2020**
- **Duration 4 Years**
- **Budget 8M,** thereof **4 M for Open-Calls**
- **Web Site https://robmosys.eu**

Complexity in SW Robotics

RobMoSys

Application

Algorithms

- Mapping
- Task Definition
- Obstacle Avoidance
- Path Planning
- Kinematics

Stakeholders

- Design
- Quality Management
- Component Release
- Implementation
- Safety Assessment
- Validation & Verification

Platforms

- Middleware
- OS
- Actuators, Sensors, Computing
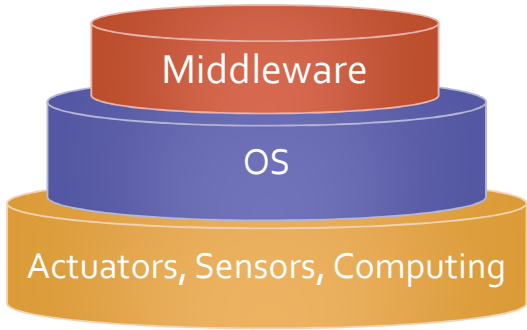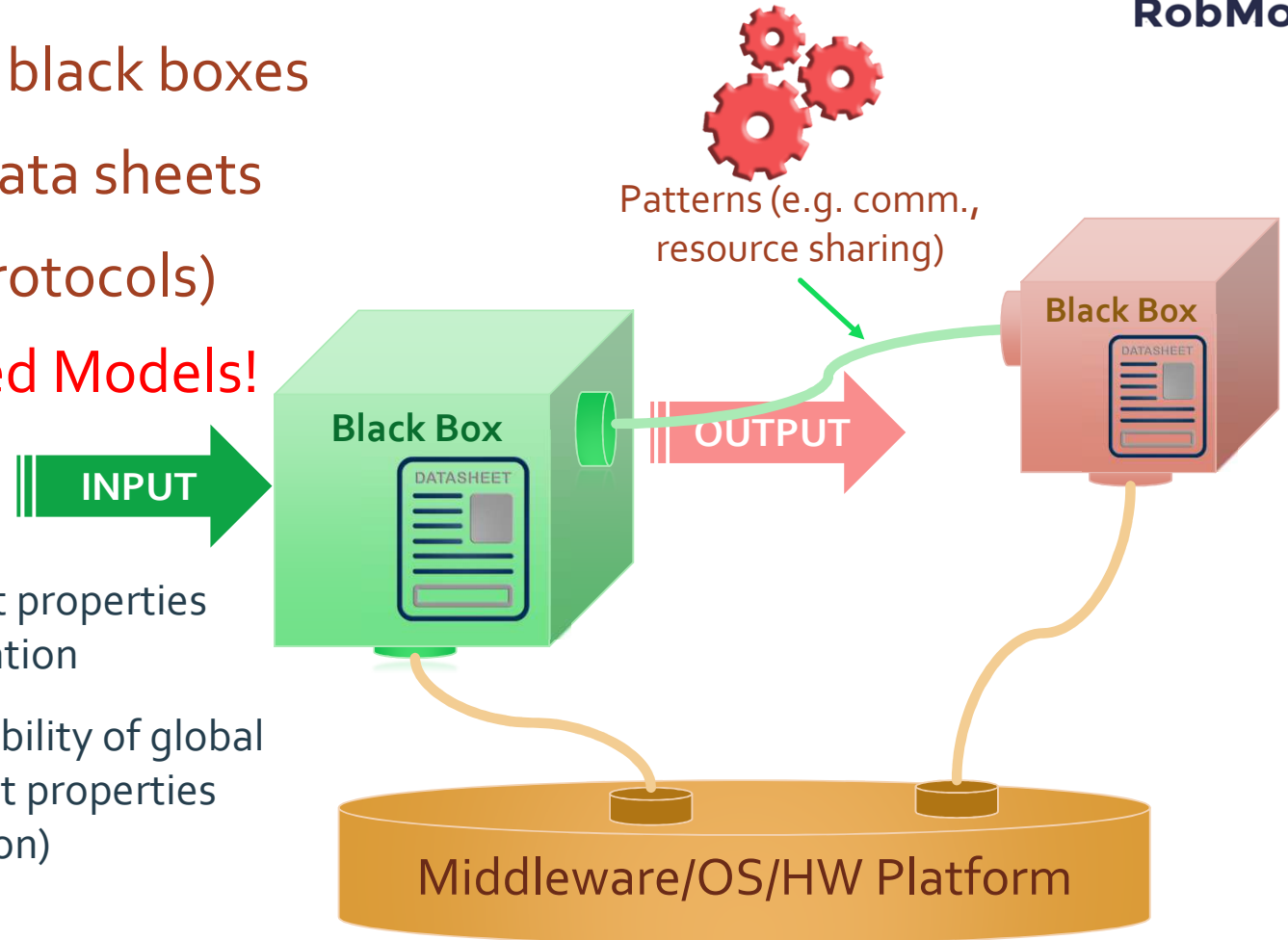
RobMoSys Composition Principles

1. <u>Components</u> as black boxes

2. <u>Interfaces</u> like data sheets

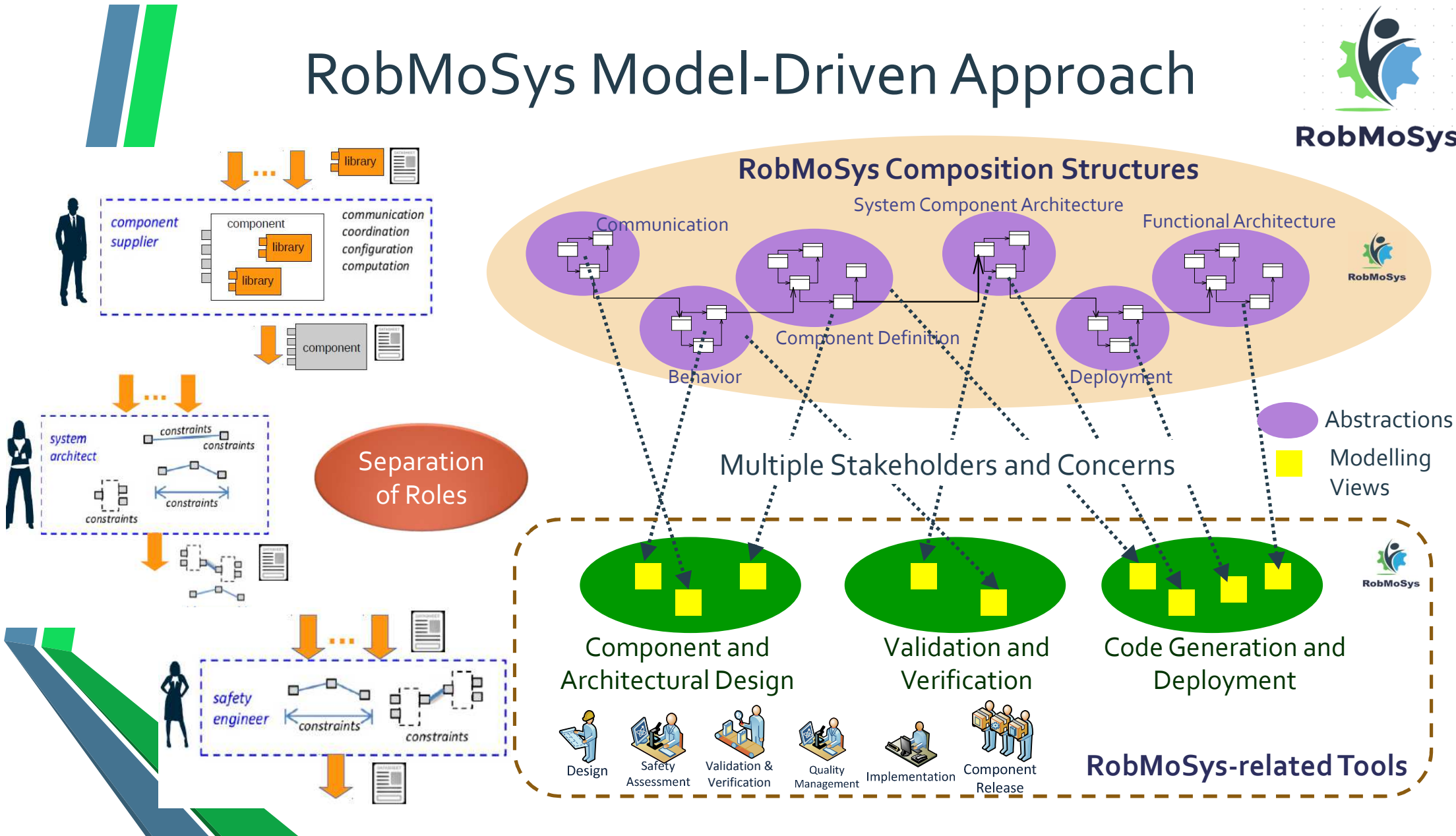3. <u>Patterns</u> (e.g. protocols)

Need of Standardised Models!

Composability: component properties preservation across integration

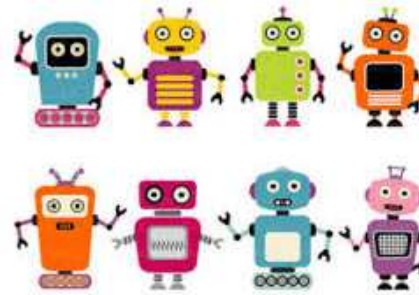*Compositionality*: Predictability of global properties from component properties (correctness-by-construction)

Patterns (e.g. comm., resource sharing)

RobMoSys

Black Box

Black Box
DATASHEET

INPUT

OUTPUT

DATASHEET

Middleware/OS/HW Platform

RobMoSys Model-Driven Approach

RobMoSys Composition Structures

- Communication
- System Component Architecture
- Functional Architecture
- Component Definition
- Behavior
- Deployment

component supplier

communication
coordination
configuration
computation

library

component

system architect

constraints
constraints
constraints
constraints

Separation of Roles

safety engineer

constraints
constraints

Multiple Stakeholders and Concerns

Abstractions

Modelling Views

Component and Architectural Design

Validation and Verification

Code Generation and Deployment

Design
Safety Assessment
Validation & Verification
Quality Management
Implementation
Component Release

RobMoSys-related Tools

RobMoSys Roadmap

Better Models, Software & Tools

Pilots & Success Stories
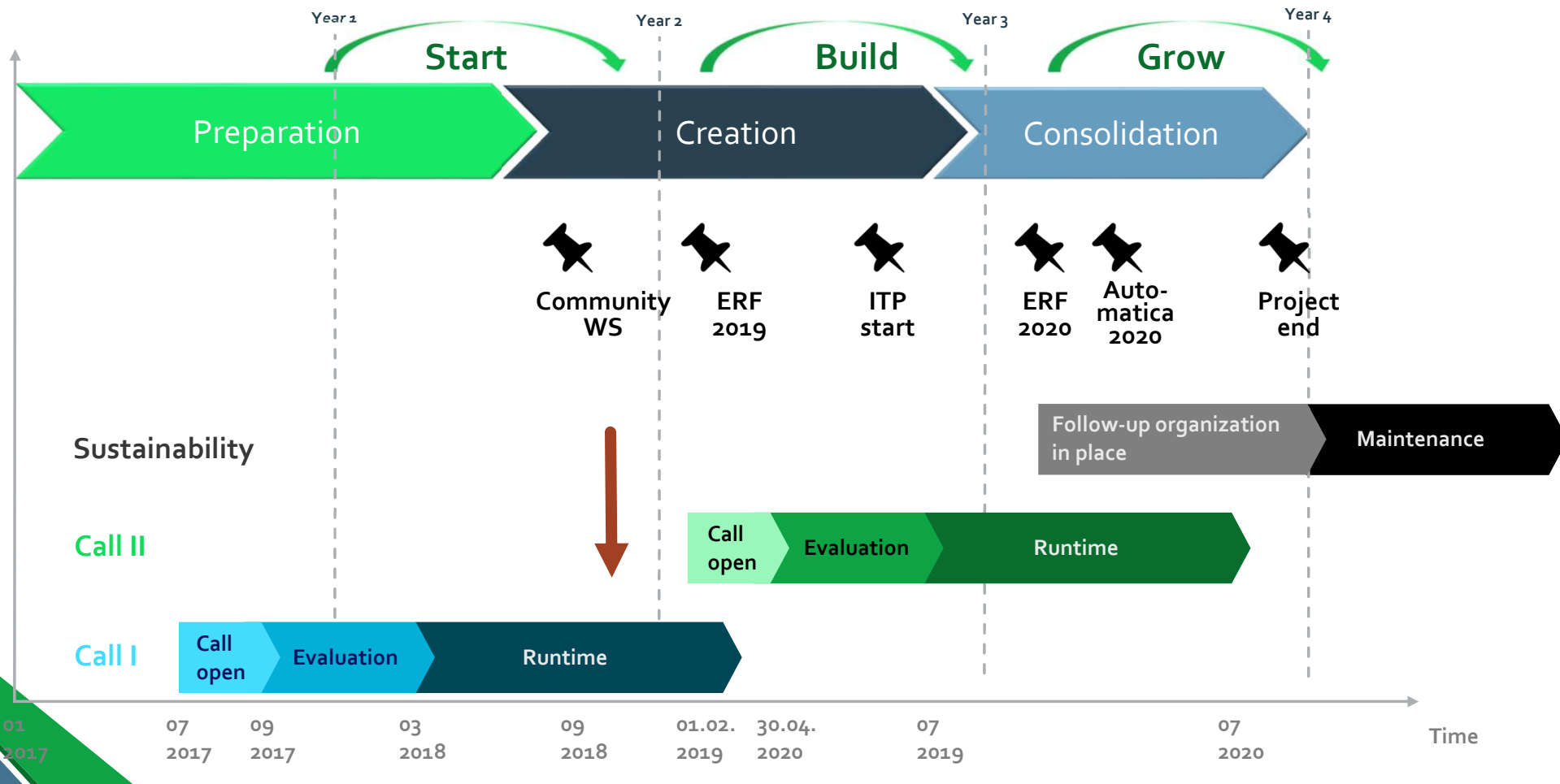
RobMoSys Ecosystem

- **Core** Version of the RobMoSys **Platform**
- **First Call** for **ITPs** (Integrated Technical Projects)

- RobMoSys **Pilot** Skeletons
- **Second Call** for ITPs
- **Success Stories** and Training

- **Full** RobMoSys **Platform**
- RobMoSys **Community** Consolidation
- Business Models and **Exploitation**

Community Building Roadmap Phases

RobMoSys

	Year 1			Year 2			Year 3			Year 4

Start → **Build** → **Grow** →

Preparation	Creation	Consolidation

📌 Community WS
📌 ERF 2019
📌 ITP start
📌 ERF 2020
📌 Auto-matica 2020
📌 Project end

Sustainability

Follow-up organization in place | Maintenance

Call II

Call open | Evaluation | Runtime

Call I

Call open | Evaluation | Runtime

01 2017	07 2017	09 2017	03 2018	09 2018	01.02. 2019	30.04. 2020	07 2019	07 2020	Time

First Open Call
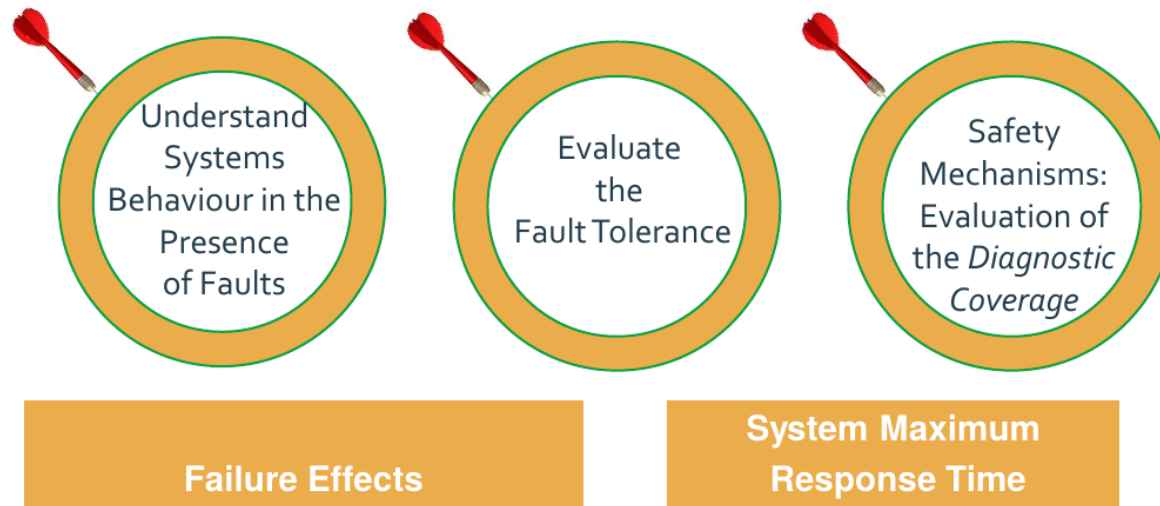
RobMoSys

Better Models, Software & Tools

- **Funding Budget:** 1,36 Million EUR
- **Period:** Mar 2018 – Feb 2019

- **Six Selected ITPs:** focused on behaviour, communication, control, QoS, safety, benchmarking
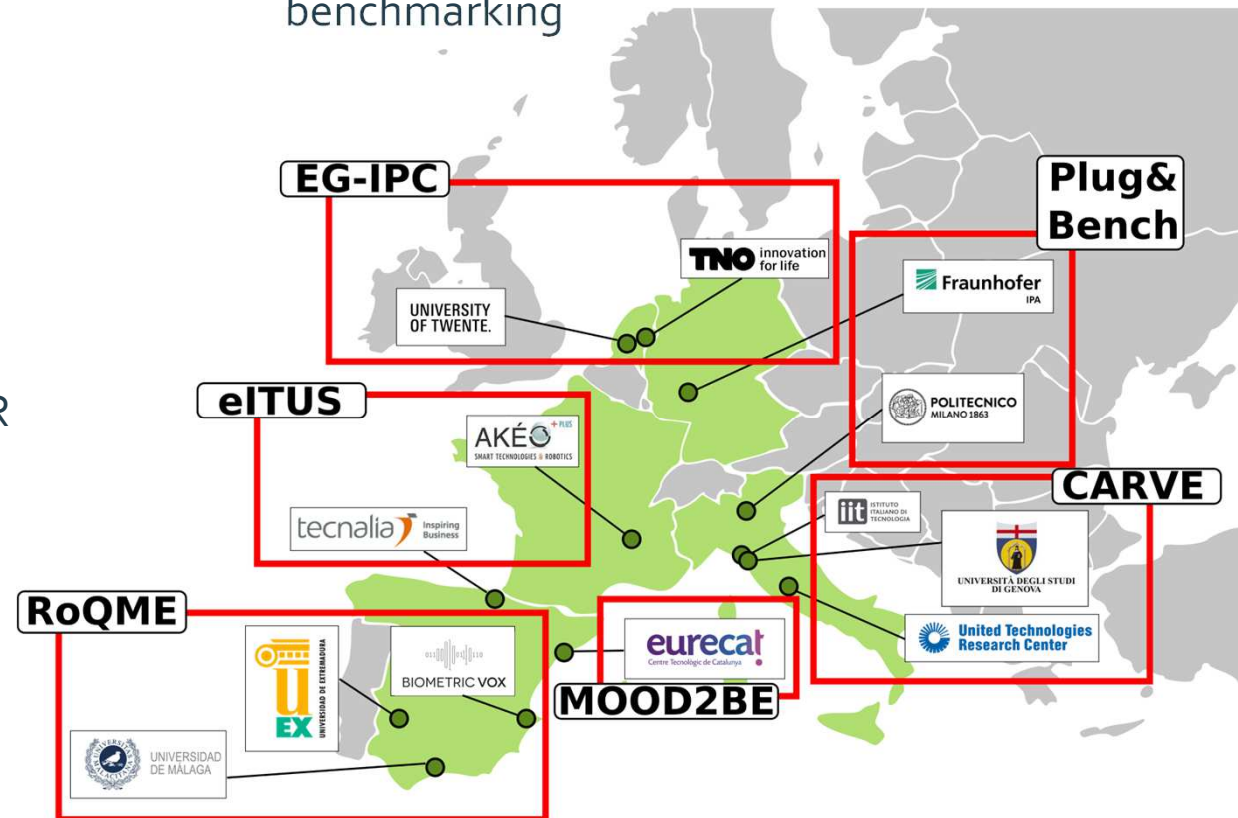
Example of an ITP

RobMoSys

- **eITUS Experimental Infrastructure Towards Ubiquitously Safe Robotic Systems using RobMoSys**

- Akeo (SME) and Tecnalia (research institute)

- *AIM: create an experimental infrastructure (models, software and tools) that assures system safety both at design time, using analysis and simulation-based techniques, and at run-time, using safety monitoring algorithms.*


Understand Systems Behaviour in the Presence of Faults

Evaluate the Fault Tolerance

Safety Mechanisms: Evaluation of the *Diagnostic Coverage*

Failure Effects

System Maximum Response Time

Selection criteria (from Call 1)

1. Expected impact	Weight: 35%
- Size of the potential users group(s) - Potential extension of the RobMoSys ecosystem coverage - Accessibility of the results, preferring open source licensing that enables composability similar to proven platform projects as Eclipse	Score: ? / 10 *(Threshold: 6/10)*
2. Technical excellence	**Weight: 35%**
- Compliance with the RobMoSys meta-models and methodology - The excellence w.r.t. the state of the art in the field - Quality - Envisioned Technology Readiness Level - Clarity of suggested KPIs	Score: ? / 10 *(Threshold: 6/10)*
3. Implementation of the ITP	**Weight: 30%**
- Coherence, appropriateness, effectiveness - Composition of the tandem/consortium - Risk management	Score: ? / 10 *(Threshold: 6/10)*

MoSys

Second Open Call
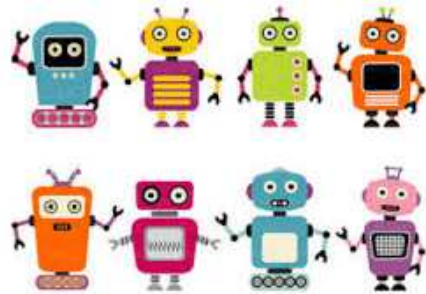
Pilots & Success Stories

- **Funding Budget:** 2 Million € (Pilots), 0,64 Million € (Tools)
- **Funding per ITP:** 300 K€ max.
  (different project types/sizes)
- **Call Opening: Feb 1, 2019 (- April 30th 2019)**
- **Period:** Sept 2019 – Aug 2020

How to apply?
See
robmosys.eu/open-calls

Intralogistic Industry 4.0 Robot Fleet

Healthcare Assistive Robot

Flexible Assembly Cell

Modular Educational Robot

Human-Robot Collaboration for Assembly

RobMoSys Ecosystem

- RobMoSys defines a platform of assets and services to help **industry to improve their software/system engineering practice**… join us to **work together to create this ecosystem** and to demonstrate with **real industrial cases** your own **success story**.

- We call for **expert groups** which are willing to be **coached by us**, which want to help us in implementing the RobMoSys concepts under our guidance, which are ready to thereby advance the **RobMoSys way of thinking**, which are ready to go for real world examples **in line with our industrial pilots**.

RobMoSys Ecosystem

GET INVOLVED
www.robmosys.eu

Open Call II: Big Picture

RobMoSys

Sustainability and Communication Strategy

- Key industrial communities
- Key robotics platforms
- Development Communities
- Past ITPs/non selected ITPs

- Business improvements
- Technical improvements
- Adoption path
- Migration path

- Instruments
- Technical Challenges
- Application domains
- Sustainability roadmap

- Methodology
- Success stories
- Pilots
- Tools/SW

Communities

Outlet

Guidelines

How-to

Wiki Demos

Academy

Coaches Tools& SW

1. Leaflet
2. Web front-end
3. Short demo videos (user stories)

December 15th, 2018

1. Applicant Guide
   - Companion docs
2. Evaluation Guide

February 1, 2019

Already available for Call I
February 1, 2019 (update Call II)