

# Driving Robotics Forward through Collaboration, Benchmarking and Competitions

The logo for the ROCKIn project, featuring the word "ROCKIn" in a stylized, metallic, 3D font. The letters are dark grey with highlights and shadows, giving them a mechanical appearance. The background is a blue circuit board with various electronic components and labels like "TYT", "SF1", "A12", "30", "31", "38V", "C12", and "-220V".

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the European Union



**Matteo Matteucci (Politecnico di Milano)**  
**Forum on Robotics Challenges & Competitions**  
**- ICRA 2014, Hong Kong -**

# Competitions lead to...

- Innovation
  - powerful means to foster progress in R&D
  - introduce/compare best practices in robotics
  - lead to technology transfers
- Focused R&D
  - research issues derived from real-world problems
  - development of commonly accepted test beds and benchmarks
  - experimental validation of state-of-the-art research
- Awareness of new technologies among citizens
- Attractiveness of scientific & engineering disciplines
  - from primary/high school education up to university level education



Competition Events

Camps and  
Community Building

Benchmarking

RoCKIn@Work

RoCKIn@Home

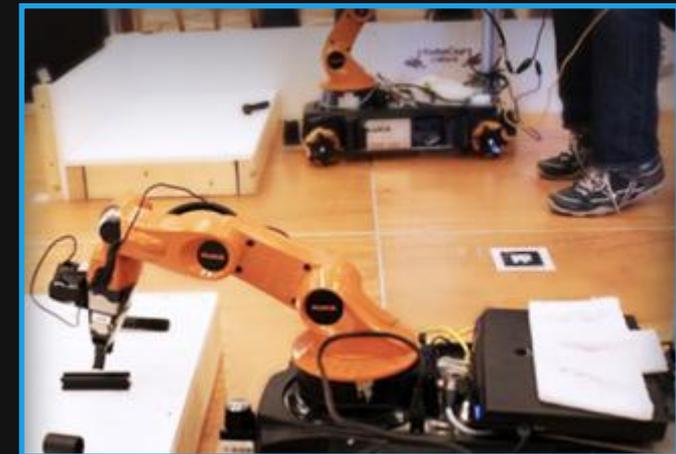
Dissemination

Test Beds

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# RoCKIn@Work

- **Innovative robot applications in industry that**
  - work interactively with humans
  - have reduced initial programming requirements
  - have enhanced physics simulation capabilities
- **Contribute to the continued commercial competitiveness of European industry**



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# RoCKIn@Home

- **Socially beneficial domestic service robots that**
  - have enhanced networking and cognitive abilities
  - support the impaired and the elderly
- **Contribute to an improved quality of life for the population of Europe**



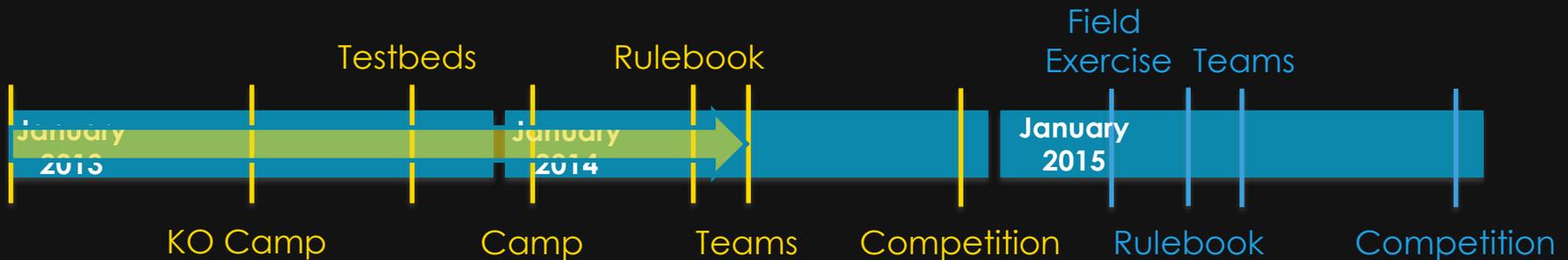
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# Project strategy

Build upon the well-established infrastructure of **RoboCup** competitions **plus**:

- networked robot systems
- natural (human – robot) interaction
- objective evaluation in the competitions
- system vs. subsystems evaluation
- better comparison across years
- lower barriers for new teams

# Project Timeline & Consortium



SAPIENZA  
UNIVERSITÀ DI ROMA



Hochschule  
Bonn-Rhein-Sieg

**KUKA**



POLITECNICO  
DI MILANO

**INNOCENTIVE®**

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# 2014 RoCKIn Camp

Antonianum Auditorium, in Rome



19 teams (9 @Work +  
10 @Home) + 5  
individual participants

63 participants  
from 13 countries

Lectures at Dipartimento di Ingegneria Informatica e Gestionale



# 2014 RoCKIn Camp Video



# RoCKIn Competition 2014

**La Cité de L'Espace, Toulouse, on 26-30 November 2014**  
(during the 2014 European Robotics Week / ERW 2014)

- 20 teams expected (~ 10 @Work, 10 @Home)
- Co-located events:
  - research workshop on HRI and
  - workshop industry-meets-academia



With the support from the City of Toulouse  
and the Toulouse region

Co-organized by Rachid Alami/LAAS

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# RoCKIn 2014

- Important Dates for 2014:

- Rulebook online: 01 April 2014
- Intention to participate deadline: 01 May 2014
- Application deadline: 24 May 2014  
(for all teams, even if not yet qualified)
- Decision on Qualified Teams: 01 June 2014
- Registration opens: 09 June 2014  
(for the qualified teams only)



**WE WANT YOU!**

- Some spots still available for @work teams !!!!

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# Competitions as Experiments

“Challenge and competition events in robotics provide an excellent vehicle for advancing the state of the art and evaluating new algorithms and techniques in the context of a common problem domain.

[...] treat competitions and challenges as repeatable experiments.”

Monica Anderson, Odest Chadwicke Jenkins, and Sarah Osentoski  
*“Recasting Robotics Challenges as Experiments”*

The experimental method suggest experiments to allow for:

- Comparison
- Reproducibility / repeatability
- Justification / explanation

# Hey look Ma! No hands!

“One-time demonstrations of robot performance (e.g., grand challenges or other competitions) in robotics are one way of comparing the performance of robots, but they do not necessarily prove that one’s robotics research is consistently better or worse than another lab’s.”

Leila Takayama (Google[x], formerly at Willow Garage)

*“Towards a Science of Robotics: Goals and Standards for Experimental Research”*

- Benchmarking activities in RoCKIn are aimed at
  - Inspiring the design of competitions to allow for benchmarking
  - Designing suitable metrics for the competitions (and for robotics)
  - Applying such metrics during the competitions
  - Comparing results after the two competitions



# Functional and task benchmarks

- Competitions may challenge robots at two different levels (ability vs capability in SRA?)
  - Task Level: evaluation of whole systems on a specific task (e.g., the “bring me the glasses” tasks)
  - Functionality Level: evaluation of modules implementing, in a general manner, functionalities required by the competition tasks (e.g., grasping and manipulation)
- Benchmarking competitions should allow independent evaluation at both levels
  - To encourage participation of people interested in specific aspects of robotics (e.g., object recognition)
  - To evaluate at what extent the interplay among modules is relevant (e.g., the precision in positioning before grasping)

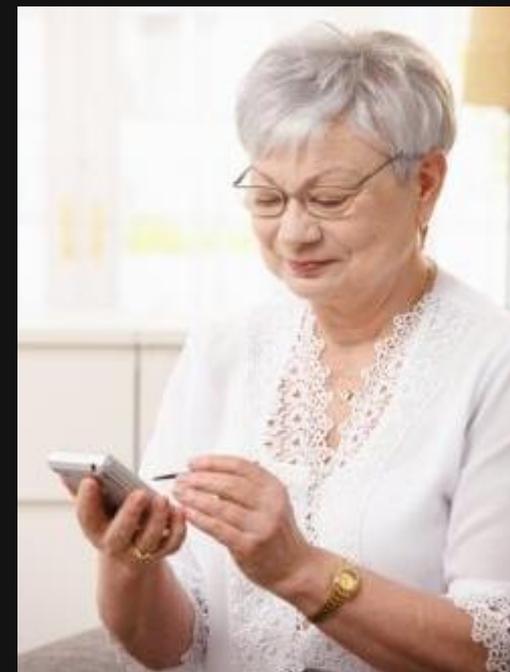
# User Story: Granny Annie

Granny Annie is a nice but slightly seasoned lady. Luckily, she could get into a new program, sponsored by her health & social security insurances, by which elderly people are supplied with household and elderly care robots to assist in managing and mastering their daily lives.

- Task: “Getting to know my home”

*Granny Annie is waking up and today she feels a bit tired because she has not slept very well. Still a number of tasks need to taken care of. The home robot will help her in all these tasks.*

- Task: “Catering for Granny Annie’s comfort”
- Task: “Welcoming visitors”
- ...



# RoCKIn@Home Tasks & Functionalities

- Tasks Benchmarks
  - Comfort Providing Task Benchmark
  - Visitor Handling Task Benchmark
  - Environment Learning Task Benchmark
- Functionality Benchmarks
  - Object Perception Functionality Benchmark
  - Object Manipulation Functionality Benchmark
  - Speech Recognition Functionality Benchmark

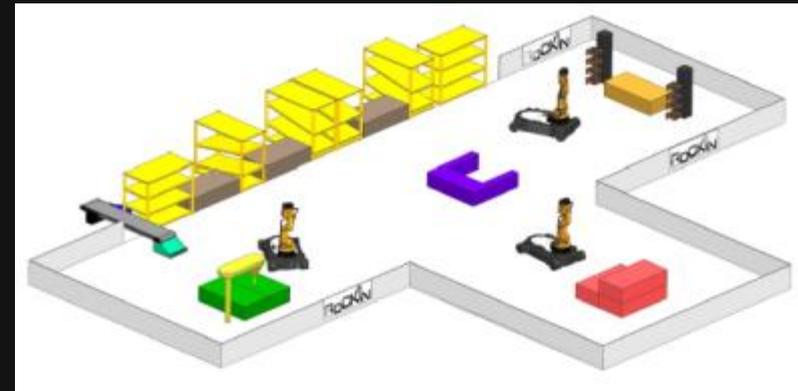


RoCKIn

# RoCKIn@Work Tasks & Functionalities

- Tasks Benchmarks

- Assemble-Aid-Tray Task Benchmark
- Plate Drilling Task Benchmark
- Fill a Box Task Benchmark



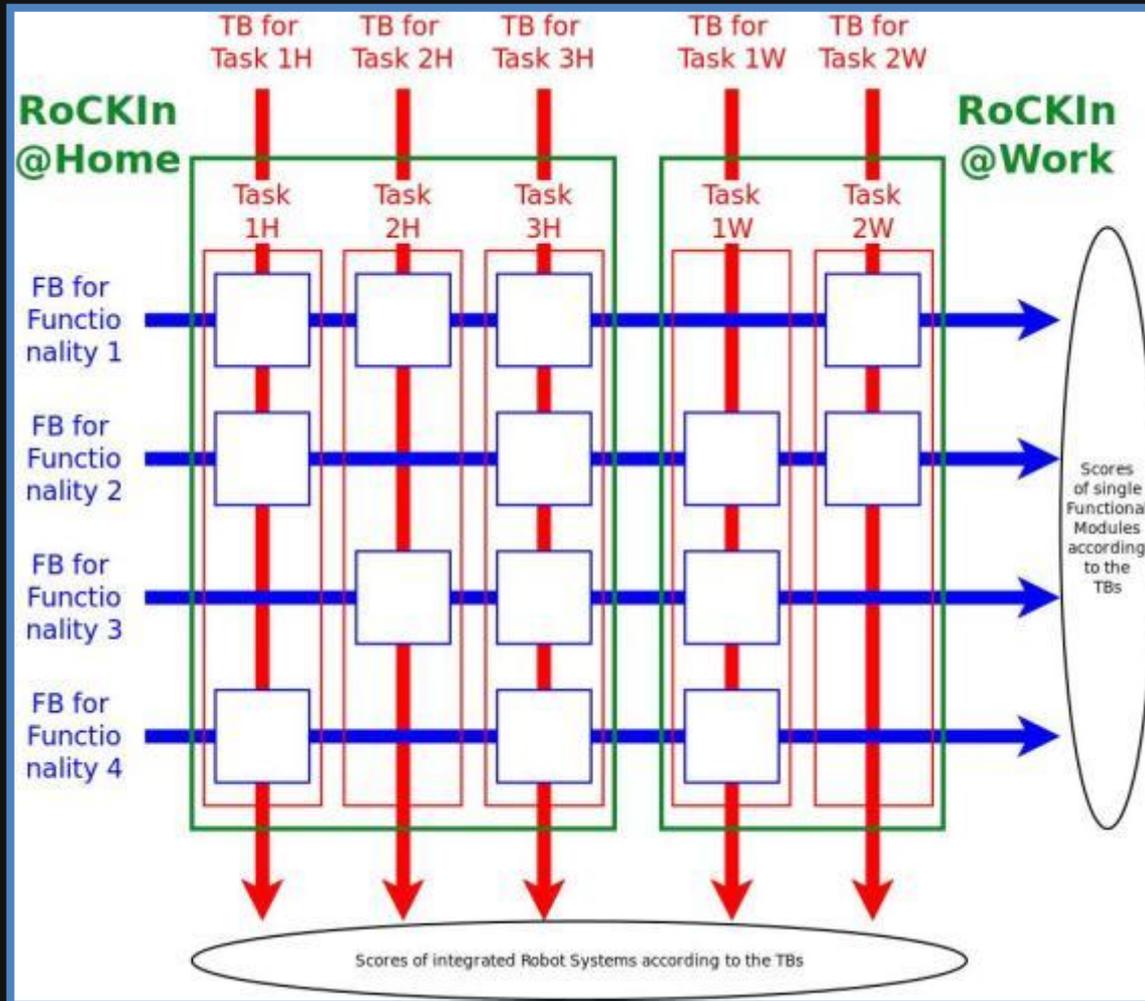
- Functionality Benchmarks

- Object Perception Functionality Benchmark
- Visual Servoing Functionality Benchmark
- Planning and Scheduling Functionality Benchmark



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# A big picture ...



*Join us in Toulouse!*

**ROCKIN**  
CITÉ DE L'ESPACE  
TOULOUSE, FRANCE

2014

26-30 NOVEMBER



[www.rockinrobotchallenge.eu](http://www.rockinrobotchallenge.eu)

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