

Factory in a Day

eu
Robotics
Forum



**3rd Workshop on
Hybrid Production Systems**

Factory-in-a-day (Fiad)

Composeable skills for a factory in a day


Carlos Hernandez Corbato

TU Delft Robotics Institute
Mekelweg 2
2628 CD Delft
The Netherlands
E-Mail: c.h.corbato@tudelft.nl


 **TU Delft**

- Reduce installation time of industrial robots
 - hardware
 - software
 - procedures
 - business models


Analyze workflow




Design custom components for the job




Components are 3D printed




8:00 Everything is shipped to the factory




10:00 Unloading and self calibration



12:00 Instruction and teaching



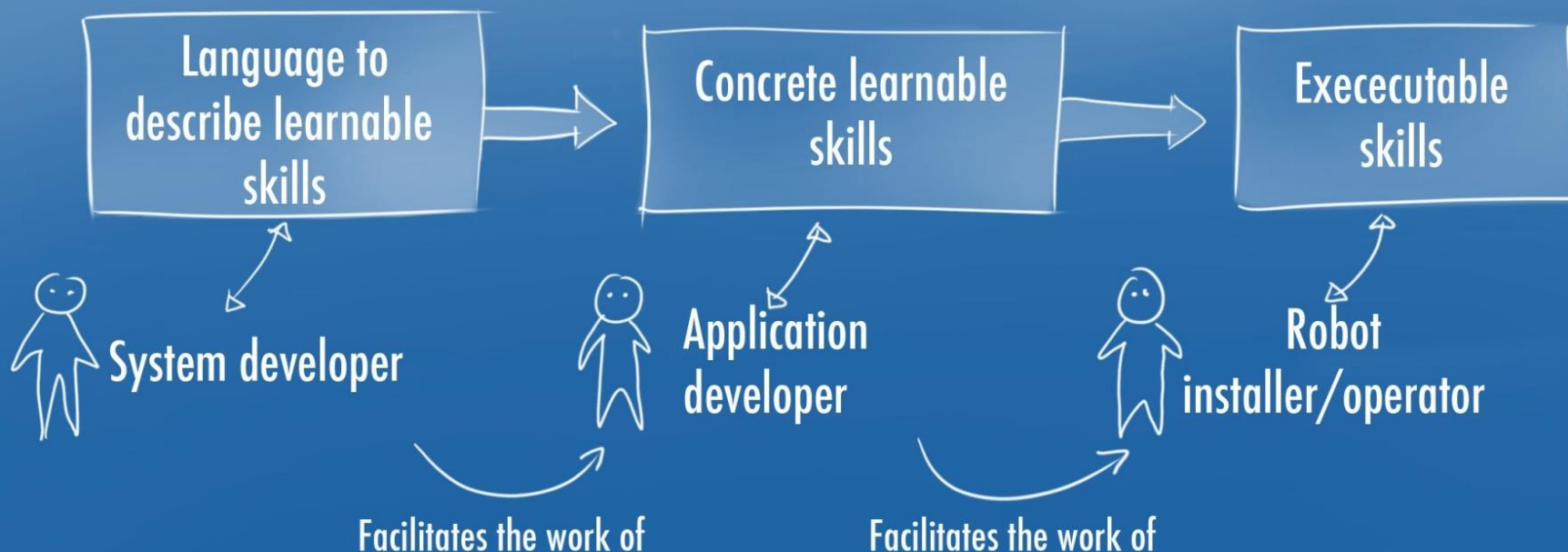
16:00 Done!



- Almost independent of app domain
- Larger effort
- Larger development time

- Application domain specific
- Expert in the app. Domain

- For a given product line
- Small effort
- Quick deployment



- Programming by demonstration
- Efficient motion planning
- Dynamic obstacle avoidance

- Programming by demonstration using human-robot co-manipulation
 - Kinesthetic teaching using the multi-modal artificial skin
 - semantic-based inference method is used to automatically segment and recognize the demonstrated activities.
- Constraints satisfaction using model-based task specification (eTaSL)
 - target endpoint constraints determined by vision
 - collision avoidance



Motion planning for pick-and-place

- Goal: efficient and reusable pick-and-place
- MoveIt-based motion planning pipeline
- Marker-based extrinsic camera calibration
- Runtime components integration: ROS
- Architecture:
 - State machine based coordinator
 - Model-Driven Development: BRIDE (ROS)



Dynamic obstacle avoidance

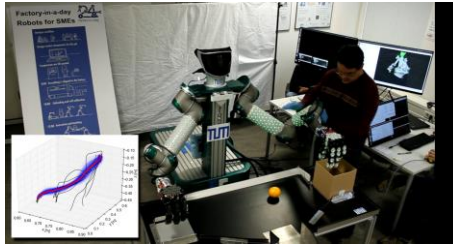
- human and robot safety in a shared workspace
- Path planning + proximity sensing + reactive obstacle avoidance



Challenges:

- Integration:

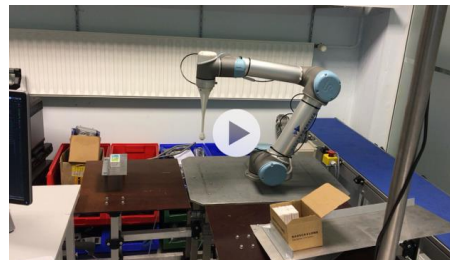
Learnable skills



Dynamic obstacle avoidance

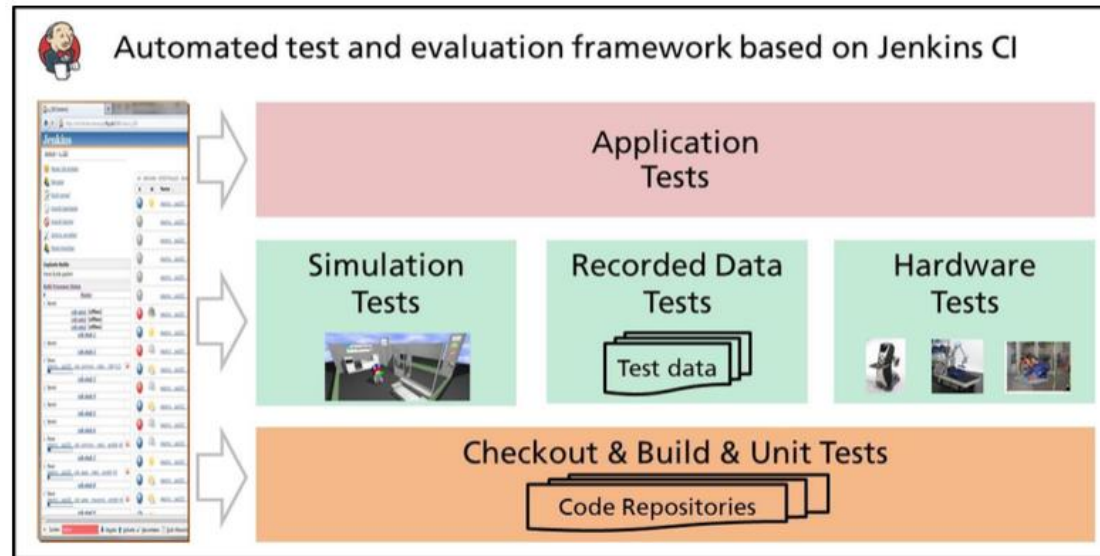


Efficient and reusable motion planning



- More skills:
 - polishing

- Development: continuous integration and testing platform (Fraunhofer IPA)



- Runtime: ROS-Industrial
- **Challenges** for skill composeability:
 - Skill model
 - Control architecture

Contact Information



Presenter

Carlos Hernandez Corbato
Tel: +31 15 278 86 43
E-Mail: c.h.corbato@tudelft.nl

Project Coordinator

Martijn Wisse
Tel: +31 15 27 86 834
E-Mail: m.wisse@tudelft.nl



For more information visit us at www.factory-in-a-day.eu

Thank you for your Attention!

Questions?

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 609206.

