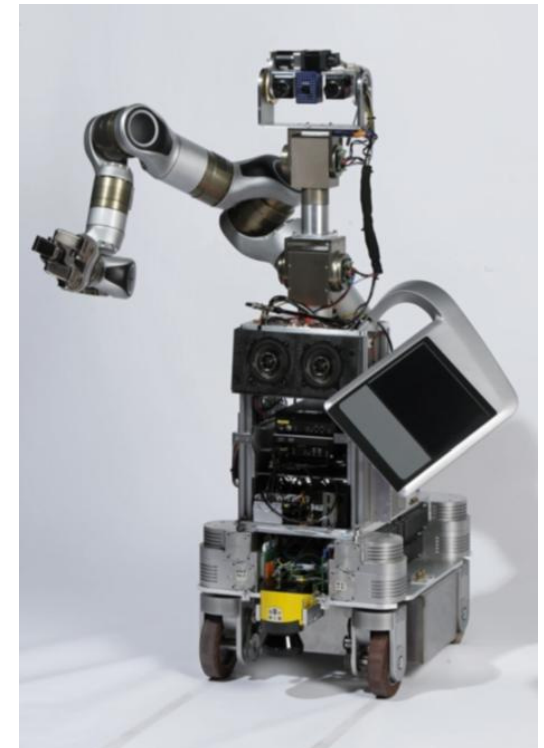
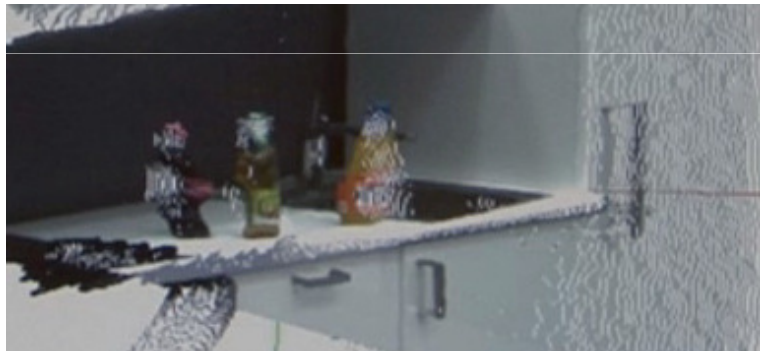
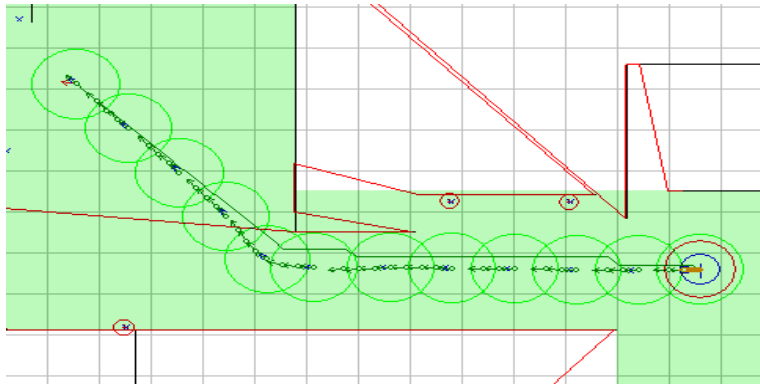


# SERVICE ROBOTICS AT FRAUNHOFER IPA OFFER TO INDUSTRIAL AND ACADEMIC PARTNERS IN ECHORD

Dr.-Ing. Dipl.-Inf. Birgit Graf, [birgit.graf@ipa.fraunhofer.de](mailto:birgit.graf@ipa.fraunhofer.de)

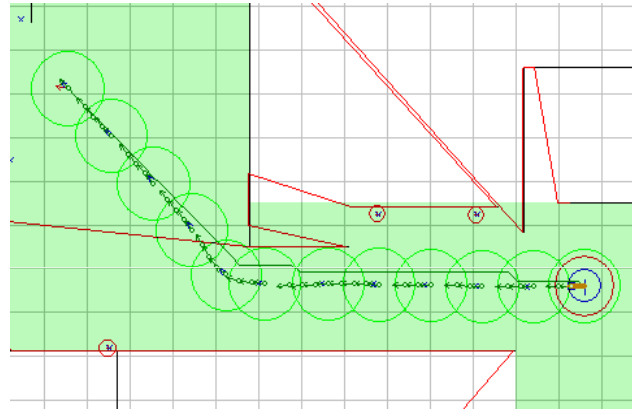
Fraunhofer-Institut für Produktionstechnik und Automatisierung (IPA)



# Offer to Industrial Partners: Individual Development and Integration of Dependable Service Robot Technologies

- Customized software development / integration of existing components
  - Sensor fusion, sensor data processing and interpretation
    - Environment modelling
    - Obstacle detection
    - Object learning and localization
  - Navigation / (mobile) manipulation in dynamic environments
    - Sensor based motion planning including obstacle avoidance
    - Motion control for complex kinematic chains including coordination of arm and platform movements or force control
- Customized hardware development
  - New service robot systems for different applications
  - Application specific actuators, sensors, and tools

# Technology Examples – SW Development / Integration



Path planning and adaptation for dynamic environments

Successful technology transfers



Courier robot for hospitals

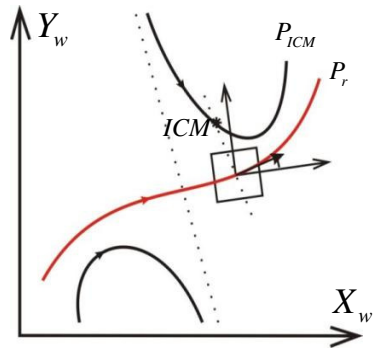


Cleaning machine



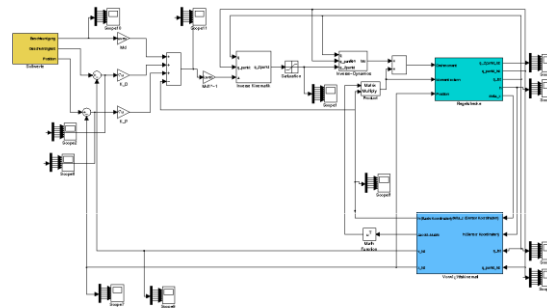
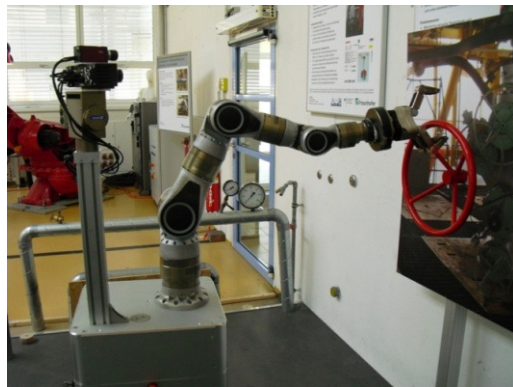
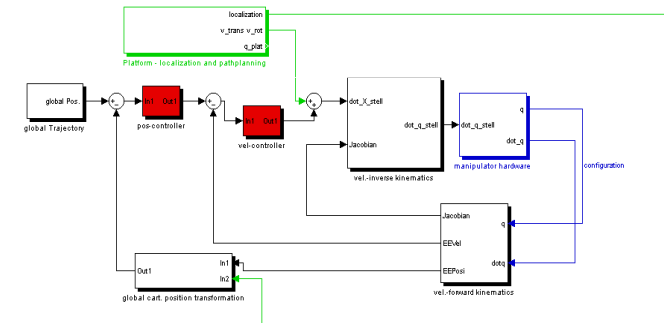
Advanced AGV

# Technology Examples – SW Development / Integration



ICM-based motion controller for a pseudo-omnidirectional mobile platform

Real-time coordination of arm and platform movements to open a door



Impedance controller for tuning hand wheels with by maintenance robot

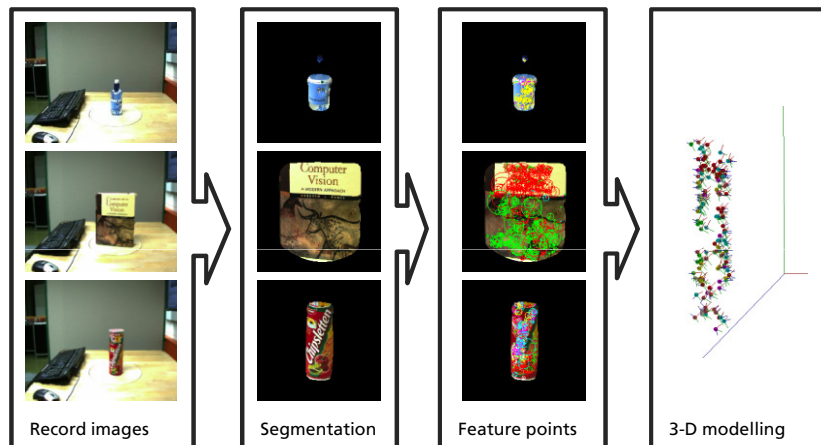




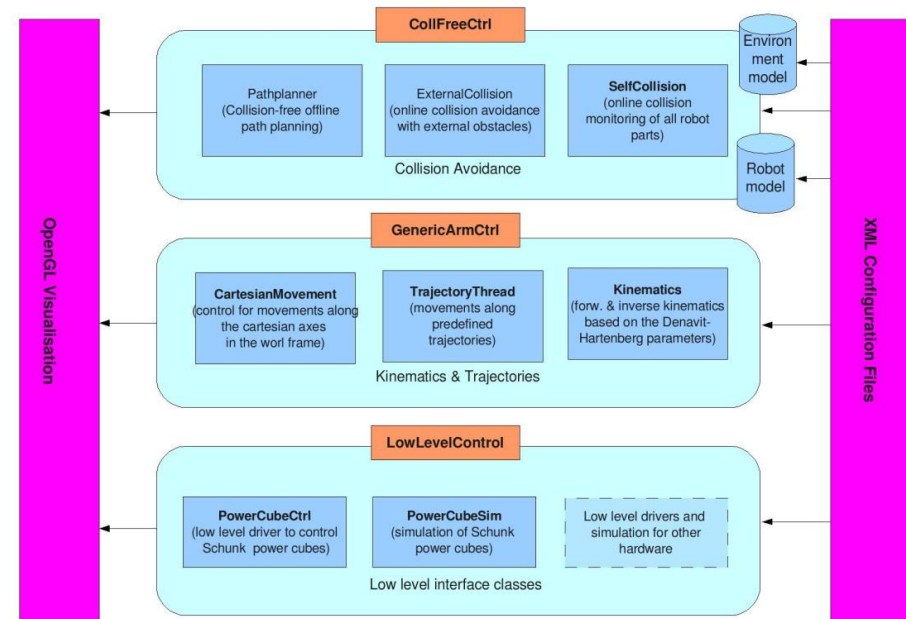
# Technology Examples – SW Development / Integration



3-D environment modelling



Automatic object learning

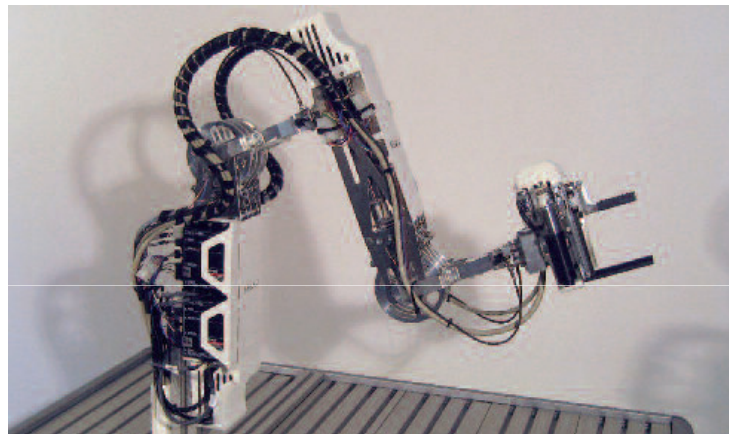


Modular, PC-based manipulation framework including path planning and dynamic obstacle avoidance

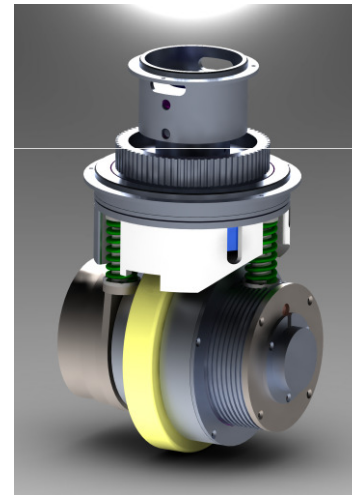
# Technology Examples – HW Development / Integration



Prototypes of low-cost domestic robots



Efficient light-weight robotic arm based on new artificial muscle concept



Compact, integrated omnidirectional drive module



Inspection robot able to operate in explosive atmospheres

# Offer for Academic Partners: Robust hardware platform Care-O-bot<sup>®</sup> 3 for advanced robotics research

## Sensor Head

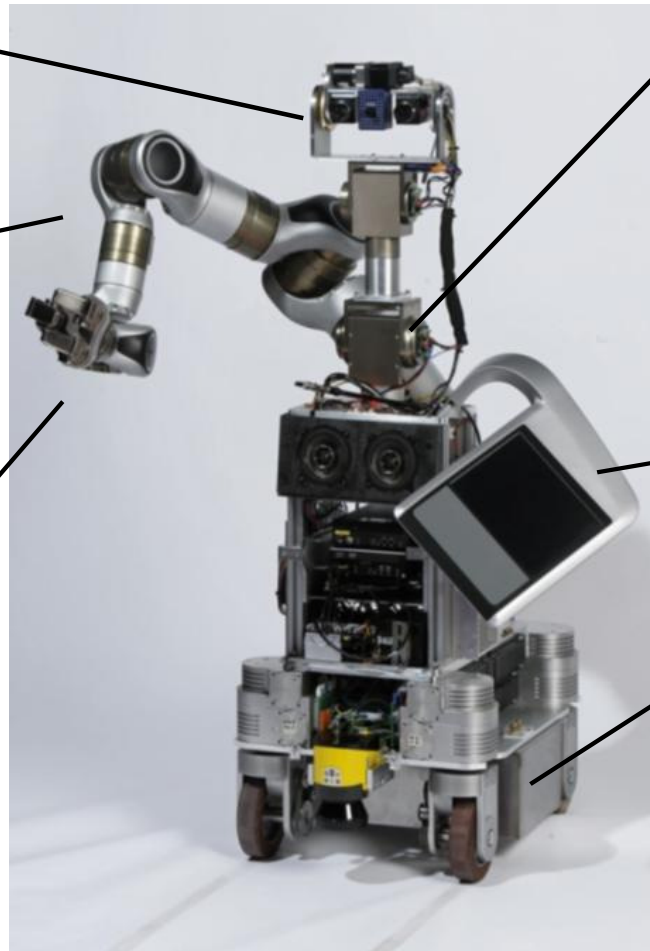
- Stereo-camera
- 3-D-ToF sensor
- 1 DOF

## Arm

- SCHUNK LWA 3, 7 DOF, redundant
- TCP, joint control
- Hollow shaft (cables)

## Gripper

- SCHUNK SDH, 7 DOF, 3 fingers
- In-finger tactile sensors



## Basis

- Height 1.4 m, width 0.6 m
- Weight ~180 kg
- 4 DOF kinematic for body expressivity
- Stereo speakers
- 3 Control PCs

## Tray

- 1 DOF
- Touch screen

## Mobile Platform

- 4 wheeled omni-directional locomotion
- Back/front laser scanners
- Li-ion battery

# Modular Hardware Setup – Possible Configurations

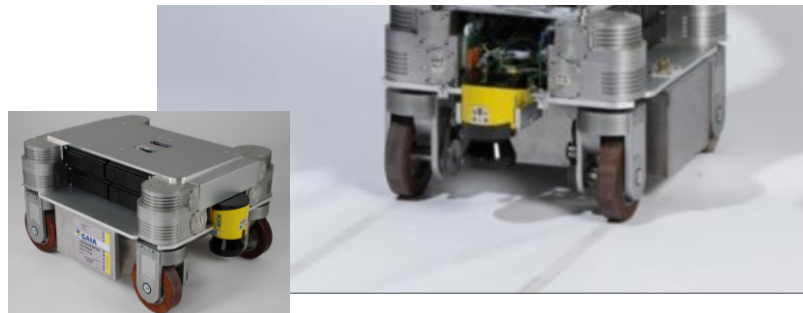


- Sensor head mit pan-tilt unit(s)



- Torso with flange for SCHUNK arm

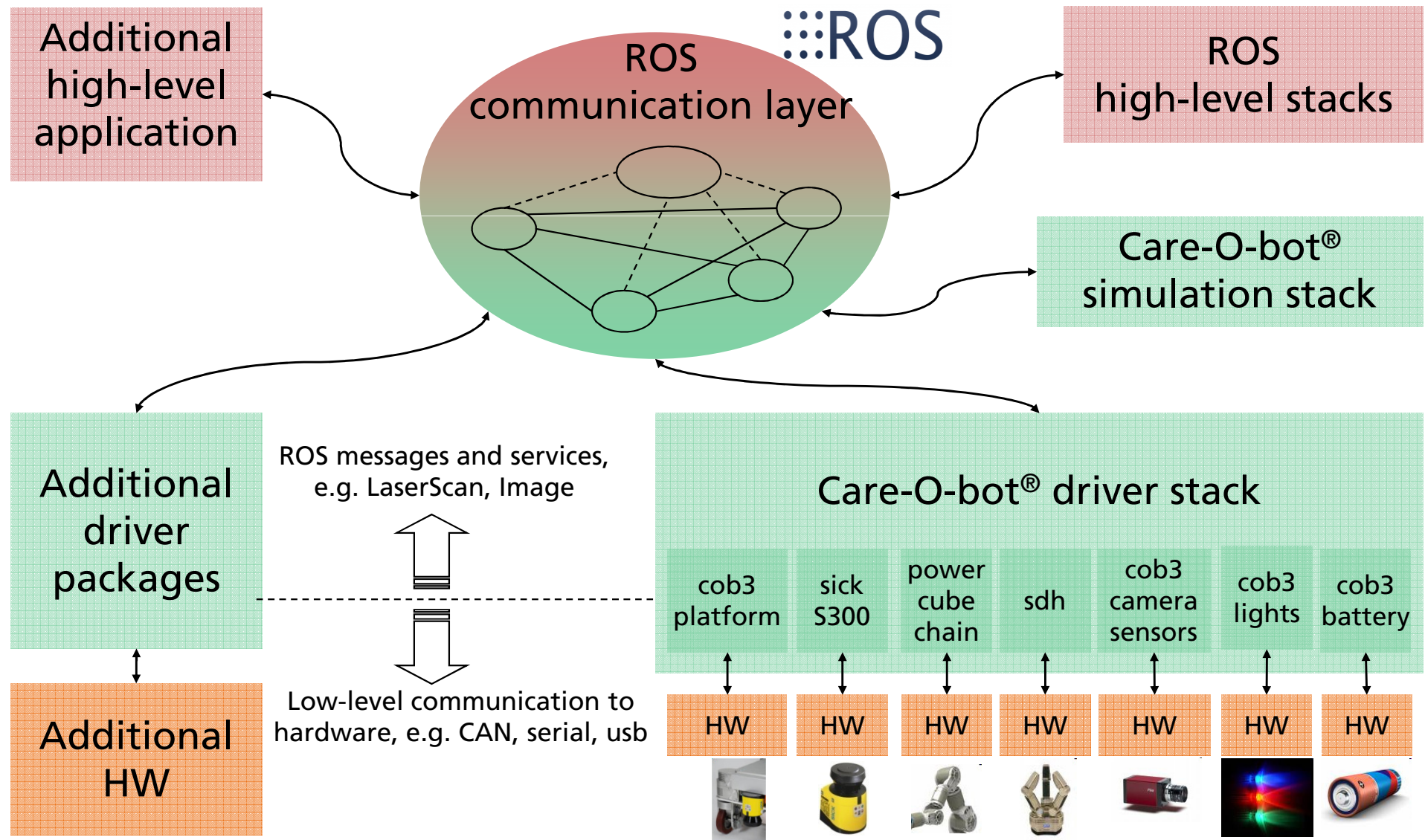
- Omnidirectional mobile base



**Please contact us to discuss your individual system assembly!**



# ROS Open Source Software Stacks for a Simple Start



**Further Information for industrial partners:**

[www.care-o-bot.de/english/Cob3\\_Software.php](http://www.care-o-bot.de/english/Cob3_Software.php)

**Further Information for research partners:**

[www.care-o-bot-research.org](http://www.care-o-bot-research.org)

