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Modularity for Task-configuration of Small Flexible Mobile Robot Platforms (ARTEMIS-JU project R5-COP)

ERF15 workshop:
Hardware and software modularity and interoperability in service robotics: Towards standardisation

Vienna, 12th of March 2015

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Small Flexible Mobile Robots

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- **Typical trade marks:**
  - Load capacity: 50-300 kg
  - Operating time: 10-20 hours
  - Robot investment: €16,000 - €40,000
  - Avg. dimensions: 500 x 500 x 1000mm
  - Env. adaptations: None required
  - Safety: Safety laser scanner
  - Operating velocity: < 1.5 m/s
  - EU platform producers: < 10

- **Task compliance:**
  - A-to-B logistics
  - Conveyors, cabinets, etc. can usually be mounted on top of the platforms

- **Strong application potential:**
  - Healthcare sector, Production industry, and Service sector

- **Typical integrators for one-off solutions:**
  - The platform producers themselves. It often requires strong technical competences to realise a system.

- **System integrators for larger or duplicate installations:**
  - ***Alarmingly few!*** Besides technical competences it often requires in-depth process knowledge to argue RoI. It is deceptively challenging.

R5-COP (ARTEMIS-JU)

***R**econfigurable **R**OS-based **R**esilient **R**easoning **R**obotic **CO**o**P**erating Systems, 2014-2017*

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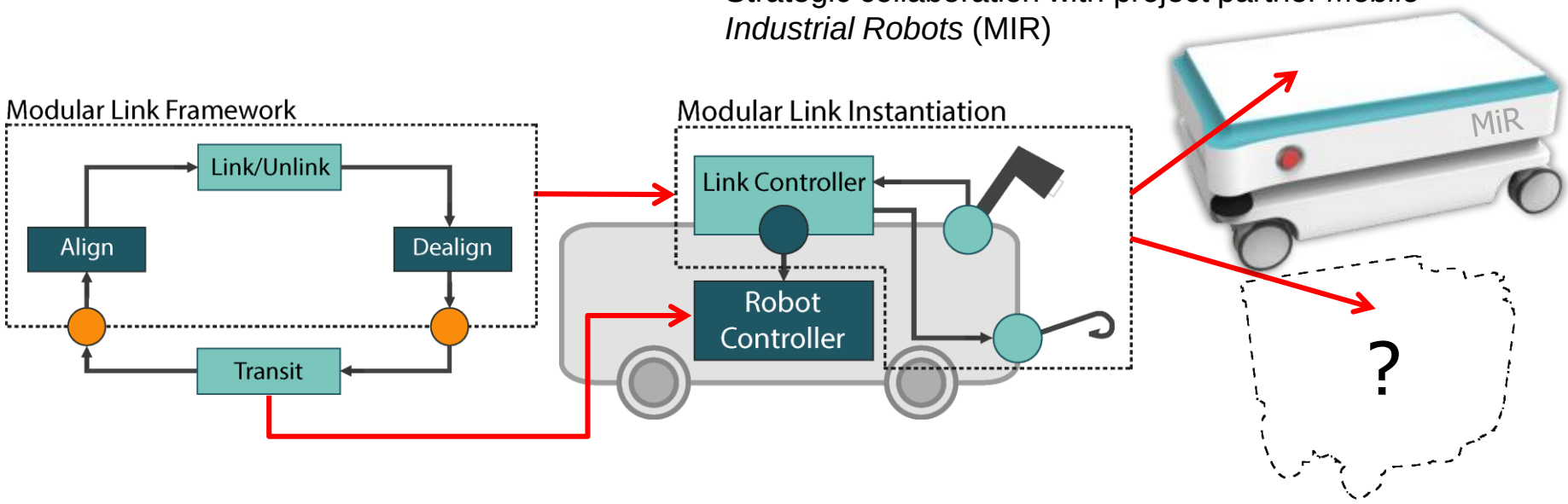
- Idea
  - ✓ Few robotic components are designed for easy adaptation and reuse
  - ✓ R5-COP focuses on agile manufacturing paradigms and specifically on modular robotic systems
  - ✓ R5-COP will help to identify and develop reconfigurable key hardware and software components
- Project
  - ✓ 1/2-2014 – 31/1-2017
  - ✓ 30 partners
  - ✓ Budget: ~ €12,000,000
  - ✓ Effort: 1,327 Person Months
- **DTI**
  - ✓ Development of a ***Modular Link Framework*** **(MLF)** for flexible task-configuration of existing mobile robots for integrators
  - ✓ MLF decouples locomotion from object handling
  - ✓ Strategic collaboration with project partner *Mobile Industrial Robots* (MIR)



Modular Link Framework (MLF)

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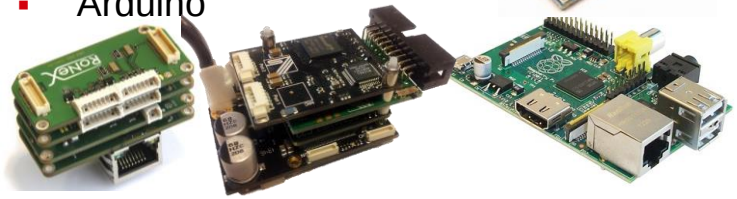
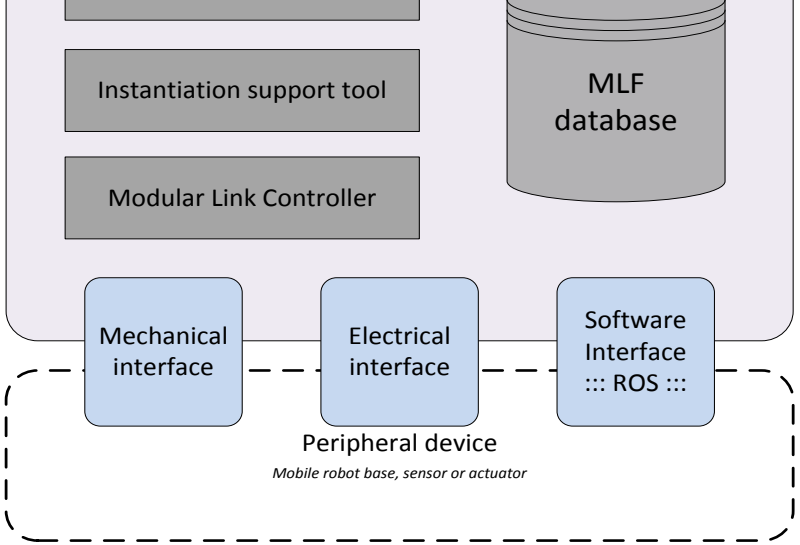
- **Modular Mechanical Interface**
  - CARMEN* Palette

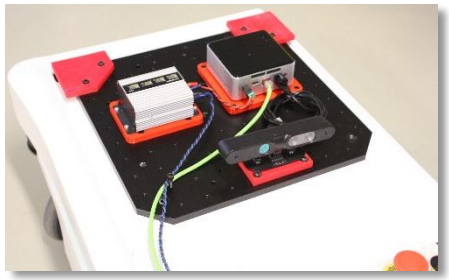
- **Modular Electrical Interfaces**
  - RoNeX
  - Synapticon DYNARC
  - Raspberry Pi
  - Arduino



- **Platform Software Interface**
  - ROS

- **Modular Infrastructure Components**
  - Wireless (ISM-band) call-buttons
  - Wireless (ISM-band) elevator and door control





*Center for Advanced Robotic Manufacturing Engineering (CARMEN) is supported by Danish Agency for Science, Technology and Innovation, 2012-2016

Modular Link Controller (MLC)

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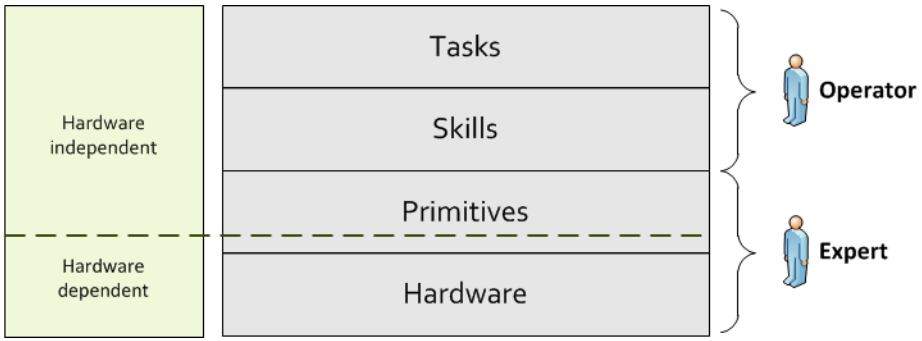
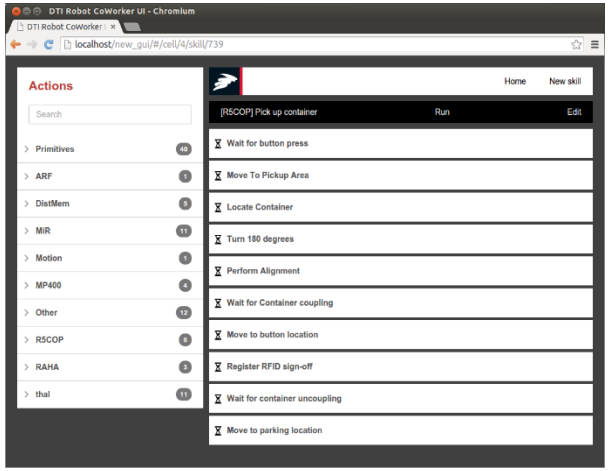
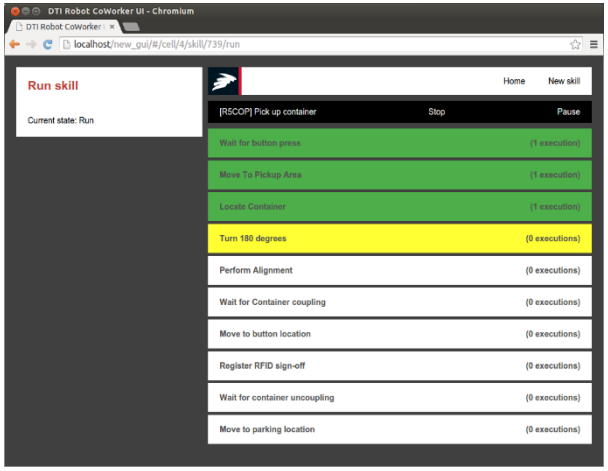
- **Link Controller Hardware**
  - Intel NUC
- **Skilled Robotics**
  - Execution of skills decoupled from robot hardware – i.e. skills reusable across platforms



  - Intuitive Graphical User Interface – modular drag'n'drop





Example Applications

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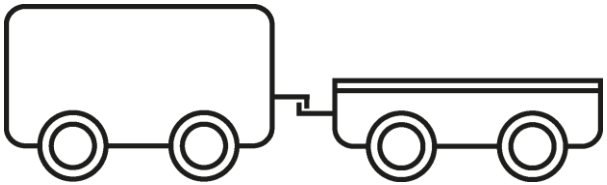
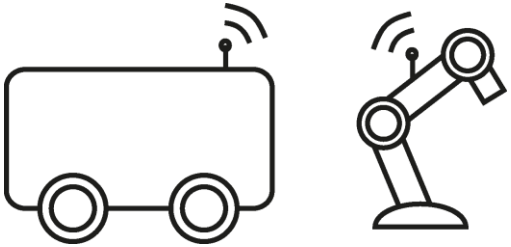
- **Trolly transport**



- **Collaboration with e.g. manipulators**



- **Collaboration among mobile robots**