“STATUS AND OUTLOOK OF OPEN SOURCE BEYOND RESEARCH AND SERVICE ROBOTICS”

Dr. Mirko Bordignon – Fraunhofer IPA / ROS-Industrial Consortium EU

Or, more concisely:

THE TRAJECTORY OF OPEN SOURCE ROBOTICS
The past, present and future (?) of Open Source Robotics

L9: standard system

L8: first installation

L7: pilot

L6: trade fair demo

L5: lab demo

2007  2012  2017

Src: Willow Garage
Src: Otto Motors
Src: MSH / Unity
Src: Bär
The past, present and future (?) of Open Source Robotics

Short-term result: direct support from OEMs

L9: standard system

L8: first installation

WRC, Beijing
Aug 2017

SPS IPC Drives
Nurnberg, Nov 2017

IREX, Tokyo
Nov 2017

2017
The past, present and future (?) of Open Source Robotics

Long-term achievement: full-stack adoption in all robotics domains

L9: standard system

Hurdles:
- SW quality
- Safety certification
- Standardization / gov’t adoption?

L8: first installation

Src: B&R
Src: Nvidia
Src: NASA

2017

© Fraunhofer IPA
How do we possibly get there?

<table>
<thead>
<tr>
<th>Explaining the rationale</th>
<th>Developing the value proposition</th>
<th>Expanding the frontier</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Why Open Source makes sense in robotics and automation</em></td>
<td><em>How end-users, sys. integrators, OEMs in robotics can benefit from Open Source</em></td>
<td><em>Towards higher-quality, widely-taught, ubiquitous Open Source Robotics</em></td>
</tr>
</tbody>
</table>

[Images of logos: open robotics, ROS, OSADL, ROS industrial consortium, ROSin, ROS]
Explaining the rationale – why Open Source makes sense

1. Open-Source: only a hobby?
   - “I’m doing a (free) operating system (just a hobby, won’t be big and professional like gnu) for 386(486) AT clones.” (Torvalds, 1991)
   - As of today, 91.8% of the kernel engineering is paid, professional development (source: 2017 Linux Kernel Development Report)

2. When and how to use it?
   - Pyramid of differentiation (C. Emde, ROS-I Conf’16): use it for components below the “uniqueness line” -> for non-differentiating know-how (e.g., infrastructure)
   - Knowledge of community dynamics necessary! You are not subcontracting work

3. Free as in beer / free as in speech?
   - Understanding of the relationships between developer, distributor, end-user
   - Understanding different license obligations, etc (C. Maracke, ROS-I Conf’16)
Developing the value proposition – how you can benefit

<table>
<thead>
<tr>
<th>End-user</th>
<th>Sys. integrator</th>
<th>OEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Source can provide a vendor-neutral, hardware-independent software solution which cannot be discontinued</td>
<td>Leverage a rich collection of utility components and focus your efforts on the core application</td>
<td>Focus your resources on building great hardware and open it to development by third parties</td>
</tr>
</tbody>
</table>

Possible analogy (and its limitations):
Smartphone market: 99.6% of new smartphones run Android (82%) or iOS (source: Gartner, Feb’17)
BUT reliability, safety, market dynamics does not make for a perfect comparison!
Expanding the frontier – next actions

Make ROS-I better (in terms of software quality) business friendly (components, licensing) accessible (widely taught, easy for everybody)

**Software Quality**

- ROS-I best practices and tools: continuous integration, unit testing, code reviews
- ROSIN further improves on them with code scanning, automated test generation, model-in-the-loop testing

**New components + path for exploitation**

- 3+ Million € available to third parties for ROS-Industrial development
- Develop missing components or improve existing ones
- Commercial release template (licensing, etc)

**Education**

- Educate students: summer schools
- Train professionals: ROS-I academy
- **Open Call** to fund your ROS education initiative

This project has been funded by the European Union’s Horizon2020 research and innovation programme under grant agreement No 732287
Expanding the frontier – raising the bar

(T. Jacobs, ROS-I Conf’16)
Expanding the frontier – raising the bar

(T. Jacobs, ROS-I Conf’16)
Expanding the frontier – resource-constrained devices

Plug-and-play hardware components made from cost-efficient, resource-constrained devices
Thanks again to ROS-I Consortia members - enjoy the conference!