ROS-Industrial turns four and expands worldwide

ROSCon 2016
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Why ROS-Industrial?

Today robots can do much more than preprogrammed motions!

Quick history and some stats

<table>
<thead>
<tr>
<th>Year</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
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<tbody>
<tr>
<td>Growth in ROS-Industrial users</td>
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Activities

- Technical
  - driver development & maintenance
  - robotics as a service
  - training

- Non-technical
  - guidance on how to properly use OSS in commercial products
  - OSS and safety regulations

The ROS-Industrial expansion ...

... in Asia Pacific

ROS-Industrial Asia Pacific Consortium

ROS-Industrial Software Process

Recruiting

Do you have a job?

- Do you want one now?

ROS-I: What we do!

ROSCon 2016
Why ROS-Industrial?

Today robots can do much more than preprogrammed motions!

It is mostly a software affair ...
- adv. capabilities are typically implemented in SW
- more complex setups require better "plumbing"
- distributed/collaborative development is central

so let's bring ROS to industrial robotics!
Today robots can do much more than preprogrammed motions!

By BMW Werk Leipzig [CC BY-SA 2.0 de], via Wikimedia Commons

By Team Delft, Amazon Picking Challenge 2016

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(2011) SwRI and Yaskawa team up to use ROS with Motoman
first pilot project

(2012) public debut at an industrial forum

(2013) RIC-North America launches

(2014) RIC-Europe launches

(2016) ROS-I expands into Asia Pacific

ROS-I Consortia members

System integrators & "power users" (35%)
- Close to "appliance part of" need better SW tools and freedom from vendor lock-in

Research / gov't (40%)
- Benefit from a vehicle to market their research, promote open standards & provide vendor-agnostic education

OEMs (25%)
- Acknowledge the significance of a SW "tech enabler", want to focus on core competence (HW)
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ROS-I expands into Asia Pacific
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RIC-North America launches public debut at an industrial forum.

RIC-Europe launches

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- capabilities dev
- training

**Non technical**
- guidance on how to properly use OSS in commercial products
- OSS and safety regulations
- lobby for public funding to be directed towards OSS

ROS-I conference 2016
Stuttgart (Germany), Nov 3-4
Technical

- driver development & maintenance
- capabilities dev
- training

Non-Technical

- guidance
- OSS in core
- OSS and directed trainings
- lobby for OSS
Non technical

- guidance on how to properly use OSS in commercial products
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The ROS-Industrial expansion ... 

... in Asia Pacific

Introduction

ROS-Industrial Asia Pacific Workshop - July 2016

ROS-Industrial Asia Pacific Consortium
Introduction

Advanced Remanufacturing and Technology Centre

NANYANG TECHNOLOGICAL UNIVERSITY

School of Mechanical and Aerospace Engineering

About the ARTC

- An initiative by A*STAR (Agency for Science, Technology and Research) and Nanyang Technological University (NTU)
- Focus: Advanced Remanufacturing and Technology
- Core Technology Themes:
  - Advanced Manufacturing Technology
  - Materials and Process Technology
  - Product Design and Engineering
- Currently 42 Industry Members

Core Technology Themes

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Prezi
About the ARTC

- An initiative by A*STAR in partnership with NTU
- **Model** – 1st Centre in Asia adopting the AxCRC model of Industry-Led Public-Private Partnership across Supply Chains
- **Mission** – To Bridge the Gap from Research to Industry Applications for Remanufacturing & Manufacturing for Cross-Sectoral Industries
- **Vision** – World Renowned Industry-Led Centre of Excellence for Remanufacturing & Manufacturing Technologies, Processes and Systems

- **Currently 42 Industry Members**

ARTC Grand Opening by S. Iswaran, Minister for Trade and Industry (Industry) on the 28th Jan 2015

Core Technology Themes
### Core Technology Themes

<table>
<thead>
<tr>
<th>Category</th>
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| **Repair & Restoration** | - Integrated adaptive repair processes  
- In-situ repair  
- Rejuvenation of end-of-life components  
- Adaptive machining of components |
| **Surface Enhancement**       | - Adaptive surface profiling and controlled material removal for complex and inaccessible features  
- Environmentally friendly in-situ surface modification  
- Residual stress profile control and characterization |
| **Robotics**            | - Adaptive robotized finishing  
- Intelligent inspection system  
- Automated cleaning system  
- Collaborative robot |
| **Product Verification**   | - Non-destructive evaluation technology for inspection and sentencing  
- In-situ measurement and inspection for process control  
- Contact and non-contact scanning and measurement  
- Condition Monitoring and Lifetime prediction |
| **Additive Manufacturing** | - Product design optimisation for additive manufacturing  
- Quality and lifecycle management of feedstock material  
- Process optimisation for material performance and part validation  
- Post-process machining and surface finishing techniques |
Currently 42 Industry Members

Focus sectors

Aerospace  Machinery  Oil & Gas  Marine  Land Transport  Clean Technology

Anchor / Tier 1

IHI  Rolls-Royce  SIEMENS  SKF  DMG  MORI  e2s  McKinsey&Company  SAESL

Tier 2

3M  ABB  Barnes Aerospace  Ecoroll  Hexagon  Jot  Kennametal  Materialise

Tier 3

Nakanishi  National Instruments  Plasma  Taylor Hobson  Trumpf  UL  Zeiss

Kawasaki  Abitech  Ablative Engineering  Alpha Sonics  AmpTec  CREATZ  Eye2Eye  CT

Kansas  Laser Cladding  NakoM-Link  Spire  Stealth  TruMarine  VBC  Whts Technologies

ARTC
Our Track Record

**Our Membership**
- 2013: 10
- 2014: 14
- 2015: 29
- 2016: 42

**Project Delivery**
- 2013: 0
- 2014: 15
- 2015: 50
- 2016: 90+

**Our Manpower**
- 2013: 12
- 2014: 40
- 2015: 82
- 2016: 122

**Facility Growth**
- Total: 7200sqm (77,500sq ft)
- 600sqm
- 125sqm (1,345sq ft)

ARTC
Event - ROS-Industrial Workshop

Held on 14 to 15 Jul 2016

A 2 days workshop to bring together representatives from academia and industry to exchange experiences and knowledge on application development with ROS, and clarify the current and future needs of industry with respect to Robotic Operating System (ROS)

Program includes
- Guest Speakers from Open Source Robotic Foundation
- Expert users and speakers globally
- Lab Demonstration of ROS applications
- Networking dinner
Event - ROS-Industrial Workshop

Survey Results

- > 140 participants
- Over 12 countries

Geographical Regions:
- Asia: 91%
- Europe: 5%
- America: 3%
- Middle East: 1%

Interest to join ROS-I Consortium:
- Yes: 40
- No Thanks: 20
- Mixed: 0
- Unknown: 0
ROS-Industrial

- Educator / Non Profit
  - Synergetic with other research technologies

- End Users
  - Develop new capabilities
  - Explore new business opportunities
  - Enhance productivity through robotics

- System Integrators
  - Access Technology Roadmap
  - Access to expertise & facilities
  - Setup a core team to support ROS-I

- Technology Providers
  - Economic Development
  - National Robotic Program

- Support by Gov’t

- Underpin by A*STAR

- Collaborative Network
  - Support from communities

- Open Source Community
  - Code Development
  - New capabilities / bug fixes

- Applications Development
  - Focused tech projects

- Training / Workshop
  - Capabilities dev
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Consortium Map

Proposal to set up ROS-I Asia Pacific Consortium

- Existing ROS-I consortiums in the world
  - Americas & Europe
- Proposal to create ROS-I Asia Pacific through ARTC to achieve the following objectives.
  - Help local industry gain access to and influence strategic ROS developments and facilitate local industry adoption of ROS
  - Development of talent in robotics software for Asia Pacific
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Factory of the Future

Developing ARTC as an FoF Testbed

ARTC FoF Testbed focus on 3 Production Methodologies

1. Advanced Robotics
2. Industrial Internet of Things
3. Industrial 3D Printing
4. Drone Surveillance
5. Green Manufacturing
6. Smarts Control Room
7. Smart Storage System

The future disrupts technologies - such as 3D printing, mobile Internet of Things, and drones - are being developed throughout the National Research and Development Agency. The factory will be able to work more efficiently with green manufacturing solutions, open architecture, as well as smart control of energy and storage equipment systems.
Developing ARTC as an FoF Testbed

ARTC FoF Testbed focus on 3 Production Methodologies

1. **Advanced Robotics**
   - Robotics and automation technologies help boost productivity as part of the government’s efforts to shift towards higher value manufacturing.
   - AMSTAR has a number of teams dedicated to robotics. In Singapore, robotics is tapped on to complement the workforce, not to replace.

2. **Industrial Internet of Things**
   - Objects such as manufacturing machines and environmental sensors are interconnected through a wireless network to provide data, which is then analyzed in a variety of ways to improve productivity. Examples include better product design and machine diagnostics to predict when machines need maintenance, thus reducing their downtime.

3. **Green Manufacturing**
   - Efficient use of renewable resources such as solar panels to generate electricity: saving building designs that promote passive cooling to maintain comfortable room temperatures without air-conditioning: better water treatment to reduce pollution, etc.

4. **3D Printing**
   - Known in industry speak as Additive Manufacturing, this technology creates intricate parts more efficiently.
   - Three-dimensional (3D) printing technology — which generates 3D objects from computational data by building them up in layers from materials such as plastic or metal — allows rapid production of complex, customized and previously inaccessible designs. The precise addition of material also minimizes waste for a reduced environmental footprint.

5. **Smart Control Room**
   - A fully integrated control system that does away with the countless monitors, keyboards and buttons that could lead to human error. Tapping on the Internet of Things, the connected and smart control rooms is an organized way for managers to monitor the processing line.

6. **Smart Storage System**
   - For fast and accurate inventory management, companies could tap on technologies such as AMSTAR’s Item Management and Tracking System. The data collected from this system can also be analyzed to manage production capacity and predict the demand of the goods, to improve efficiency in production and ensure that customers receive their orders in a timely fashion.
Register your interest to become a ROS-Industrial Asia Pacific Member today!
ROS-Industrial Software

Robots Wanted!

Package Architect

Requirements
ROS-Industrial Software Process
Recruiting

Do you have a job?

Yes

Do you like it?

Yes

ROS industrial

No

NO

Do you want one now?

Yes

ROS industrial

No

Fraunhofer IPA
ROS-I: What we do!