



ROS-Industrial Asia Pacific Consortium

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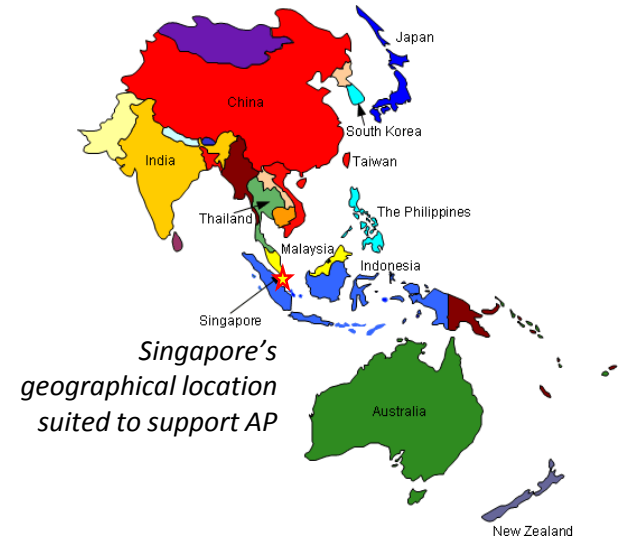


ROS-Industrial Consortium - AP



The Objective:

- Increase global competitiveness of the robotics industry through ROS development and adoption in Asia Pacific
- Develop ROS-Industrial talent pool through training, summer schools and workshops
- Address specific features for industry applications



Singapore's geographical location suited to support AP

Examples of ROS based products in Asia Pacific



Hope Technik (Singapore)



Ctrlworks (Singapore)



DJi (China)
VCs include Sequoia Capital, Accel



YuJin Robotics (Korea)



Kawada Robotics (Japan)



CSIRO – Bobcat (Australia)

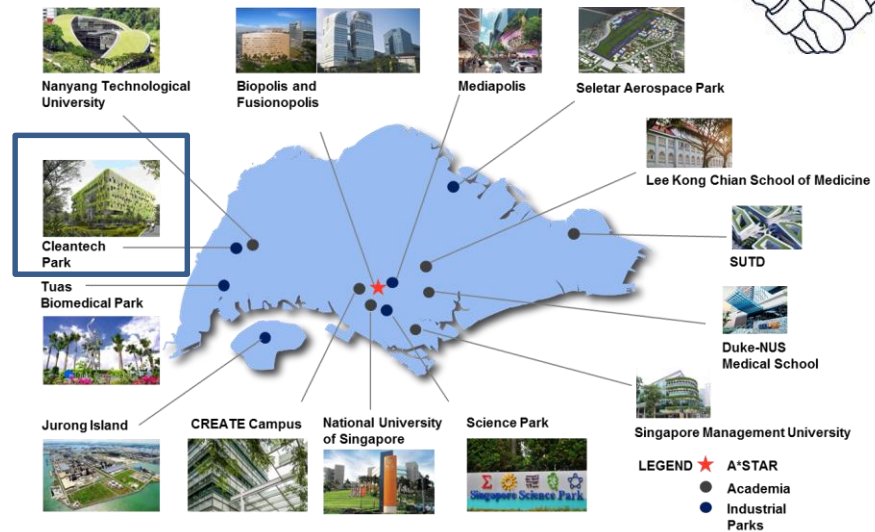
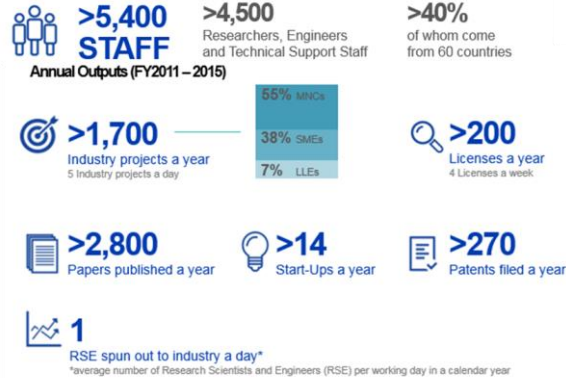




A*STAR, Singapore Research Ecosystem



Biomedical Research Council (BMRC) 10 Research Units	Joint Council Office (JCO)	Science & Engineering Research Council (SERC) 8 Research Units	ETPL Commercialisation	A*STAR Graduate Academy Scholarships
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Advanced Remanufacturing and Technology Centre, ARTC

- Industry-led Public-Private Partnership
- AxRC Model
- Mission – To Bridge the Gap from Research to Industry Applications for Remanufacturing & Manufacturing for Cross-Sectorial Industries



Current 46 Industry Members





ROS Statistics



unique wiki visitors Jan 2016 – July 2016

1.	United States	96,176 (22.76%)
2.	China	41,902 (9.92%)
3.	Germany	33,072 (7.83%)
4.	Japan	31,028 (7.34%)
5.	India	21,326 (5.05%)
6.	France	14,432 (3.42%)
7.	United Kingdom	13,225 (3.13%)
8.	Canada	11,278 (2.67%)
9.	South Korea	10,788 (2.55%)
10.	Spain	10,576 (2.50%)
11.	Italy	9,166 (2.17%)
12.	Russia	7,980 (1.89%)
13.	Taiwan	7,458 (1.76%)
14.	Brazil	6,683 (1.58%)
15.	Singapore	6,462 (1.53%)

- **6 AP countries in top 15**

visitors per million people

1. Singapore: 1167
2. Switzerland: 505
3. Germany: 404
4. Sweden: 394
5. Hong Kong: 370

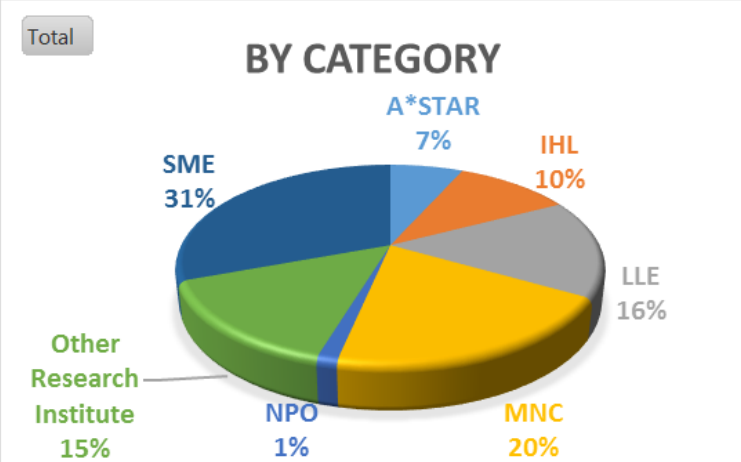
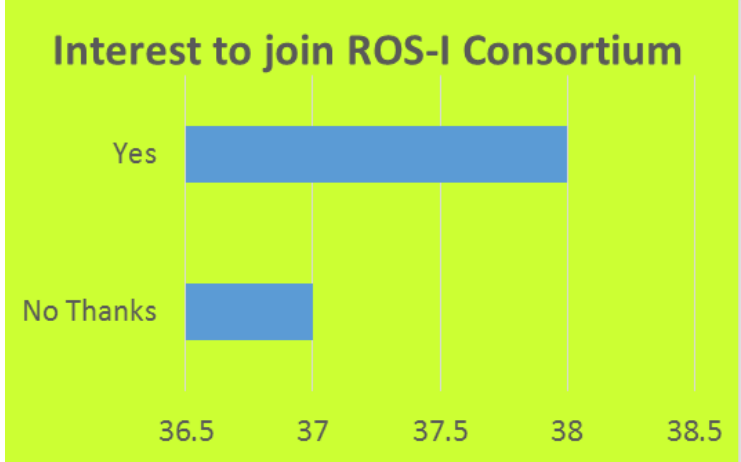
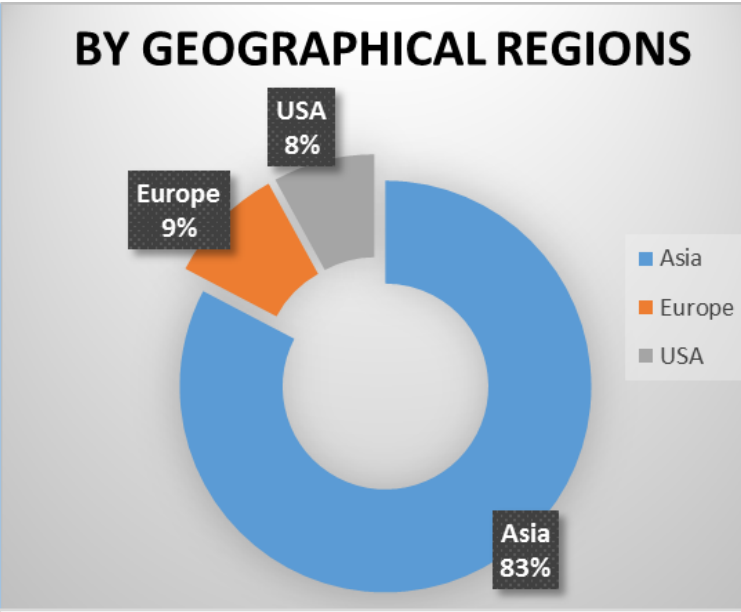
14. USA: 297



ROS-I AP Workshop 2017 – Registered Participants



Singapore
USA
Taiwan
China
Norway
Germany
Denmark
Japan

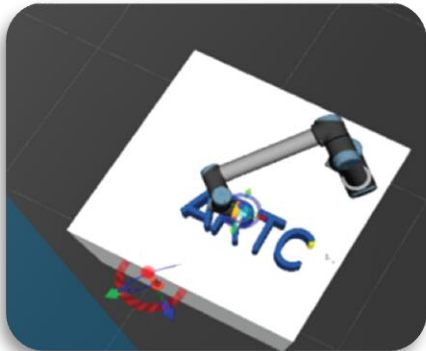




ROS-I AP Workshop - Demonstrations



Masking with Cartesian Path Planner



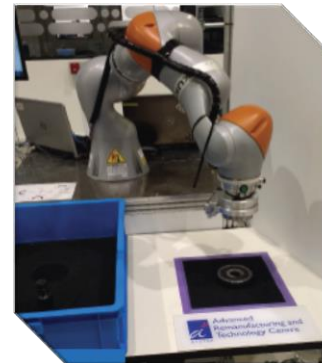
ROS Support Tools for Robotic Welding



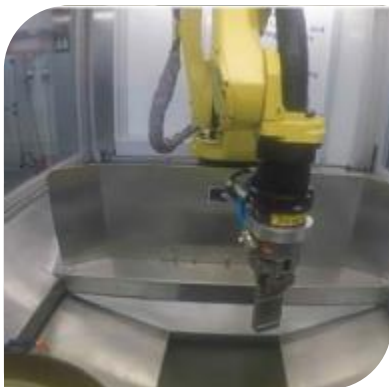
3D Vision Driven Flexible Robot Object Picking and Palletizing



D&D of Multi Purpose Gripper



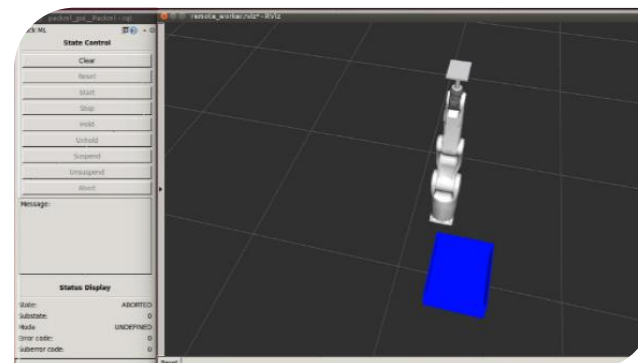
Fanuc Robot Surface Finishing



FTP: Robotic Blending – Milestone 4



FTP: PackML



Kindly note, **no photography and videos** allowed in the workshop area.

Selected images from the workshop photographer and videos will be made available for participants to access.





Membership Framework



Full Member

- Seat on the ROS-I AP Consortium Advisory Committee
- Voting on FTP priorities
- Live Technical Support
- Participate in FTPs
- As a FTP participant access to FTP Project data & reports
- ROS-I Training
- ROS-I roadmap input
- Attendance to all events
- Present related research

SGD 14,000

Associate Member

- Live Technical Support
- Participate in FTPs
- As a FTP participant access to FTP Project data & reports
- ROS-I Training
- ROS-I roadmap input
- Attendance to all events
- Present related research

SGD 7,000

Research / NPO

- Participate in FTPs
- As a FTP participant access to FTP Project data & reports
- ROS-I Training
- ROS-I roadmap input
- Attendance to all events
- Present related research

SGD 3,500

Government

- ROS-I Training
- ROS-I roadmap input

SGD 0

(Fee alignment with SwRI & Fraunhofer)





RIC-AP 2017 Activities



Confidential



Operational basic team

1
Applications development through focused technical projects and member specific projects

Exhibition Demonstration

ROS-I Focused Technical Projects ★

ROS-I Technical Capability Development ★

2
Training & Education

△ ROS-I AP Workshop (Singapore) May 25th – 26th

△ ROS-I Training (Singapore) Aug - TBC

△ ROS-I Summer School (Singapore) Nov - TBC

★

3
Networking Activities

△ ICRA 2017 (Singapore) May 29th – June 3rd

△ ROSCon (Canada) Sept 21st – 22nd

△ Automate 2017 (USA) April 3rd – 6th

△ RIC-NA Annual Meeting (USA) Apr 7th

△ ROS-I Conference (Germany) Dec 12th – Dec 14th

★ Membership benefits





ROS-Industrial Process: Proprietary Modules / Applications



Open Source



Process to select modules and application

ARTC Facilities (Cobots, Industrial Robots)
NTU Resources / Facilities

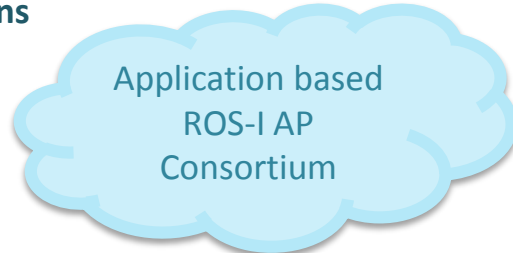
**Closed
Company Proprietary**



Local SME to provide Problem
Statements for Member Projects

“Selected” information by Member can
be released to Open Source

**Advanced Applications
→ Closed**



NTU Resources / Facilities



Improving existing OS for our use





ROS-I AP Consortium: PackML



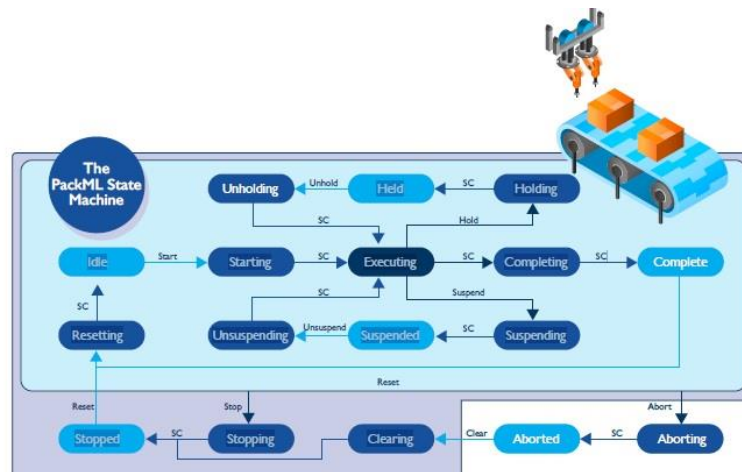
- PackML collaboration project:



- **Benefits:** Ability to run ROS across multiple OEM PLCs for manufacturing plants for communication between PLCs, increased interoperability, modular and efficient

- **Current Status:**

- **Developed** open-source C++ library (Boost) or python (SMACH)
- **ROS as PackML Master**, Remote PLC as an equipment module

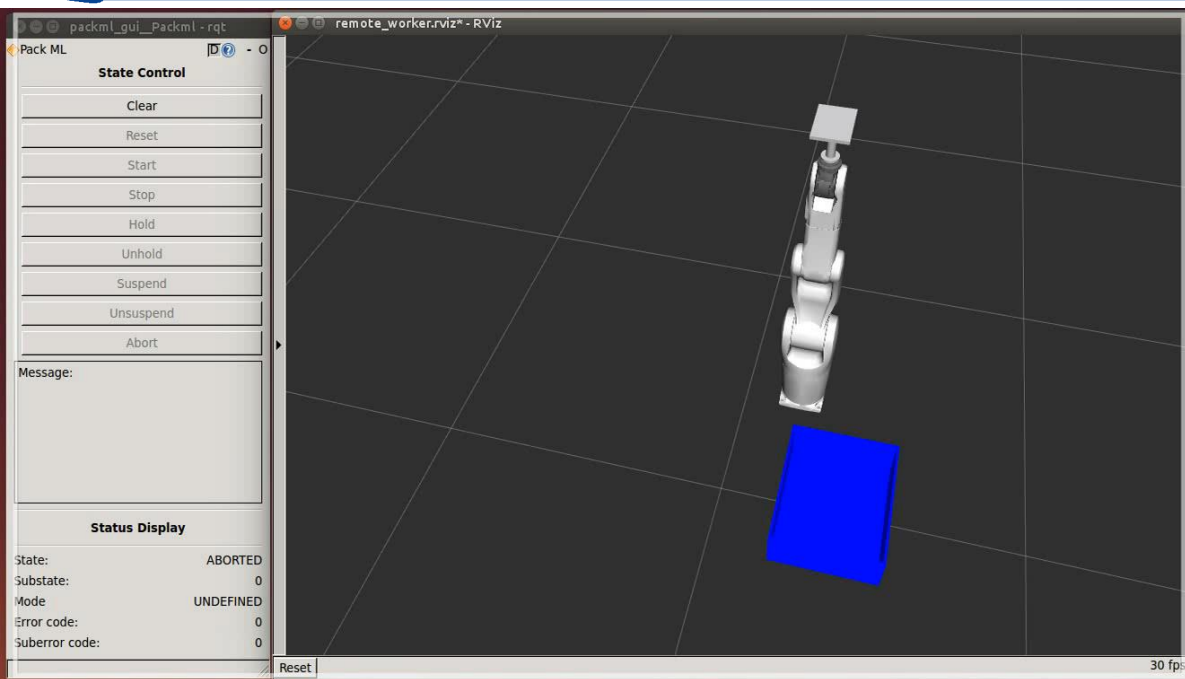


PackML (Packing Machine Language) state machine commonly used by PLCs in packaging





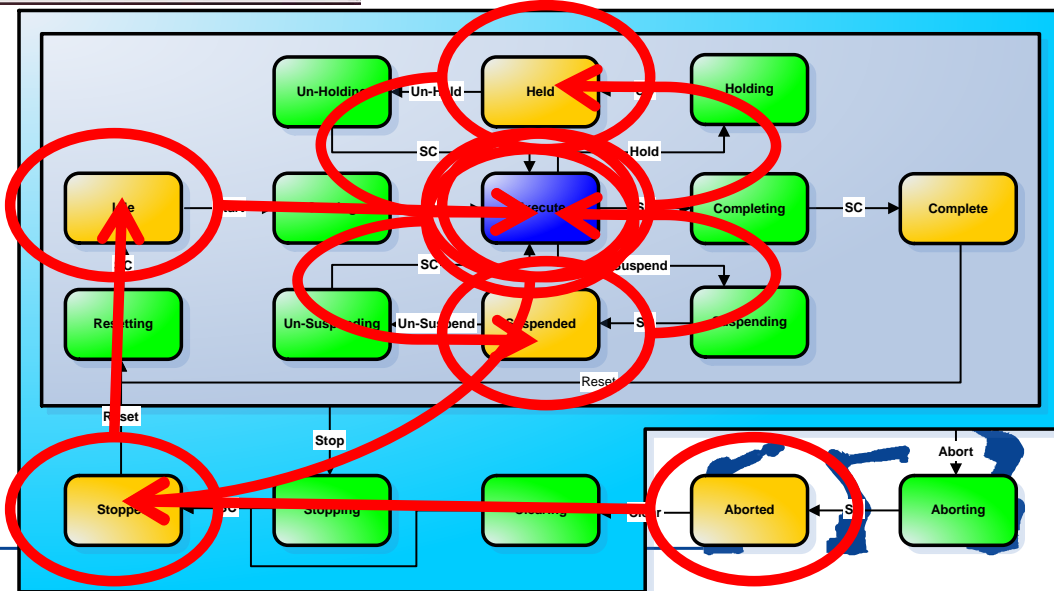
PackML Demonstration



Aim: PackML state transitions initiated from PackML GUI

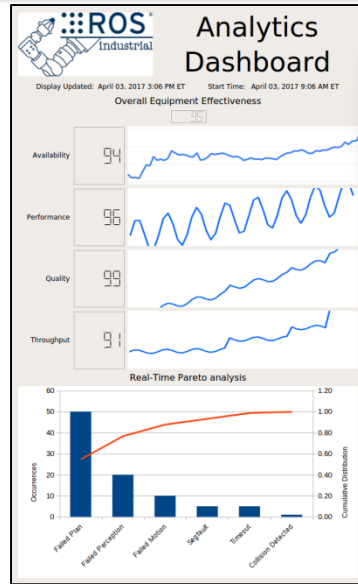
Benefits:

- State machine applied to ROS C++ node for any industrial application
- State control reporting ROS-I messages, reusable GUI widget





- Wikipedia: PackML (Packaging Machine Language) is an industry technical standard for the control of [...] industrial automation.
- PackML provides:
 - Standard defined machine states and operational flow
 - Overall Equipment Effectiveness (OEE) data [4]
 - Root Cause Analysis (RCA) data[4]
 - Flexible recipe schemes and common SCADA or MES inputs[4]
- The Business Analytics Dashboard (pictured right) provides the user an intuitive display of **the real-time root cause analysis and OEE**



Approach

- Open source tools will be used to create the Dashboard, there is no need to “invent the wheel” on any components, leveraging the benefits of ROS.
- The components for development are available gui (QT), plots (pyqtplot) and communication with the robot (ROS).
- A generic PackML test system is available to developers for testing
- A web-based Ruby on Rails implementation of the dashboard is desirable for operation on ANY system (windows, tablet, etc.)

Metrics for success:

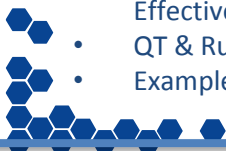
- **GUI demonstration on PackML system**

Motivation/Objective

- **Motivation:**
 - Displaying the real-time OEE allows the end-user to **measure and increase the ROI of the robot asset.**
 - Standardization using the PackML state machine allows for swift implementation and reporting.
- **Objectives:**
 - Real-Time Pareto Analysis
 - Instantaneous & Historical OEE (Overall Equipment Effectiveness)
 - QT & Ruby on Rails implementation
 - Example code and documentation

Scope Of Work

- Developer 1
 - Task: QT implementation of OEE displays
 - Schedule: 1 week
- Developer 2
 - Task: QT implementation of Pareto Analysis
 - Schedule: 1 week
- Developer 3:
 - Task: Documentation, Examples & Testing
 - Schedule: 2 week
- Developer 4:
 - Ruby on Rails implementation of the
 - Schedule: 3 weeks





PackML Call for Contributors



Current Contributors:

- ROS-I AP: Mingli Han, SMACH and remote plc
 - PlusOne Robotics: Shaun Edwards, C++ Package
 - 3M: Schoen Schuknecht, Lex Tinkett, Tom Strey: PLC and PackML support
 - SwRI: Austin Deric, Paul Evans
-
- Call for contributors and testers: C++ Package, SMACH, GUI interface
 - Call for contributors for next phase (3-4 months)
 - Business Analytics Dashboard





<Contact Info>



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