ROS-Industrial North America Updates and Application Highlights

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ROS-Industrial Conference 2019 | Stuttgart | Fraunhofer IPA
Highlights

- Membership Growth
- Automate 2019
- ROS-I Americas Annual Meeting
- Consortium Member Feedback
- ROS-I Training
- ROS 2.0
- Community Engagement
- Application Highlights

New 2019 Members
Automate 2019

• ROS 2.0 Demo
• Many ROS-I enabled exhibitors
Automate 2019 Star Attraction
2019 ROS-I Consortium Americas Annual Meeting

S is... SIMPLE
- First Robotics High School Student Platform.
- Approachable to entry level developers.
- Simplifies complicated communication code.
- Built-in libraries to handle intensive calculations such as:
  - Spatial Transformations
  - Kinematics
  - Jacobians
  - Extensive build tools and documentation.

S is... POWERFUL
- Framework on which any custom architecture can be built.
- Extensible and modular.
- Enables rapid development.

Engaging Line Up of Speakers, and working sessions, featuring a Panel on ROS2 – Is ROS2 Ready for the Factory Floor?

Dr. Dave Coleman - CEO of PickNik Consulting
Chris Lalancette - software developer at Open Robotics
Matt Hansen - Sr. Robotics Software Architect at Intel Corporation
Jerry Towler - Software Lead/ROS-M Lead at Southwest Research Institute
2019 ROS-I Consortium Feedback

Direction-Setting Feedback from ROS-I Americas Consortium Membership

• **Soft/Communication Needs/Resources**
  - Perception of Open-Source, ROS, performance, security
  - **Practical Case Studies, ROI Use Cases/Examples, simple explainers (ROS v ROS-I, 1 v 2)**
  - How to for things like: dockers, Windows, application to custom robot
  - **Reduce learning curve**

• **Technical Needs**
  - **Non-programmer user capabilities/tools**
  - Improve simulation capabilities
  - OEM Supported Drivers
  - Industrial Grade Localization
  - **Planners – multi-query, smooth motion in Cartesian space, time consistency**
  - Real-time
  - Use of ROS in leverage of built in controller features (Sensors, grippers, external I/O)
  - **Auto-recovery – all level faults**
Vision Development for ROS-I High Level/Global

High Level Strategic Goals (examples)

- Quality, Improved User Experience, Novel Intelligent Capability

Lower Level Focus Areas/Thrusts

- CAD to ROS
- Developer Tools
- Perception
- 3D Reconstruction
- L, OEE Dashboards
- MTConnect/PackML

- Advanced Capability
- Interopability

- Collaborative
- Voice Command

- Human Interface & Reaction

Members

ROS Industrial Consortium
Initiatives

• Building a complete ROS2 system
• Supporting ROS and ROS2
• Launching FTPs relevant to the community
• Providing new capabilities at a greater frequency
  • Tesseract
  • TrajOpt
  • YAK
  • Reach
• More knowledge sharing – perception sensor benchmarking; DDS implementation benchmarking
Goal for Future Development

- Environment Layer (MoveIt, Tesseract, Dart, etc.)
- ROS 1 / ROS 2 / Middleware Layer
  - Messages, Topics
- Independent of ROS
  - Collision Detection
  - Motion Planners
  - Kinematic Solvers
  - Connectivity Structure

Build ROS1 or ROS2, these are independent.

Continue to support deployed end-user ROS1 systems with new capabilities as they are developed even if for a ROS2 solution.
Community Engagement

- Meetups
- World MoveIt Day
- World ROS-I Day
Training

• Introduction to ROS2 (Dashing)
  • Intended for those familiar with ROS
  • Highlight what is different from ROS
  • Exercises include
    • Getting set up
    • Services
    • Actions
    • Porting
    • Utilizing the Bridge

• First course was 8 October in San Antonio, TX
Two Key Mechanisms for Advancing ROS-I

**ROS-I Focused Technical Projects**

- Tech Demonstration of Robotic Blending Milestone 4
  - Caterpillar, 3M, GKN Aerospace, Wolf Robotics
  - [https://youtu.be/PWCpehyKnTY](https://youtu.be/PWCpehyKnTY)

**Member Contributions & Projects**

- Visual Programming – Teaching Robots through Demonstration of Tasks
  - SwRI Internal Research & Development Program
FTP Goals, Process, Topics

• Collaborative Multi-member Projects to Solve Challenges or Develop foundational capabilities that benefit the membership/industrial community

• Championed by a member, usually involves demonstration via application/use case, and costs split equally across team

• Current Topics:
  - Robotic Blending Milestone 5
  - Dynamic Reprogramming
  - ROS-I Workbench
  - MoveIt2
  - Unified Calibration Framework
  - Simulation for Verification and Validation
  - Teaching through Motion Capture
  - Coordinated Mobility and Synchronized I/O
Recent Projects Launched - Americas

• ARM Institute Projects Launched Leveraging ROS and ROS-I
  • ROBOT ASSISTANT FOR COMPOSITES MANUFACTURING
  • SMART COMPANION ROBOT (SCR) FOR AUTOMOTIVE ASSEMBLY
  • COLLABORATIVE ROBOTIC SANDING OF AIRCRAFT PANELS
  • ROBOT RACONTEUR (RR): AN INTEROPERABLE MIDDLEWARE FOR ROBOTICS
  • SEAMLESS MULTI-ROBOT, MULTI-MAC INTEROPERABILITY
  • OPEN SOURCE TEACH PENDANT PROGRAMMING ENVIRONMENT

• ARM Institute Tech Projects often leverage open-source content and submit back

Reference: arminstitute.org/projects
Evolution of “Scan-n-Plan”
Noether, Tesseract & Trajopt in Action...

Intuitive Process Application – Registration, Multi-Process Planning
A5 – Agility in Aerospace Applications
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Robotically Integrated Prepreg Layup

- Collaborative Robot Solution – Human and Robot Work Together
- Adaptive solution with ROS-I enable parts of the workflow
Advanced Systems Development

• Sharing information between multiple traditional industrial systems and tools
• Managing dynamic manufacturing environments
• Reduce reliance on hard to find skill sets and accelerate operations where high mix/low lot is required
• Custom Mobile Robots
  • Bring the process to the part
  • Share information between systems
  • Improved agility
  • Multi-Process
  • Efficiently manage high mix of product
Upcoming Events

- February Training 2020 – hosted by new member Glidewell Laboratories in Irvine, CA

- ROS-I Americas Annual Meeting 2020 – hosted by Southwest Research Institute, San Antonio, TX March 4-5, 2020
  - Day 1 – open to public – presentations and demonstrations
  - Day 2 – members only – use cases, experiences, insights/updates on capability – FTP teaming/project topic workshop
We Advance ROS-I Together
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