ROS-Industrial Consortium Americas Community Meeting

Matt Robinson

ROS-Industrial Consortium Program Manager

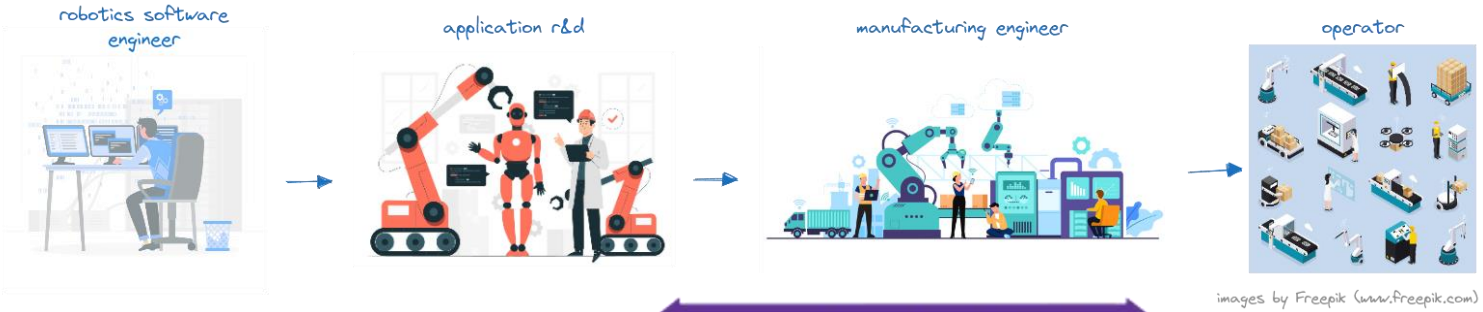
December 20, 2023

Q4 2023

Agenda

- 10:00 – Welcome
- 10:05 – ROS-Industrial Consortium Activities
  - Status on Activities and Initiatives
  - Training Update
  - Event Planning and Americas Annual Meeting
  - FTP – Collaboration Project Update
- 10:20 – Tech Updates
  - ROS-I Americas Tech Contributions/Developments – Michael Ripperger
  - Open Source Developments – tolerance for way points – Tyler Marr
- 10:45 – SWORD – Close to official release
- 10:55 – Open Forum

ROS-I Mission



- Mission
  - What do we work on?
  - How should our tools work?
- Where are we now?
- Where do we want to be?

Shaping a Roadmap - Feedback

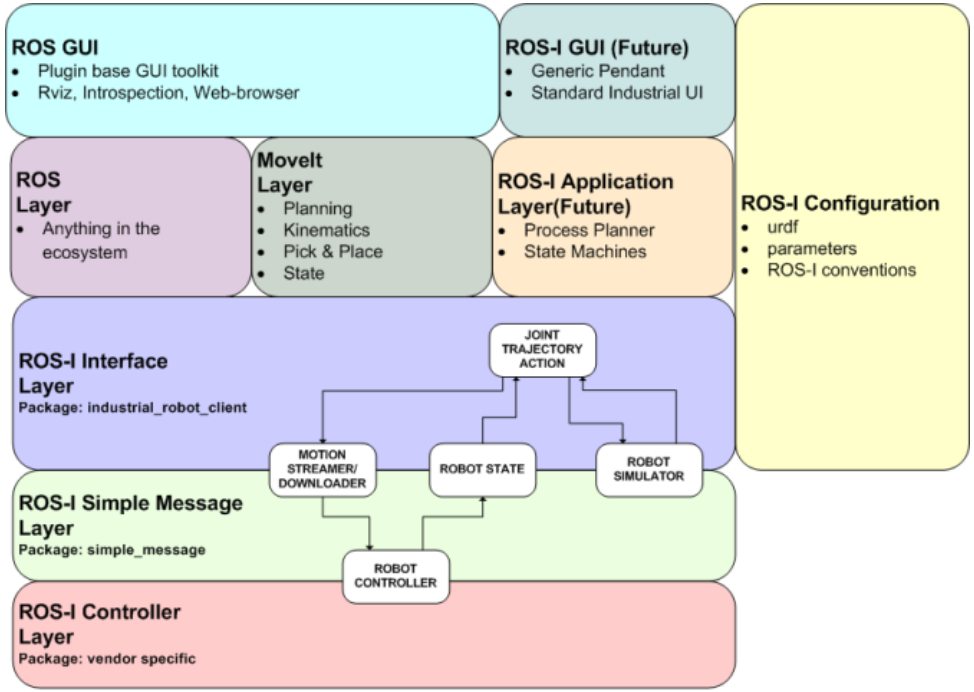
- Workshops gathering need of commmunity
- OEM outreach and more resources for education and enable more contributions and leverage on hardware
- Leverage events to create persistent tools
  - Reach Workshop

Additional Training/Learning Resources	Common Behavior for Interfaces	Usability of Existing Tools
• Executors, Composable Nodes, Lifecycle Nodes • Optimization – RMW, Networks • Calibration – LIDAR, Go/No Go Checks • Tool Path Gen from CAD • Human Robot Interaction Tools/Practices •AR/VR •Language Models • ROS System Performance Tools	• Report Joint States • Recommendations/ Specs for Drivers • Common Joint Names • Remote Motion Interface • Common start up • Read/write I/O • Driver Benchmarking for Performance •Accuracy •Accel/Jerk •Latency •Config Difficulty	• Reachability Analysis – Robot Base Placement w/predefined cell • Rviz Web based dev tool – RoboWeb Tools • Usability of existing Tools •Commissioning •Debug/Calib •Training •Match Actual Workcell to URDF •ROSdep package version •Training on CI •Layered Docker Images

Supporting ROS 2 and manipulators

- Inquiries regarding porting of industrial_core and use of legacy drivers
  - There is NO Plan to port industrial_core – NOTE: an initial port is working
- The goal is to leverage OEM provided external motion interfaces and incentivize OEMs to create interfaces between their interfaces and ROS 2
  - UR – via ros2_control
  - Yaskawa – MotoROS2 + micro-ROS (official supported release May ‘23)
  - Kuka driver support announced July ‘23
- Highlight OEM provided solutions to encourage more OEMs to offer an interface solution they can support

Supporting ROS 2

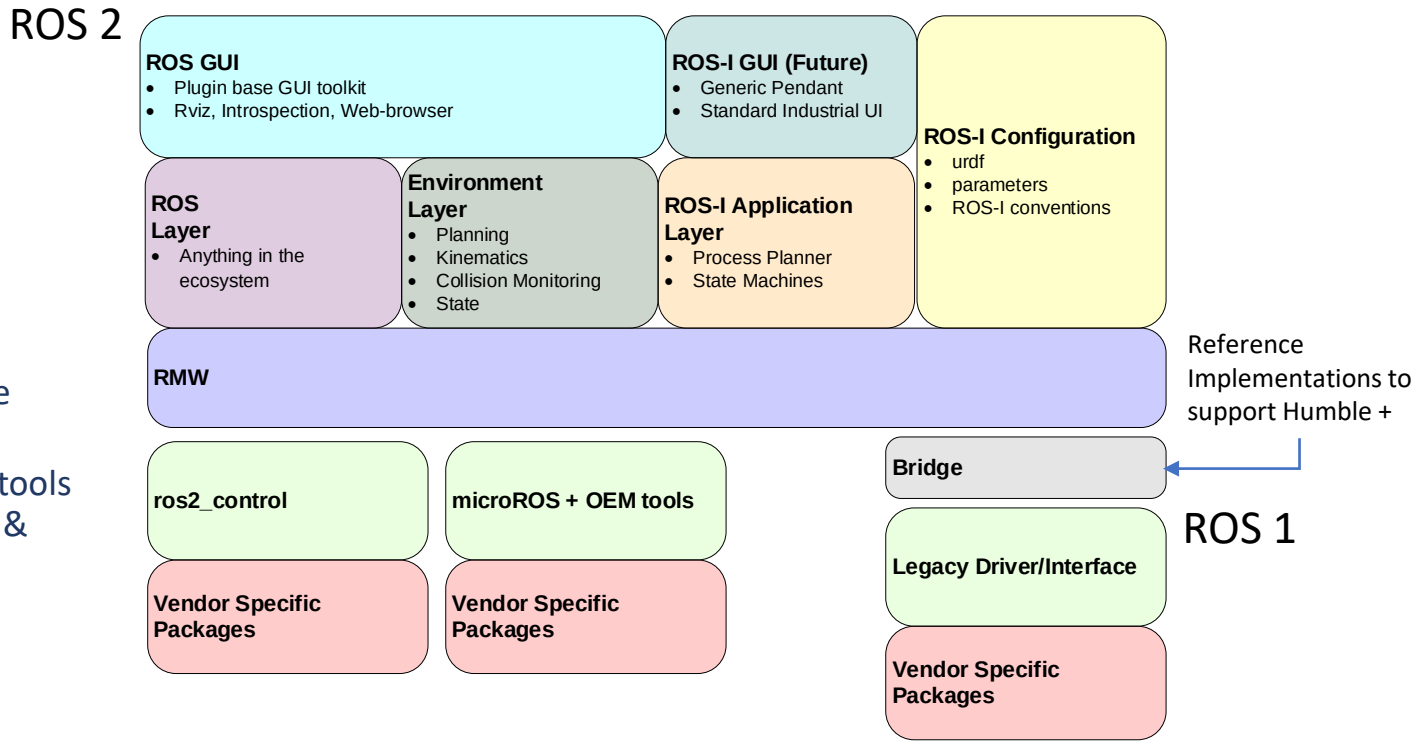


ROS-Industrial High Level Architecture - Rev 0.02.vsd

ROS 1

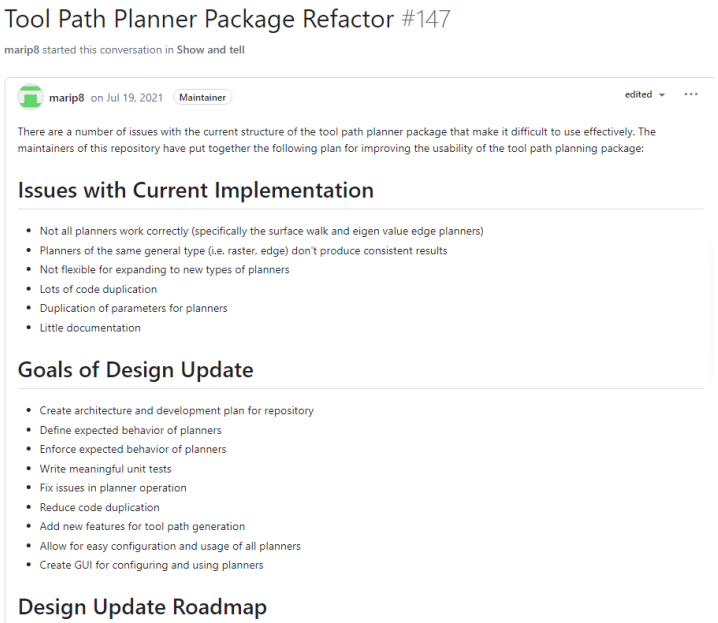
Moving Forward

- Additional paths to offering interfaces
- More OEMs offer external motion interfaces
  - Minimal interface development
  - Able to leverage tools like ros2_control & micro-ROS



Actions

- Create an Industrial Robot Driver ~~Specification~~ best practices for ROS 2
  - Planning phase – draft template early ‘24
  - Provide pathway for OEMs to build out
- Continue to add roadmaps to ROS-I repositories
  - Noether
  - Tesseract
  - TrajOpt



Tool Path Planner Package Refactor #147

marip8 started this conversation in **Show and tell**

marip8 on Jul 19, 2021 Maintainer edited

There are a number of issues with the current structure of the tool path planner package that make it difficult to use effectively. The maintainers of this repository have put together the following plan for improving the usability of the tool path planning package:

Issues with Current Implementation

- Not all planners work correctly (specifically the surface walk and eigen value edge planners)
- Planners of the same general type (i.e. raster, edge) don't produce consistent results
- Not flexible for expanding to new types of planners
- Lots of code duplication
- Duplication of parameters for planners
- Little documentation

Goals of Design Update

- Create architecture and development plan for repository
- Define expected behavior of planners
- Enforce expected behavior of planners
- Write meaningful unit tests
- Fix issues in planner operation
- Reduce code duplication
- Add new features for tool path generation
- Allow for easy configuration and usage of all planners
- Create GUI for configuring and using planners

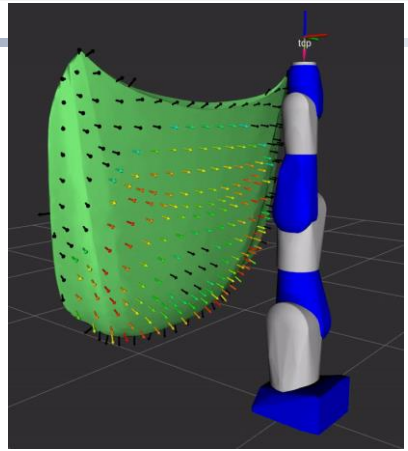
Design Update Roadmap

Training for 2024

- Planned three training events for ‘23
  - Feb 2024 – registration opening soon!, San Antonio
    - Advanced Topic: TBD (suggestions?)
  - July 2024 – Open to member hosting! Contact MR!
  - October 2024 – San Antonio, TX or member hosted
- Seeking options for additional training topics/workshops
  - Suggestions for lab exercises to Day 3 in ROS 2
- Bite Size Learning – recorded educational on a smaller topic – targeting 3-6 minutes in length – still seeking options
  - Submit topics to Matt Robinson, RIC Americas PM

Workshop(s)

- Seeking to set up a Scan-N-Plan workshop – possible in conjunction with Americas Annual Meeting
- Open to member hosted
- ROSCon23 Workshop
  - REACH - https://roscon.ros.org/2023/
- ROS-I AP Workshop – Tuning Motion planning parameters for manipulators



Updated to the website!

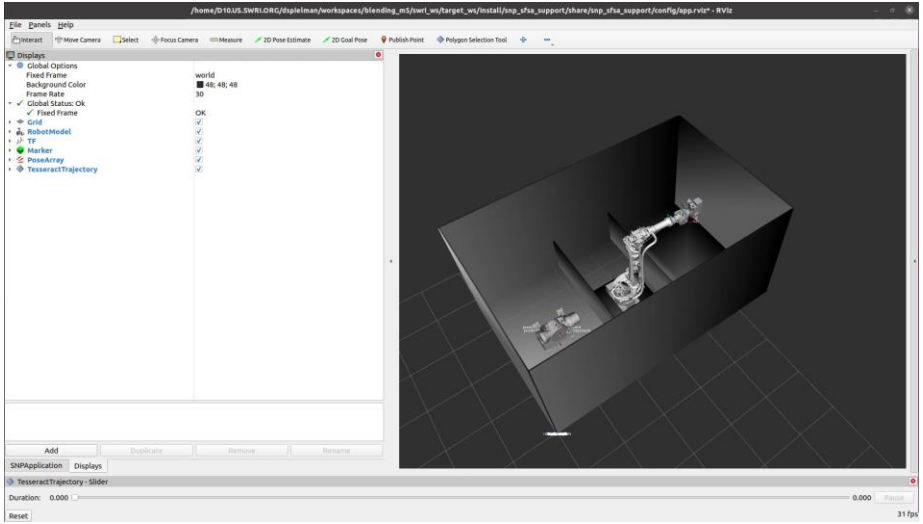
- Hoping to launch in Jan 2024
- Easier ties to the repos and resources – both open source and for Consortium members

ROS-I Annual Meeting – March 2024

- Two Day Event in San Antonio
- Demonstrations/Lab Tours
  - Members can exhibit
  - Will contact each member regarding interest
- Workshops
  - Collaboration ideas/initiatives
  - Technical workshop
    - Motion Planning
    - Application Configuration
    - Other ideas?
  - Add on day for hands on workshop (?)

FTP Update - Robotic Blending M5

- Progressing toward demonstration in a foundry – mid Feb ‘24
- Contributions to:
  - https://github.com/ros-industrial/noether - sub mesh visualization
  - https://github.com/ros-industrial-consortium/scan_n_plan_workshop
    - Dynamic scan trajectory execution
    - Additional Python Nodes
    - Docker



Tech Updates

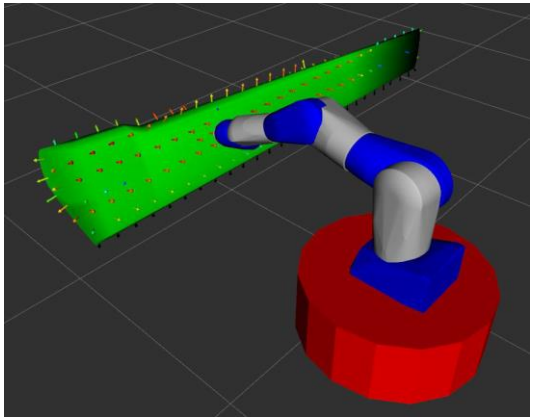
- Michael Ripperger – ROS-I Americas
- Tyler Marr – Cartesian Tolerance Waypoints

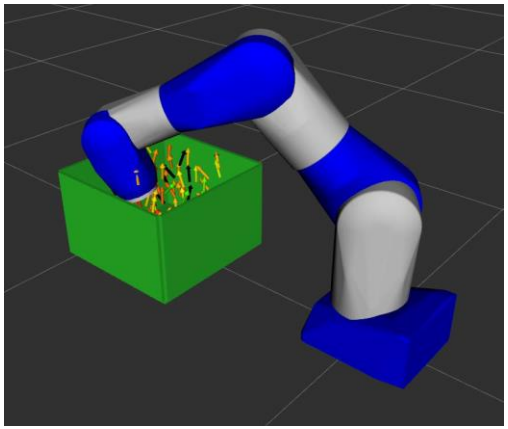
Tech Updates

- REACH
- Noether
- Industrial Calibration
- Usability

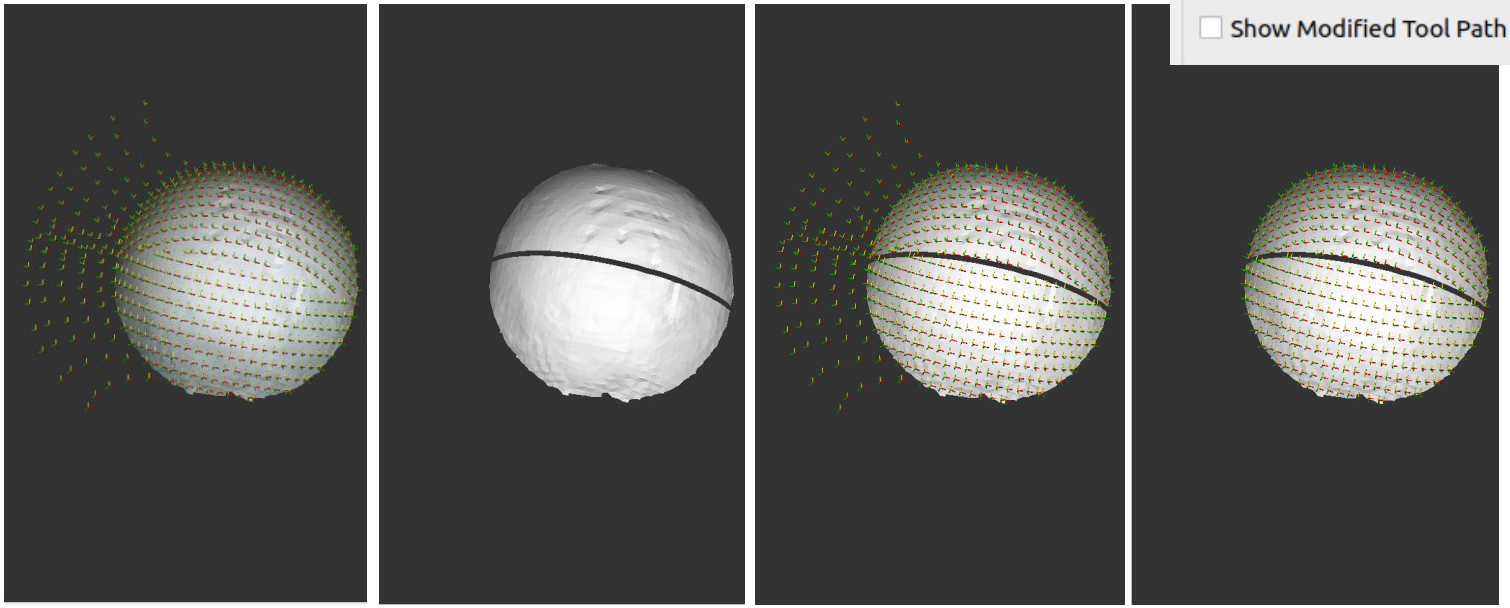
REACH

- ROSCon2023 WorkshopIntroduction to reach studies with REACH
- 2 demos for running reach studies for non-standard applications
- https://github.com/marip8/reach_roscon_2023



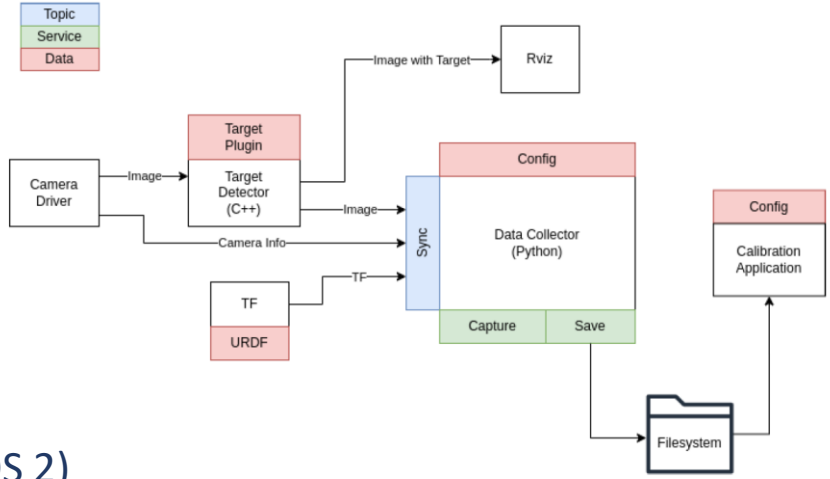


Noether


Viewer
Axis Size (m) 0.010
Show Original Mesh
Show Modified Mesh(es)
Show Original Tool Path
Show Modified Tool Path

Industrial Calibration

- History
  - industrial_calibration-> robot_cal_tools-> ???
  - Want to support ROS 1 and ROS 2
  - Need slight reorganization oflibraries and applications
- Updates
  - https://github.com/ros-industrial/industrial_calibration/tree/main
- Future development plans
  - Data collection pipeline (Python –ROS 1, ROS 2)
  - Calibration applications (GUI-based)



Usability

- ROS1 Bridge
  - Patch to support actions
    - https://github.com/ros-industrial/ros1_bridge
  - Noetic <-> Foxy
    - Docker image
    - docker pull ghcr.io/ros-industrial/ros1_bridge:noetic-foxy
  - Noetic <-> Humble
    - ROS1 for Humble via conda
    - Working on Docker image creation

Usability

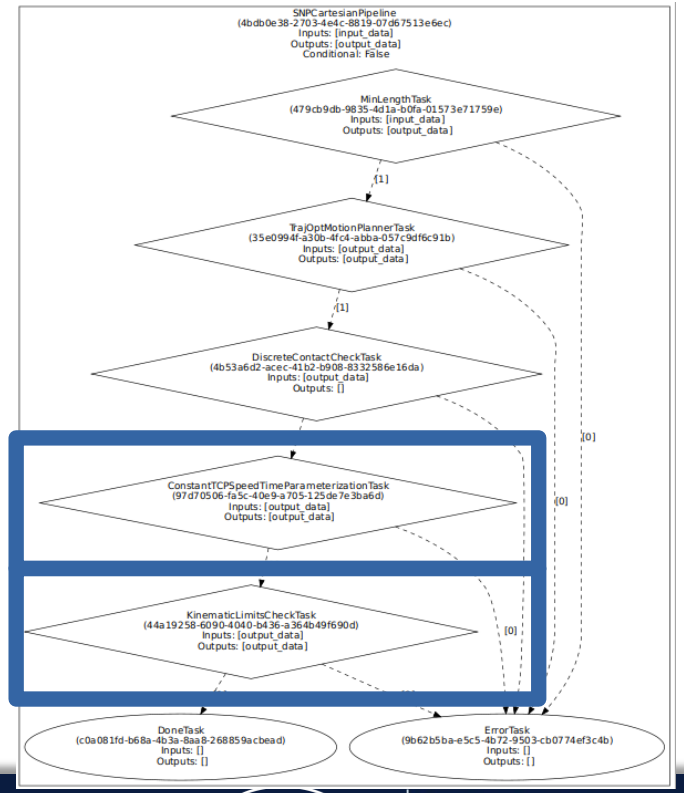
- Updated Docker images for Tesseract
  - Considerably smaller size
  - Easier to use than previous ICI-generated images
- Working on propagating Docker images to Scan 'n Plan Workshop application(s) for easier deployment

Custom Tesseract Tasks Using Plugins

Tyler Marr

Using Custom Tasks in Tesseract Motion Planning Pipelines

- Implemented 2 custom tasks in the Scan-N-Plan workshop repo:https://github.com/ros-industrial-consortium/scan_n_plan_workshop/tree/master/snp_motion_planning/src/plugins/tasks
- Constant TCP Speed
- Kinematic Limits Check



Using Custom Tasks in Tesseract Motion Planning Pipelines

- Allows for developing and easily incorporating custom/proprietary motion planning tasks
- Used at SwRI for a project, easy to drop into our motion planning pipeline

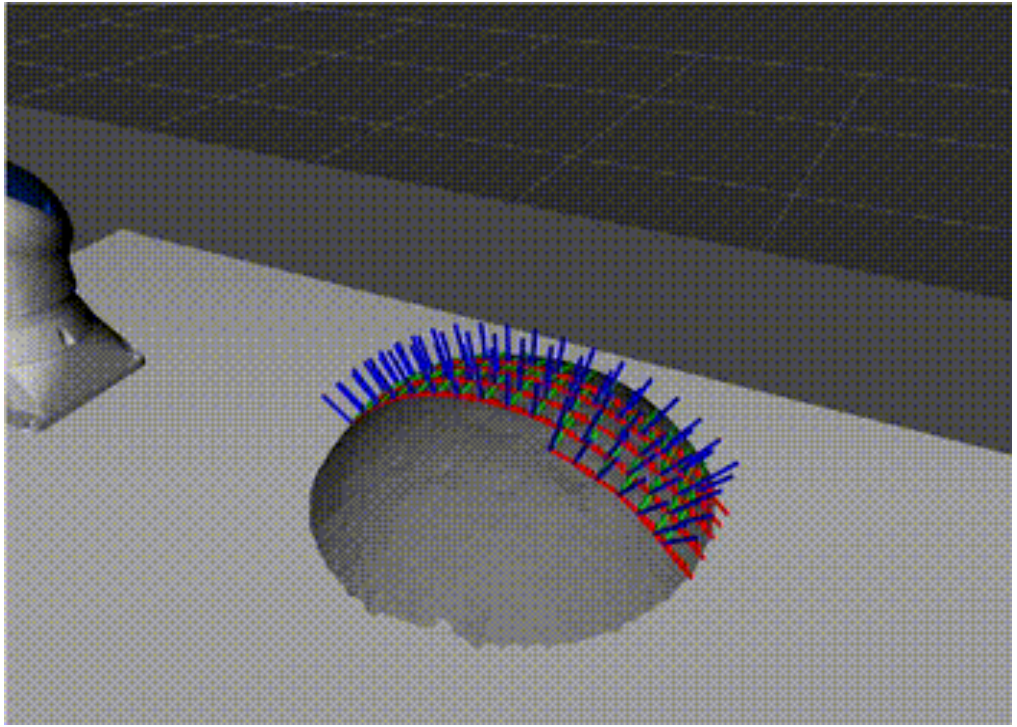
Cartesian Tolerance Waypoints in a PR for TrajOpt

Tyler Marr

Cartesian Tolerance Waypoints in a PR for TrajOpt

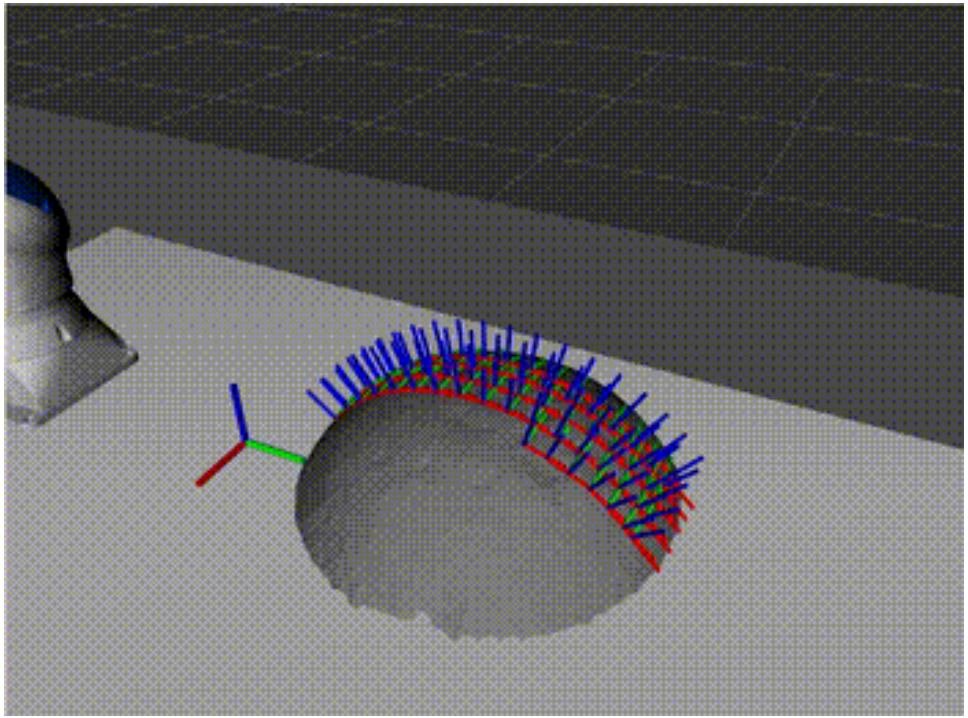
- Currently Cartesian waypoints must reach the exact position
  - Often requiring accuracy beyond manipulator capability
- Almost all real applications have available tolerance
- This allows users to specify the tolerance

Failed TrajOpt Plan



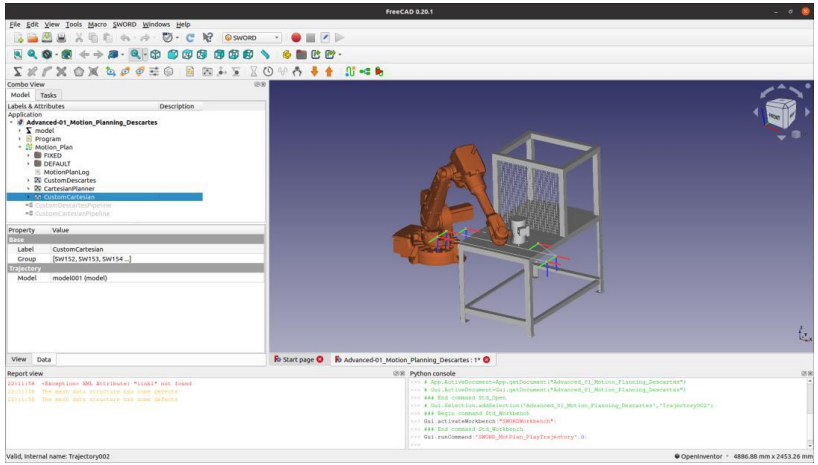
Successful TrajOpt with Tolerance

- 1.5 cm (x,y)
- 0.15 cm (z)
- 0.01 rad (r/p)
- Free z rotation



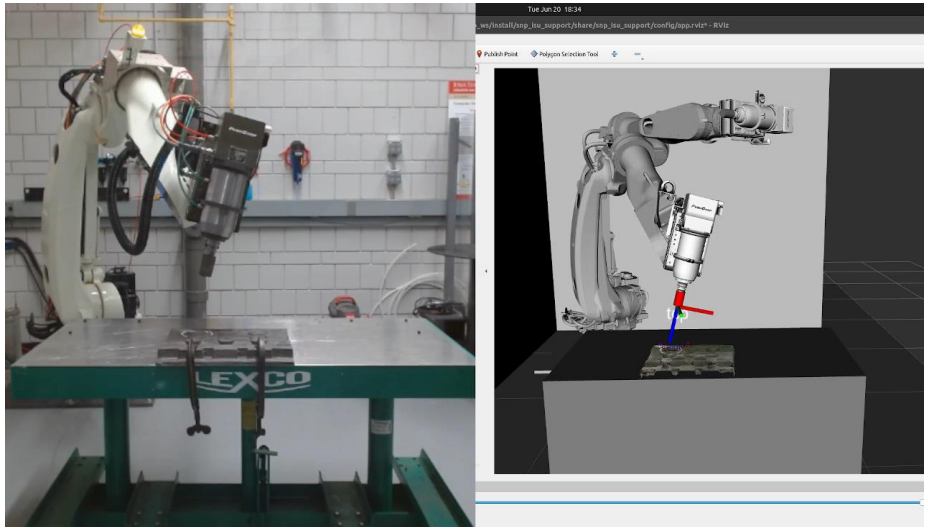
SWORD

- ROS-I planning tools in a CAD environment
- Alpha release planned for early January 2024
- Upcoming new features
  - Export to robot-native files (via RoboDK)
  - CAD to path
  - Integration with Noether
  - Raster planning
  - Meta-planning integration
  - Remote TCP
- Sandbox for motion planner configuration training



Open Forum

- Topics?

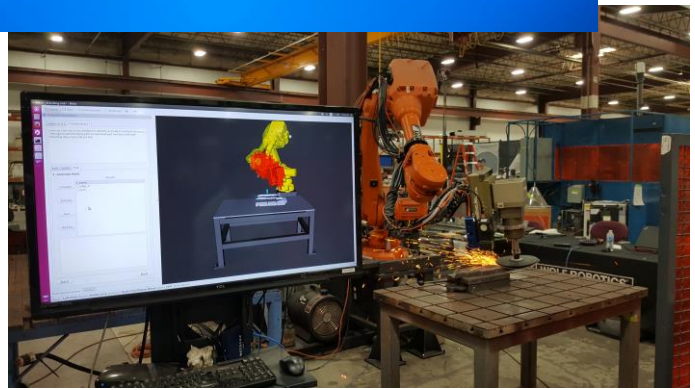


Resources for the Community

- ROS-Industrial
  - Home: rosindustrial.org
  - Documentation: wiki.ros.org/industrial
  - Code: https://github.com/ros-industrial; https://github.com/ros-industrial-consortium
  - Training: http://ros-industrial.github.io/industrial_training/
  - ROSin: http://rosin-project.eu/
- Upcoming Events (https://rosindustrial.org/events-summary/)

Thank You!

- Provide feedback
- Seek out ways to collaborate
- Engage your supplier/partners on ROS use
- Reach out if you need help



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