

# Movelt 2

The developer experience  
on Humble and beyond

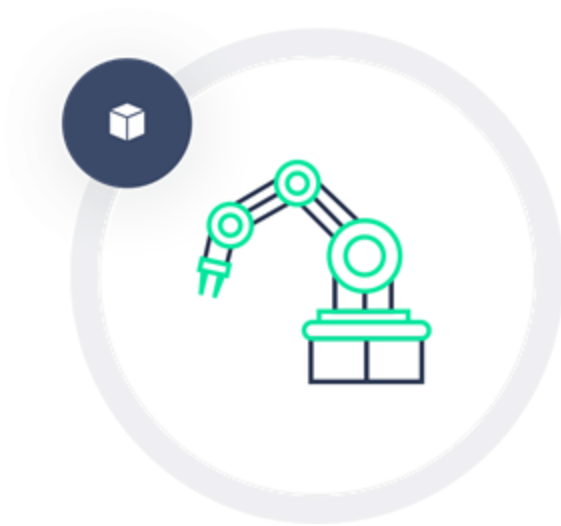
June 10, 2022

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- **What's new in Movelt?**
- **What's on the roadmap?**
- **What's Movelt Studio?**



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# What's new in Humble for MoveIt users?

# Revamped tutorials!

Revamped and new [moveit2\\_tutorials.picknik.ai](https://moveit2_tutorials.picknik.ai) content is now targeted for specific questions

- [Tutorials](#) walk you through creating your first project with MoveIt
- [How-To Guides](#) answers the question “How to do X with MoveIt?”
- [Concepts](#) discusses the design of MoveIt

New [Getting Started With MoveIt video series](#)

- Tutorial walkthroughs
- Learn how to contribute to MoveIt

# Launch file best practices and tools

[moveit\\_configs\\_utils](#) simplifies writing your launch files

+95 -398 ■■■■■■

```
5 - from ament_index_python.packages import get_package_share_directory
6 -
7 -
8 - def load_file(package_name, file_path):
9 -     package_path = get_package_share_directory(package_name)
10 -     absolute_file_path = os.path.join(package_path, file_path)
11 -
12 -     try:
13 -         with open(absolute_file_path, "r") as file:
14 -             return file.read()
15 -     except EnvironmentError: # parent of IOError, OSError *and* WindowsError where available
16 -         return None
17 -
18 -
19 - def load_yaml(package_name, file_path):
20 -     package_path = get_package_share_directory(package_name)
21 -     absolute_file_path = os.path.join(package_path, file_path)
22 -
23 -     try:
24 -         with open(absolute_file_path, "r") as file:
25 -             return yaml.safe_load(file)
26 -     except EnvironmentError: # parent of IOError, OSError *and* WindowsError where available
27 -         return None
28 + from moveit_configs_utils import MoveItConfigsBuilder
```

```
31 - # Get URDF and SROS
32 - robot_description_config = load_file(
33 -     "moveit_resources_panda_description", "urdf/panda.urdf"
34 - )
35 - robot_description = {"robot_description": robot_description_config}
36 -
37 - robot_description_semantic_config = load_file(
38 -     "moveit_resources_panda_moveit_config", "config/panda.srdf"
39 - )
40 - robot_description_semantic = {
41 -     "robot_description_semantic": robot_description_semantic_config
42 - }
43 -
44 - kinematics_yaml = load_yaml(
45 -     "moveit_resources_panda_moveit_config", "config/kinematics.yaml"
46 - )
47 -
48 - # Planning Functionality
49 - ompl_planning_pipeline_config = {
50 -     "move_group": {
51 -         "planning_plugin": "ompl_interface/OMPLPlanner",
52 -         "request_adapters": """default_planner_request_adapters/AddTimeOptimalPathParameterAdapter
53 -         "start_state_max_bounds_error": 0.1,
54 -     }
55 - }
56 - ompl_planning_yaml = load_yaml(
57 -     "moveit_resources_panda_moveit_config", "config/ompl_planning.yaml"
58 +
59 + moveit_config = (
60 +     MoveItConfigsBuilder("moveit_resources_panda")
61 +     .planning_pipelines(pipelines=["ompl"])
62 +     .robot_description(file_path="config/panda.urdf.xacro")
63 +     .trajectory_execution(file_path="config/gripper_moveit_controllers.yaml")
64 +     .to_moveit_config()
65 + )
```

# Launch file best practices and tools

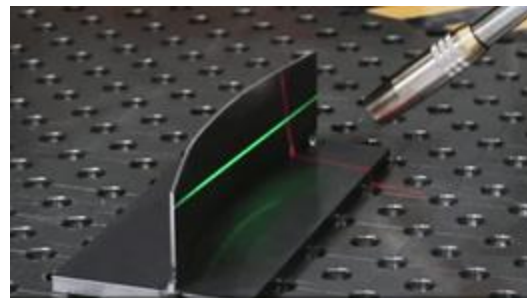
[moveit\\_param\\_builder](#) simplifies loading your launch parameters

- Avoid complex `launch_ros.substitutions`
- Stores yaml, xacro or general file parameters into internal container
- Handles standalone parameters with one value
- Supports path handling for argument passing when needed (e.g. `.rviz` file configuration)

# Hybrid planning

[New feature](#) with a [new Concept page](#)!

	Global Planner	Local Planner
Planning Problem	<ul style="list-style-type: none"><li>• Solve global solution trajectory</li><li>• Optimize trajectory path (continuously)</li></ul>	<ul style="list-style-type: none"><li>• Steer through global trajectory while adapting to local conditions</li><li>• Optimize solution locally</li><li>• Compute controller commands</li></ul>
Properties	<ul style="list-style-type: none"><li>• Complete</li><li>• No restricted computation time</li><li>• Not real-time safe</li><li>• Not necessarily deterministic</li></ul>	<ul style="list-style-type: none"><li>• Can get stuck in local minima</li><li>• Low computation time (fast)</li><li>• Real-time safe</li><li>• Deterministic</li></ul>
Examples	<ul style="list-style-type: none"><li>• OMPL planner</li><li>• STOMP</li><li>• TrajOpt</li><li>• Cartesian motion planner</li><li>• Pilz Industrial Motion Planner</li></ul>	<ul style="list-style-type: none"><li>• IK solver, Jacobian</li><li>• Potential field-based planner</li><li>• Trajectory optimization algorithm</li><li>• Model Predictive Control (MPC)</li><li>• Sensor-based Optimal Control</li></ul>

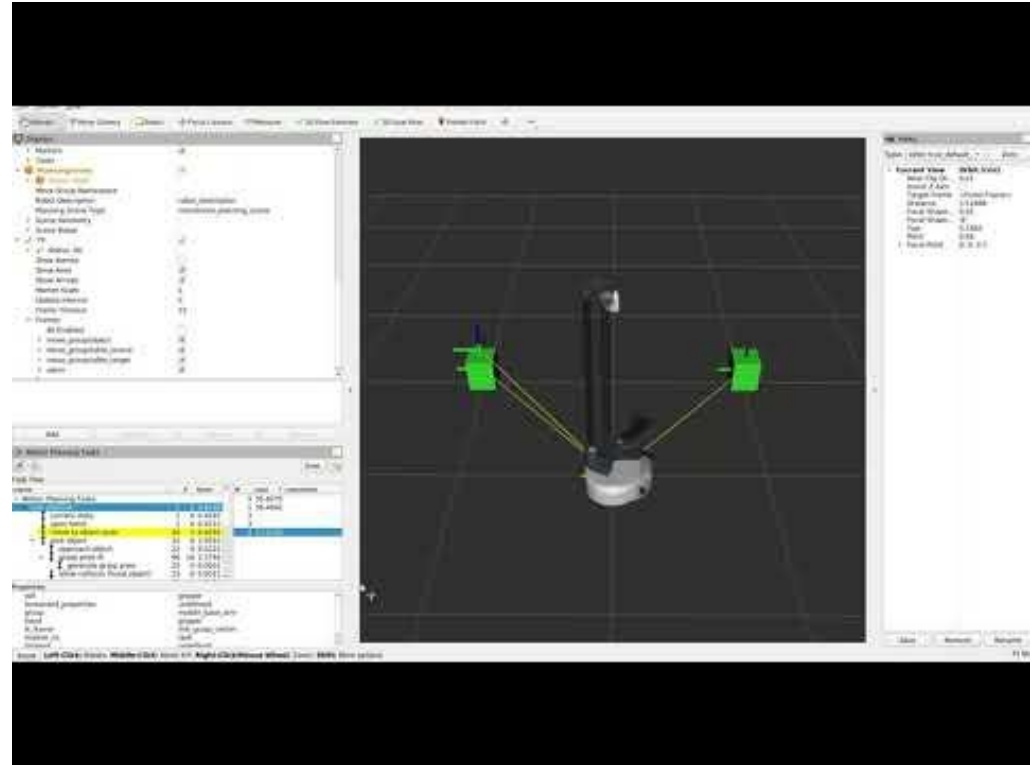


[ROS World 2021 Video](#): Hybrid Planning - Enabling Reactive Manipulation with MoveIt 2

# Planar joint modeling

[New feature](#) and [new Example](#)!

[Out of box Docker image](#) available via our ROS World 2021 Workshop with Hello Robot!



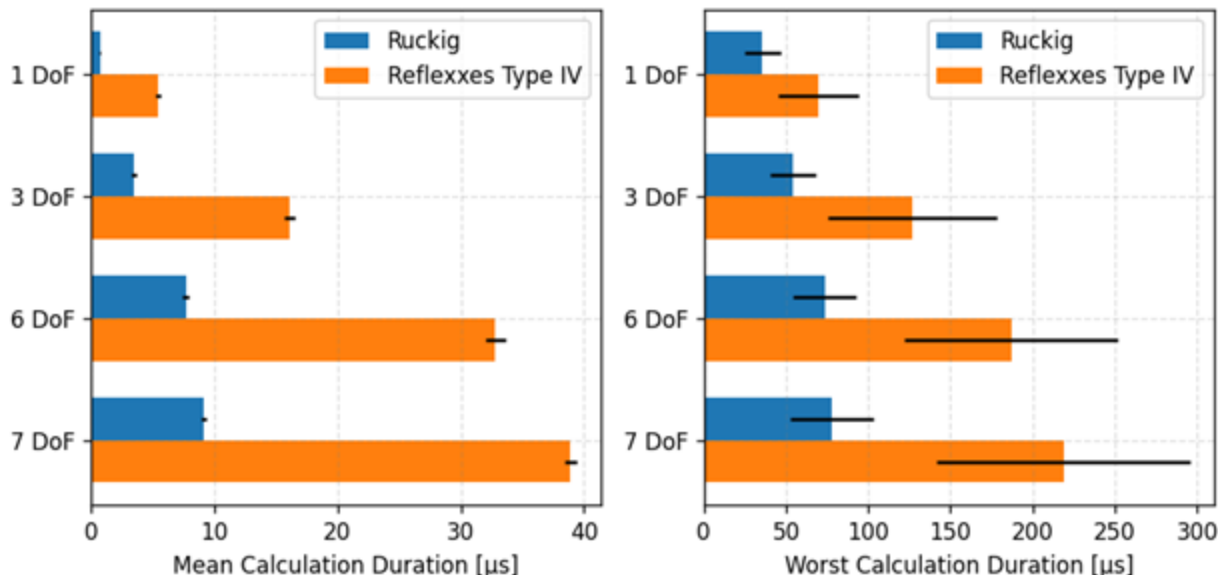


# Ruckig trajectory jerk smoothing

[New feature](#) with a [new Example!](#)

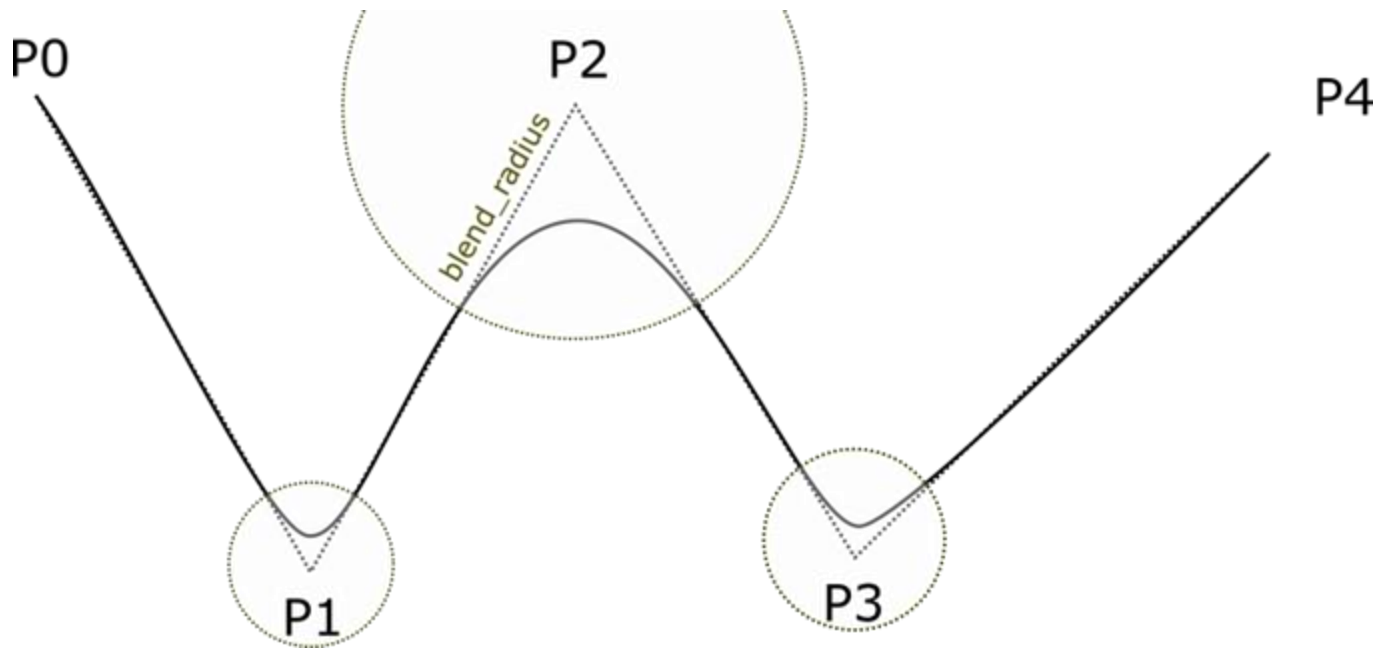
☆ one-line change in a single config file ☆

Single-thread Benchmark on Intel i7-8700K CPU @ 3.70GHz (lower is better)



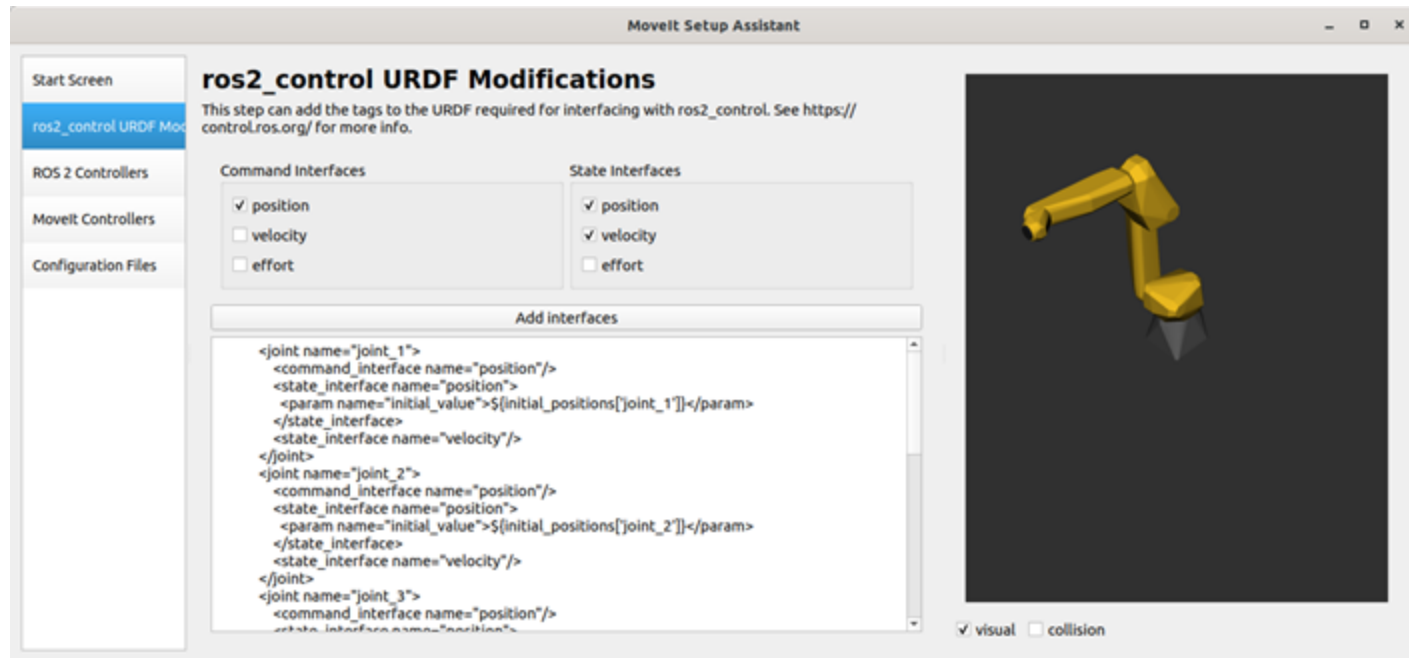
# PILZ Planner

[ROS2 port](#) and an [Example](#) page



# MSA (quite nearly)

Try out the [feature branch](#)!



# More and more ros2\_control arm drivers

Official (supported by robot manufacturer):

- [Universal Robots](#)
- [Franka Emika research robots](#)

Unofficial (from the community):

- [KUKA industrial robots \(KUKA Robot Sensor Interface \(RSI\)\)](#)
- [KUKA IIWA \(KUKA Fast Robot Interface \(FRI\)\)](#)
- [KUKA LBR and IIWA \(KUKA Fast Robot Interface \(FRI\)\)](#)
- [ABB - EGM interface](#)
- [Mitsubishi RV1A](#)
- [Elephant Robotics MyCobot](#) <--- Lightning ⚡ ⚡ ⚡ talk "Your robot on ROS 2: Easier than you might think"

Mobile manipulators:

- [Hello Robot - Stretch \(for simple simulation with MoveIt2\)](#)

[ROS World 2021 Video](#): Making a robot ROS 2 powered - a case study using the UR manipulators

More in the works - stay tuned ;)



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# Movelt Roadmap

It's going to be a busy summer

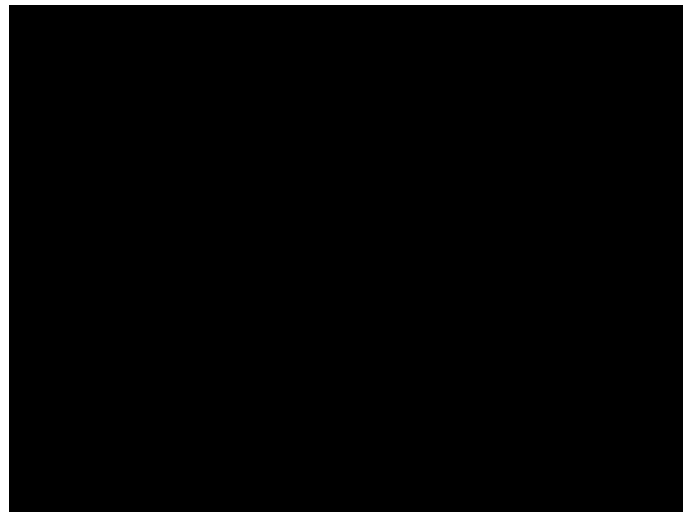
# Better Cartesian planning

Constrained OMPL planning

- <https://github.com/ros-planning/moveit2/pull/1319>

Bio IK for ROS 2

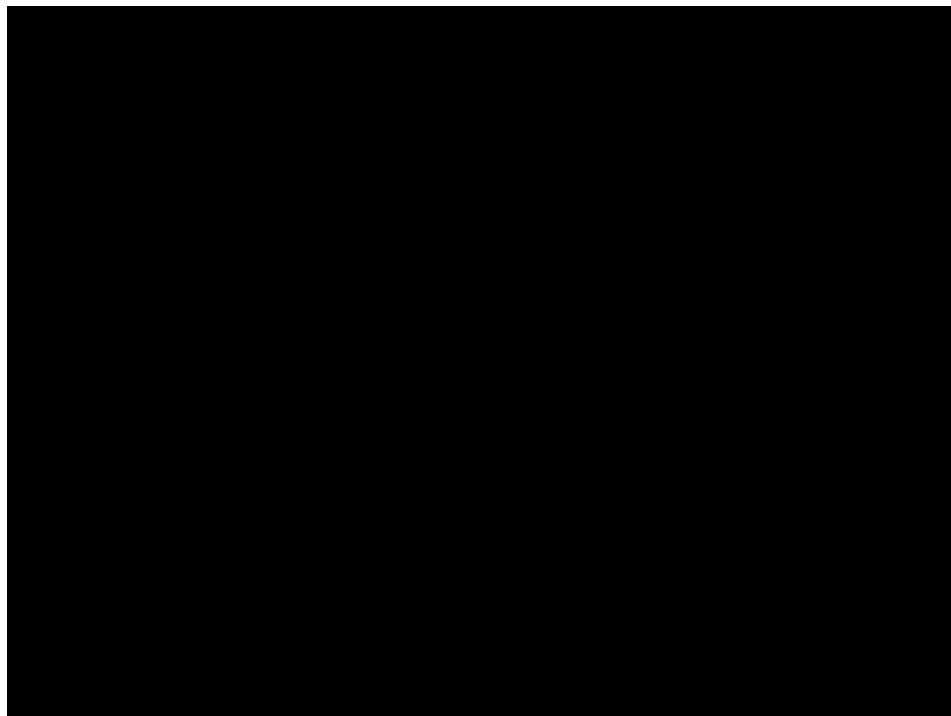
- [https://github.com/PickNikRobotics/bio\\_ik/tree/ros2](https://github.com/PickNikRobotics/bio_ik/tree/ros2)



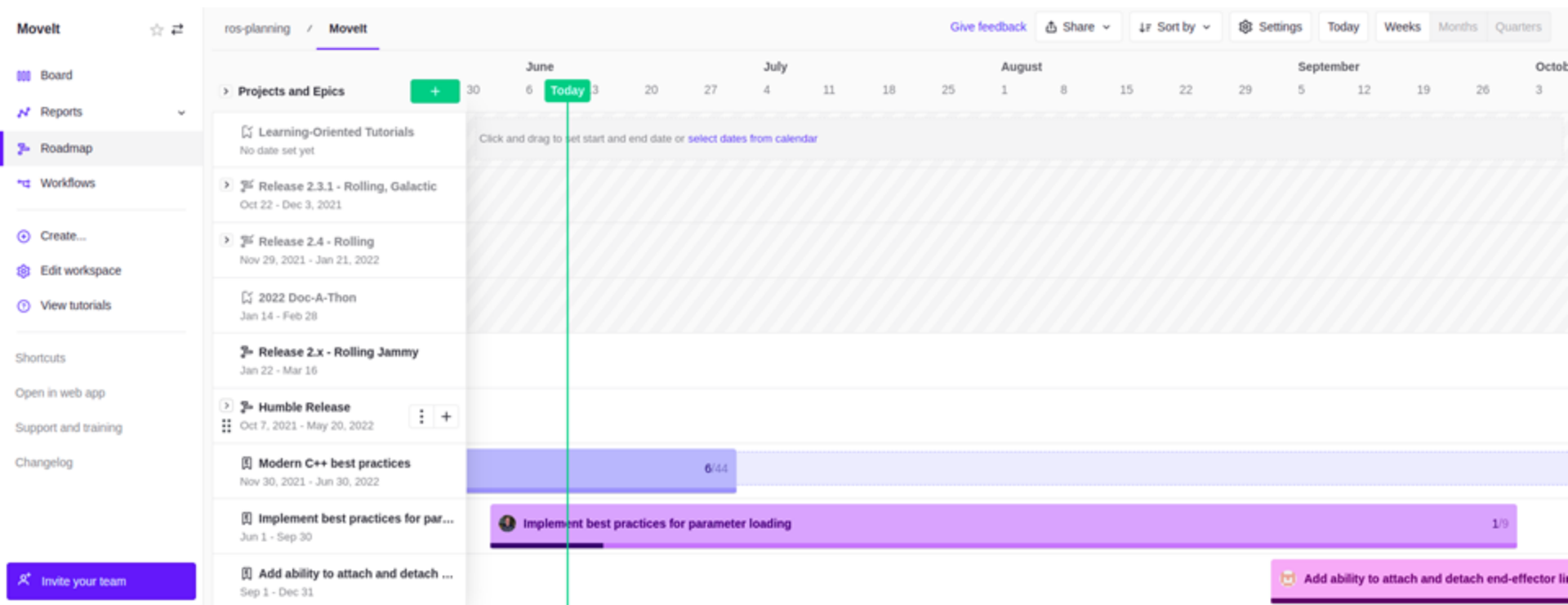
"Stay in box" constraints

## 2 Google Summer of Code projects!

- Python bindings
  - Peter David Fagan
- Multi-arm trajectory execution
  - Cristian Beltran-Hernandez



# Movelt Roadmap





# Ways to begin getting involved

## **Enhance Documentation**

Expand and improve upon our tutorials and example code.

## **Answer User Questions**

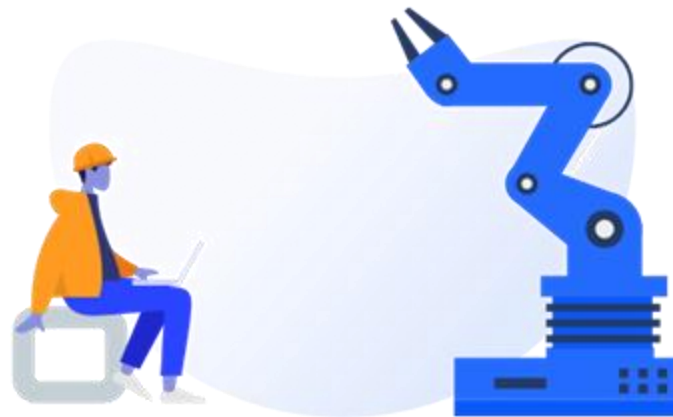
You probably know more than you realize, share that knowledge!

## **Fix Bugs**

Any active and growing project inevitably has regressions that need cleanup.

## **Add New Features**

There is plenty more to be done with our active developer base!



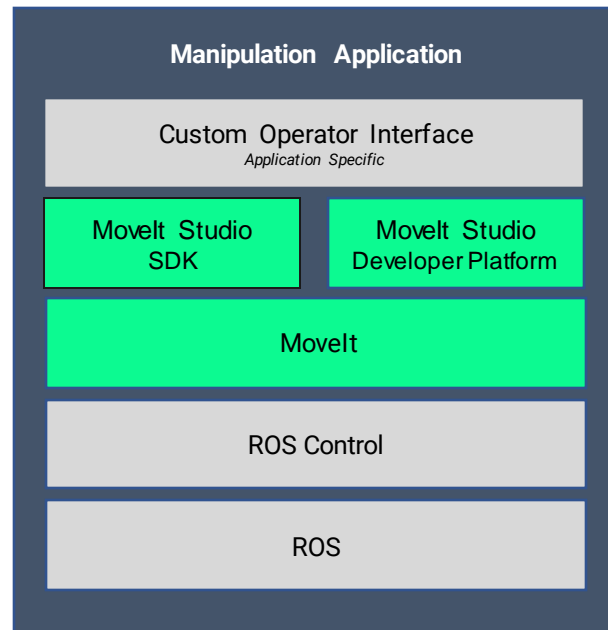
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# What's new in MoveIt Studio?

Amplifying the capability and productiveness of roboticists

# Movelt Studio

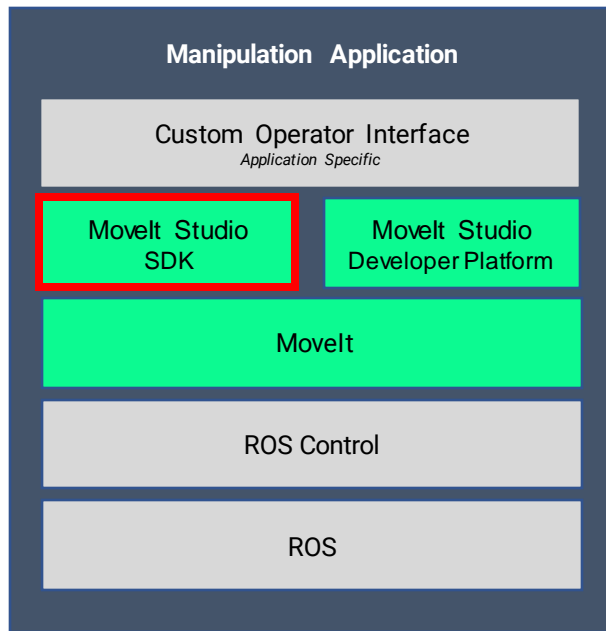
- Just like Movelt, it is hardware agnostic
- Just like Movelt, it is extendable via plugins



# Movelt Studio SDK

## Run-time SDK

- Jump start your development with a behavior tree framework built for manipulation applications
- Build behavior trees using both your custom logic and the SDK's out of box manipulation building blocks
  - Planning with Recovery
  - Execution with Recovery
  - Fine tune your system without restarting or recompiling



# Movelt Studio SDK

## Example 1: Inserting an object

```
behavior_type: LinearServo
parameters:
  reference_frame: port_frame
  min_distance: 0.01 # meters
  max_distance: 0.02 # meters
  min_force: 15 # newtons
  max_force: 100 # newtons
  timeout_duration: 10 # seconds
```

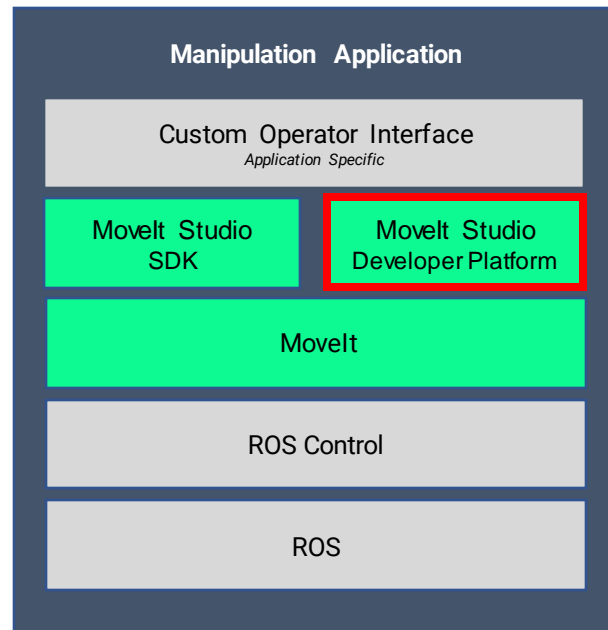
## Example 2: Pushing a button

```
behavior_type: LinearServo
parameters:
  reference_frame: button_frame
  min_distance: 0.01 # meters
  max_distance: 0.015 # meters
  min_force: 15 # newtons
  max_force: 40 # newtons
  timeout_duration: 3 # seconds
```

# Movelt Studio Developer Platform

Web tools for use during development cycle providing advanced introspection and debugging capabilities

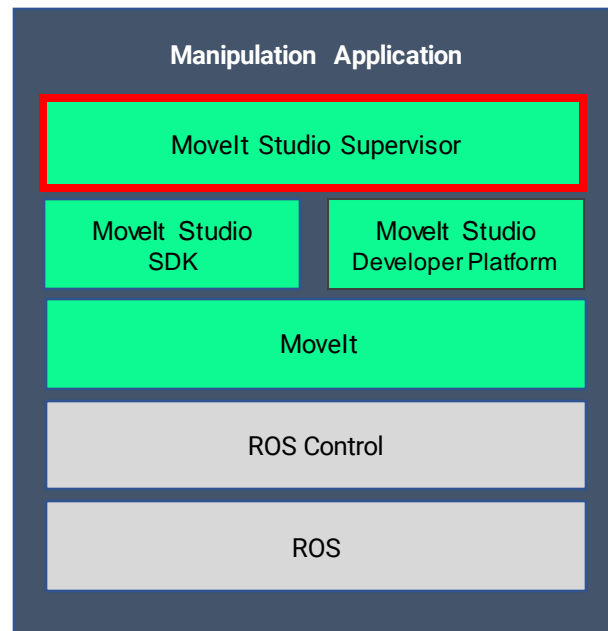
- Write, monitor, and inspect execution of your behavior trees
- Preview motions after changing constraints/planner
- Step through and diagnose failures in your manipulation objectives
- Remotely develop and test robot hardware
- Clear hardware faults and rewind arm trajectories



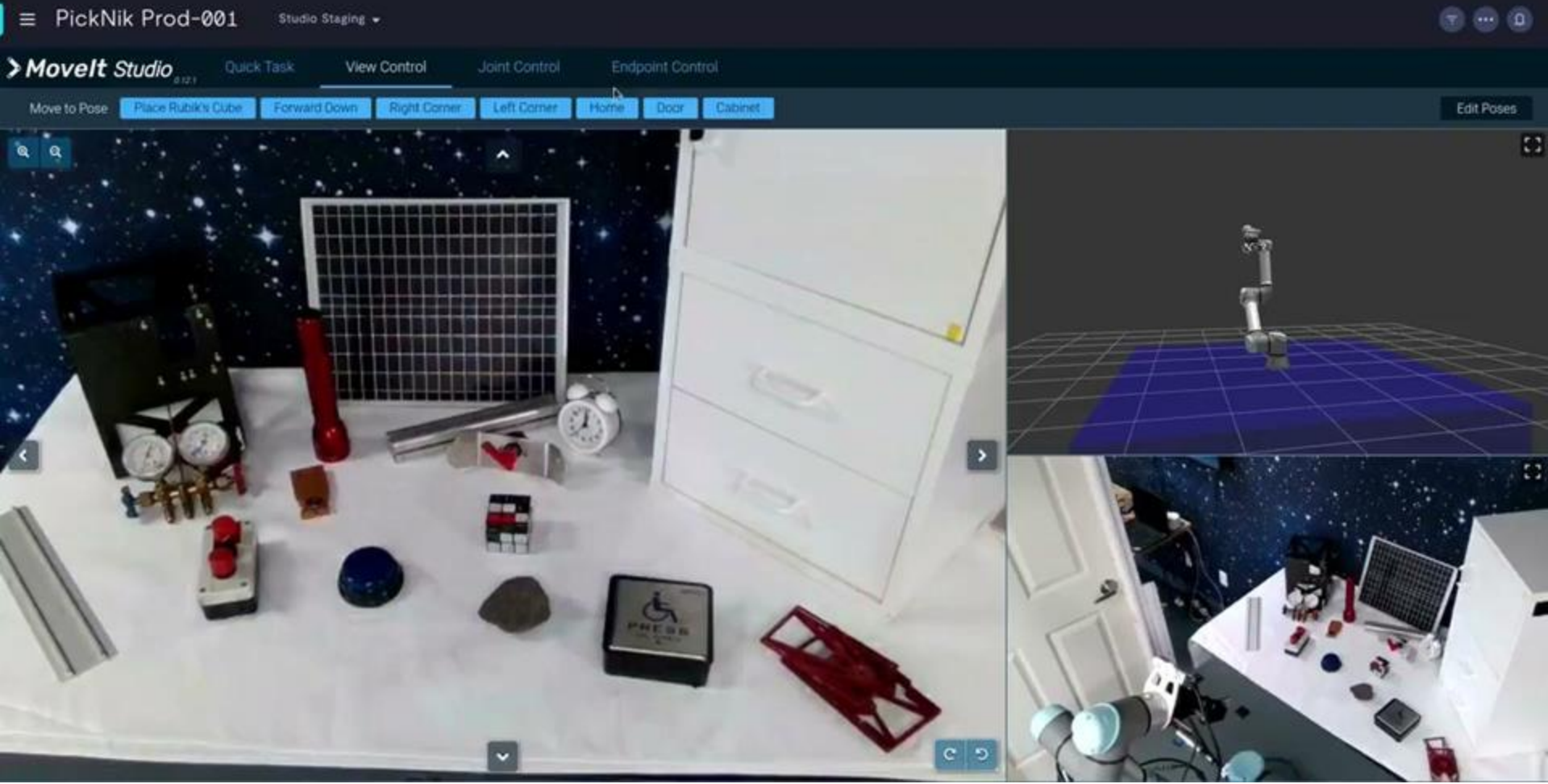
# Movelt Studio Supervisor

Supervised Autonomy web tools which provide

- Situational awareness for humans making critical decisions
- Operator interface robust to high latency environments
- Shorter path to initial on-site validation with customers



# Movelt Studio Supervisor







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# Thanks!

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