MoveIt Capabilities
Roadmapping
Recap: Key New Features In MoveIt Ecosystem

- **MoveIt Task Constructor**
  - Task Planning
  - Robert Haschke, Michael Görner
- **MoveIt Grasps**
  - Geometric-based grasp generation
  - Mike Lautman, Dave Coleman
- **MoveIt Cpp**
  - Advanced API for performance
  - Henning Kayser
- **MoveIt JogArm**
  - Realtime teleoperation planner
  - Andy Zelenak
- **CHOMP Planning Adapter**
  - Post-processing of OMPL-generated plans
  - Raghavender Sahdev
- **Iterative Cubic Spline Algorithm**
  - Smoother trajectory generation
  - Ken Anderson
- **Time-Optimal Trajectory Parameterization**
  - Follow path within bounds on accelerations & velocities
  - Michael Ferguson, Henning Kaiser
- **Named Frames on Collision Objects**
  - Subframes for placing objects
  - Felix von Drigalski
**Milestone 1**

**Straight Port to ROS 2**
- Fully migrate existing Movelt packages to ROS 2
- Wrap up Acutronic's work porting core Movelt functionality
- Leverage ROS 2: Build system (ament), middleware, logging, parameters
- Cleanup Movelt 2 codebase

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**Milestone 2**

**Realtime Support**
- Reactive, closed-loop control to sensor input
- Preempt motion if new collision detected
- Separate global and local planner (hybrid planning)
- Global planner (full collision checking): 30hz
- Local planner (IK-based, field-based): 300hz
- Zero-memory copy integration to controllers (ros_control)
- Tighter integration to ros_control
- Integrate pilz_industrial_motion

**Movelt Survey Results**
- 91% most excited about ROS 2 realtime control
- 55% reactive planning and closed loop control
- 48% better integration with lower level realtime control
- 48% planning with dynamics

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**Milestone 3**

**Fully Leverage ROS 2**
- Lifecycle management of Movelt nodes
- Deterministic startup, reset, & shutdown sequences
- Leverage ROS2 component nodes
- Ability to run Movelt as single or multi-process
- Replace pluginlib with components
- Cleanup API
- More generic and standalone interfaces

**Movelt Survey Results**
- 47% excited about component nodes

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**Future Milestones**

**Determinism**
- Out of box / default planners return reliable paths
- Tune or replace OMPL, BIT*
- Further optimize / smooth paths
  - Default use TOTG, TOPP time parameterization
  - Use post-processing optimization (STOMP, TrajOpt)
- Fully featured Cartesian Planner
  - Like Descartes but better and fully integrated
- Force-torque control

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**Improved Interfaces / State Machines**
- Deprecate the Pick and Place pipeline
- Fully support the Movelt Task Constructor
- First class support of state machines
- Non-ROS C++ API
  - Similar to MoveGroup but without middleware

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**Machine Learning**
- Neural-network based motion planning - new plugins
- General near-optimal heuristics for path planning e.g. MPNet
Open Source Planning

Cathedral vs Bazaar (*Eric Raymond*)

- **Cathedral**
  - Software carefully crafted by individuals
  - Isolated, mostly secret development team
- **Bazaar**
  - Chaotic, babbling open source development
  - Miraculously coherent among the noise of the crowds
Sticky-Note Session

Write down

- Problems
- Limitations
- Missing requirements
Solutions

Write down

- Approaches to fix the categories