



# ROS-I Training Class

## BASIC DEVELOPERS' TRAINING CLASS

February 13 – 15, 2017

Presented by Southwest Research Institute





# INTRODUCTIONS: SwRI





# SwRI: Deep Sea to Deep Space

**Independent.  
Advanced Science.  
Applied Technology.  
From *Deep Sea*  
To *Deep Space*.  
And Everything in between.**

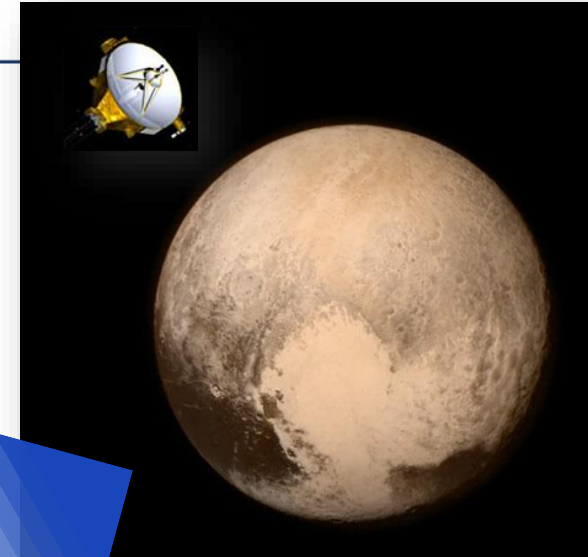


## ■ Alvin

- Tested at SwRI before first (1964) record-setting dives > 8,000 ft.
- Redesigned (2013) new Alvin (3" titanium sphere) capable of > 21,000 ft.

## ■ New Horizons

- SwRI-led
- Launched: Jan. 19, 2006
- Closest approach to Pluto: July 14, 2015
- Fastest spacecraft ever: ~30,000 mph





# SwRI: Deep Sea to Deep Space

## And Everything Between!

Spacecraft &  
Planetary Sciences



Energy



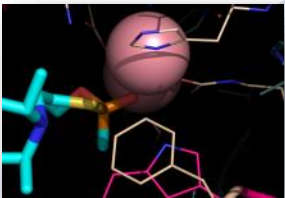
Robotics,  
Automation, and  
Simulations



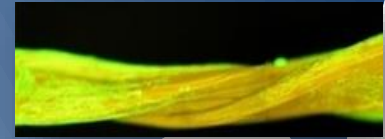
Lubricants  
Testing



Pharmaceuticals &  
Bioengineering



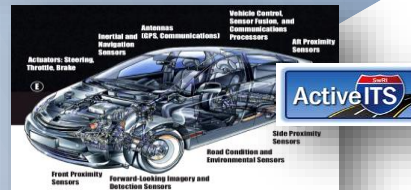
Regenerative  
Medicine



Materials &  
Engineering



Infrastructure  
Communications



Engine Design and  
Optimization



Water and  
Geological  
Engineering





# INTRODUCTIONS: INSTRUCTORS





# Instructors



**Jeremy Zoss**



**Levi Armstrong**





# INTRODUCTIONS: OTHER SwRI PERSONNEL







# Contact Info



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[www.ROS-Industrial.org](http://www.ROS-Industrial.org)







Daily Schedule, Wiki & Github (Slides, Exercises)

# CLASS LOGISTICS: AGENDA AND NAVIGATION





# Monday Agenda



- 0815 Shuttle Departs the [Hyatt Hill Country](#)
- 0835 Sign-in, Introductions, and Agenda
- 0900 ROS Setup, Catkin, Installing Packages
- 1015 Break
- 1030 Creating Packages/Nodes, Topics, Messages
- 1200 Lunch – SwRI Overview Presentation
- 1300 Services, Actions
- 1430 Break
- 1445 Launch Files, Parameters
- 1720 Shuttle Departs for Dinner
- 1800 Group Dinner at [Acenar](#) on the Riverwalk





# Tuesday Agenda



- 0815 Shuttle Departs the [Hyatt Hill Country](#)
- 0835 Recap and Agenda
- 0900 URDF, Workcell XACRO
- 1015 Break
- 1030 TF, Build a MoveIt! Package
- 1200 Lunch – SwRI Lab Tours
- 1330 Motion Planning Using Rviz, C++
- 1500 Break
- 1515 Descartes Path Planning, Intro to Perception
- 1720 Shuttle Departs for Dinner
- 1800 Group Dinner at [Two Bros. BBQ](#)





# Wednesday Lab Agenda



- 0815 Shuttle Departs the [Hyatt Hill Country](#)
- 0835 Recap and Agenda
- 0900 Building a Perception Pipeline, Recap
- 1030 Break
- 1045 Lab Introduction, Lab Time
  1. Pick and Place Application
  2. Descartes Application
- 1200 Lunch
- 1245 Work on Lab Applications
- 1530 Wrap-up, Surveys
- 1600 Shuttles Depart for Airport and Hyatt
- End



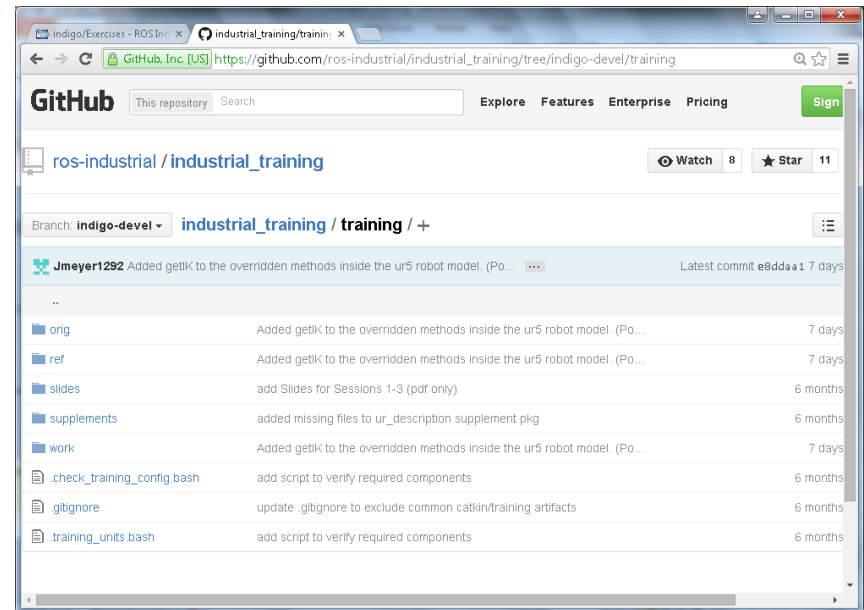
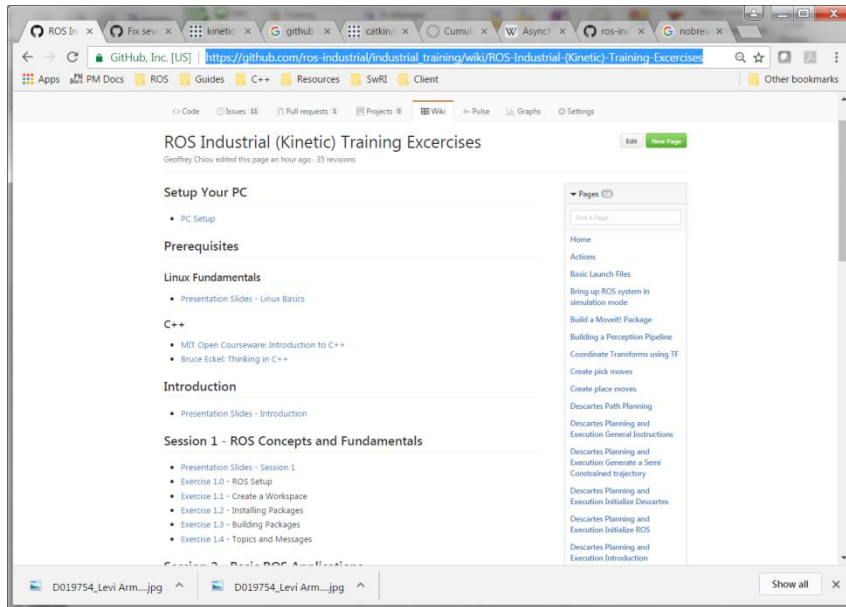


# Wiki & Github



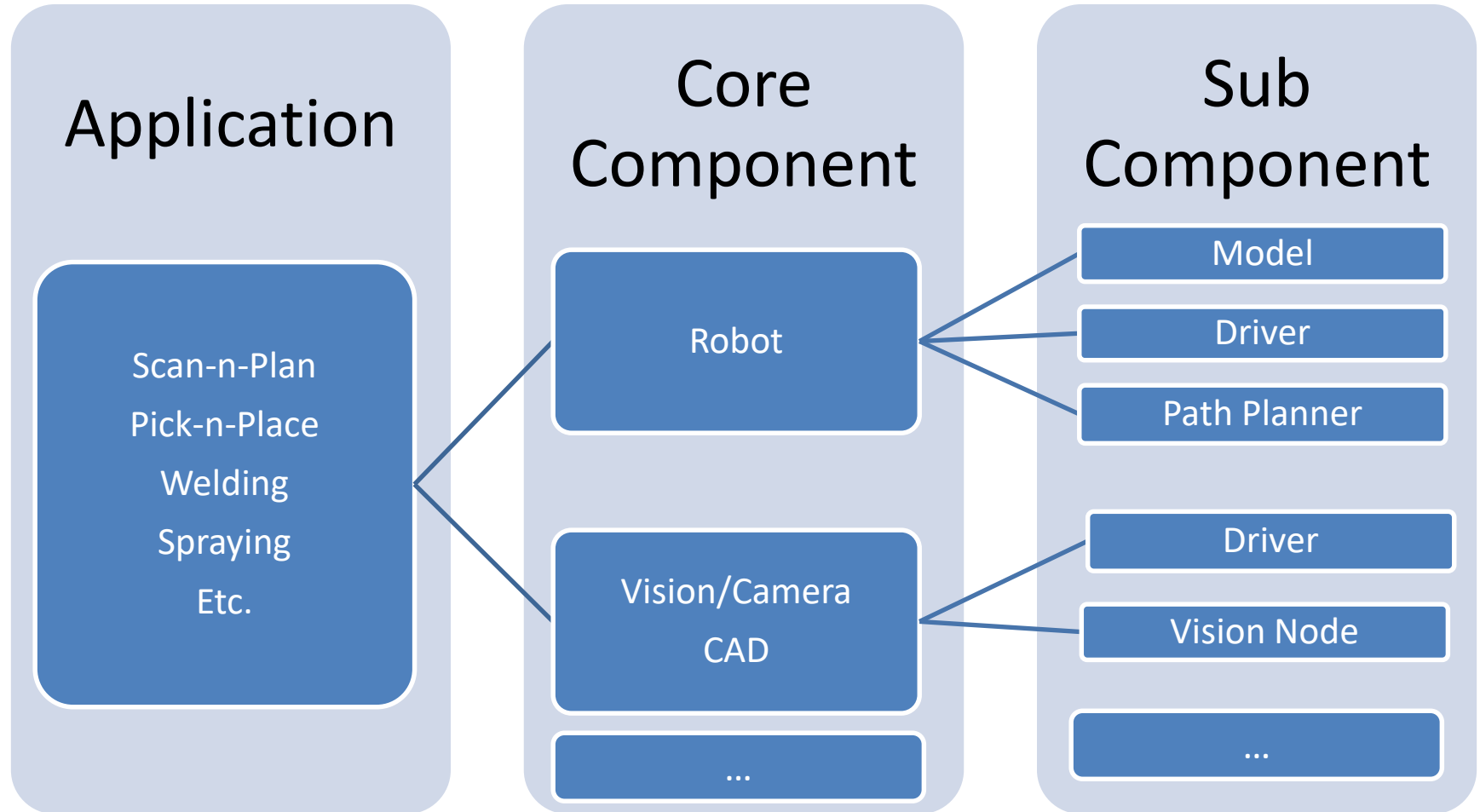
[https://github.com/ros-industrial/industrial\\_training/wiki](https://github.com/ros-industrial/industrial_training/wiki)

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# Generic App. Architecture



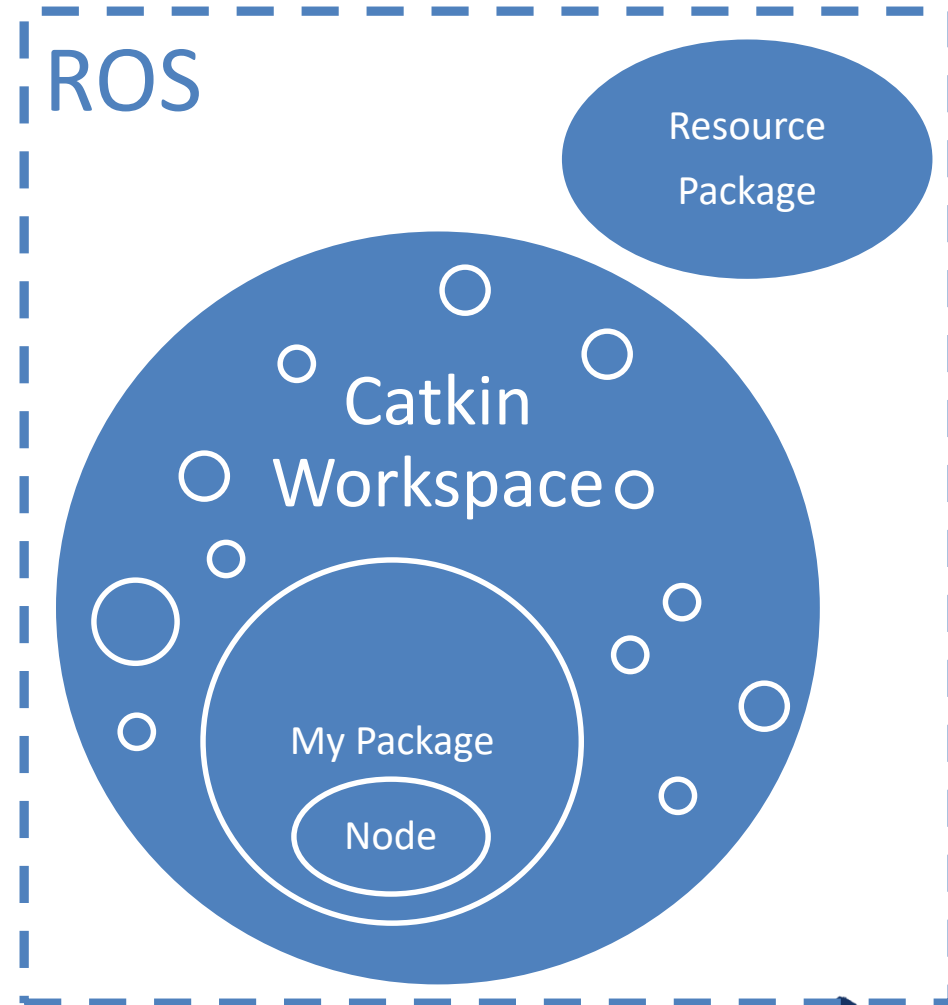




# Day 1 Progression



- ☐ Install ROS
- ☐ Create Workspace
- ☐ Add “resources”
- ☐ Create Package
- ☐ Create Node
  - ☐ Basic ROS node
  - ☐ Interact with other nodes
    - ☐ Messages
    - ☐ Services
- ☐ Run Node
  - ☐ rosrn
  - ☐ roslaunch

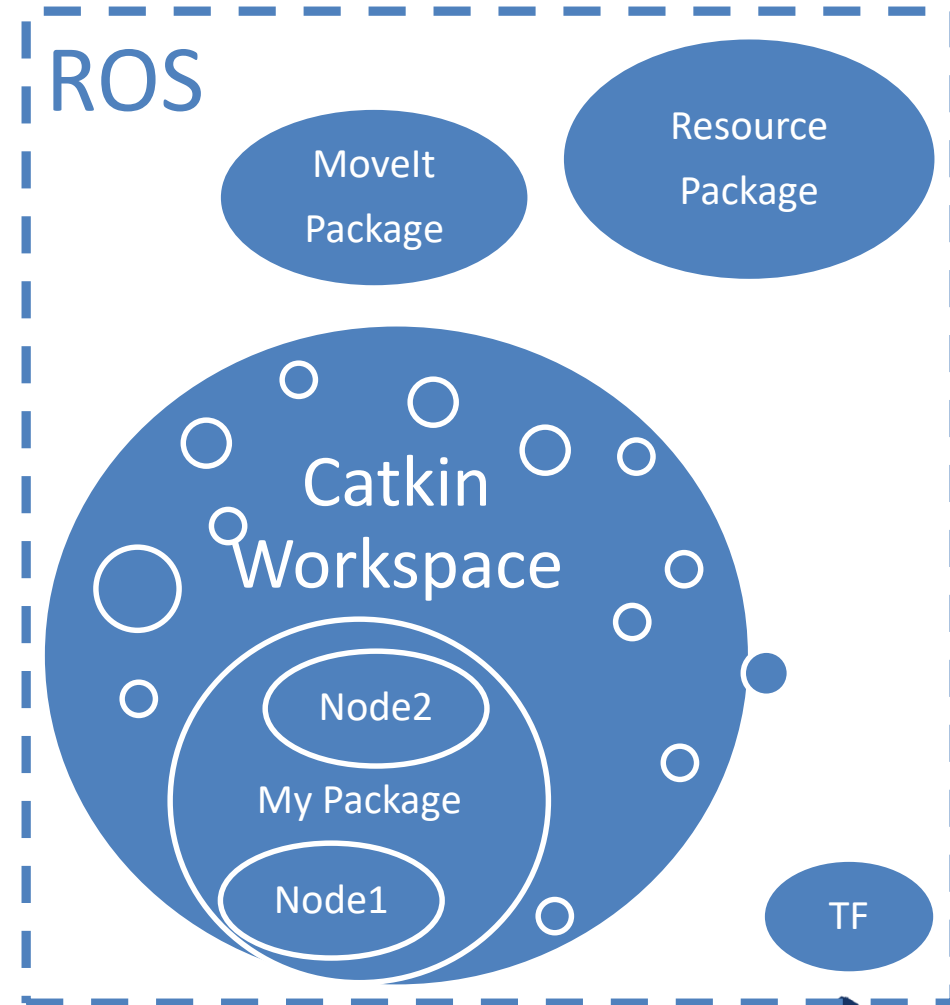




# Day 2 Progression



- ☐ Build on Day 1 nodes
- ☐ Use TF
- ☐ Create Robot Model
  - ☐ Basic, URDF
  - ☐ Advanced, xacro
- ☐ Integrate Robot Model
  - ☐ MoveIt!
- ☐ Integrate Path Planner
  - ☐ Descartes
- ☐ Dabble in Perception





# Day 3 Overview



☐ Review Day 1/2 Topics

☐ Self-Paced Application Demos

1. Perception-Driven Manipulation

*(a.k.a. Vision-Guided Pick & Place)*

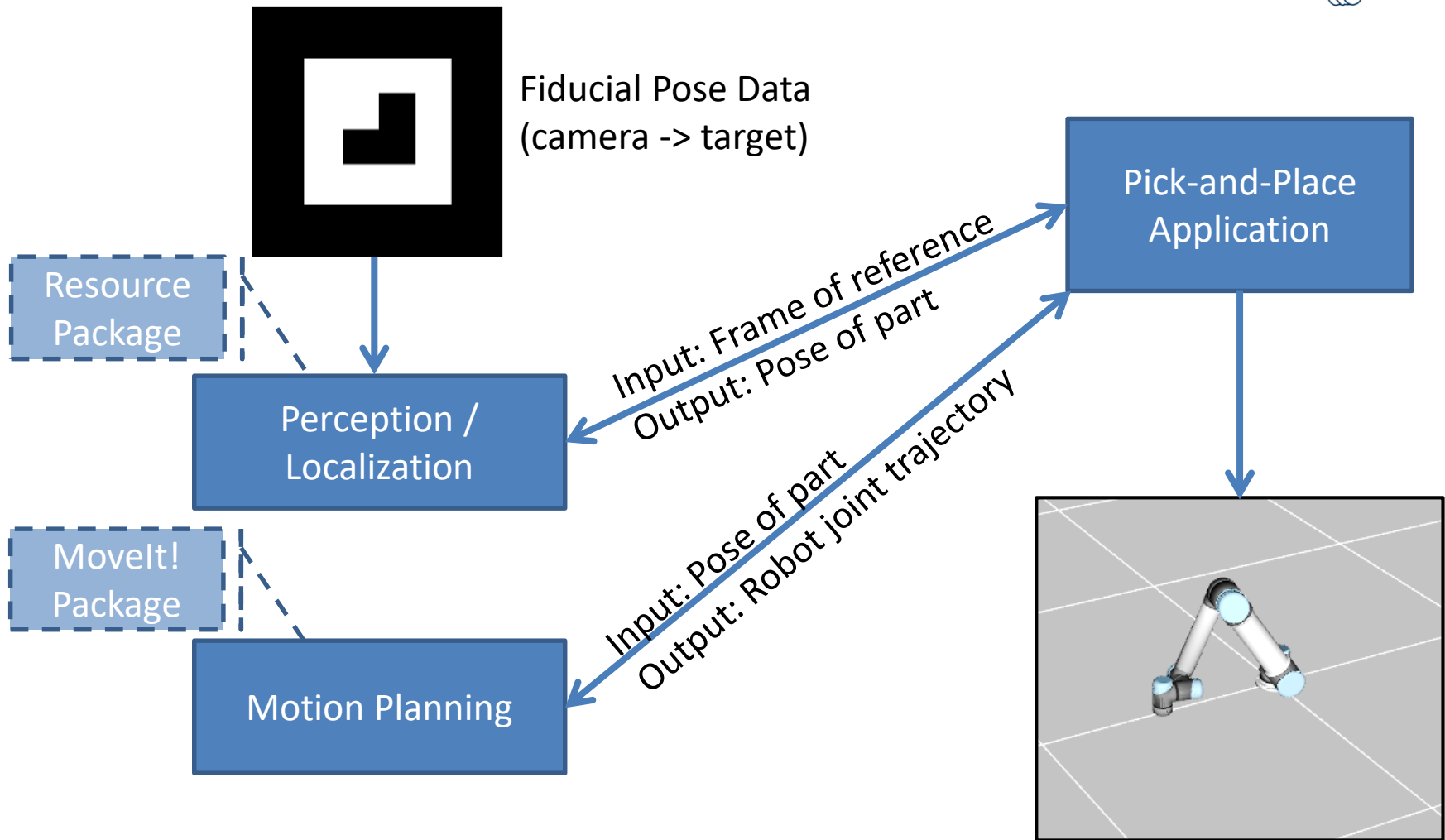
2. Descartes Planning & Execution

*(a.k.a. Semi-Constrained Path-Planning)*



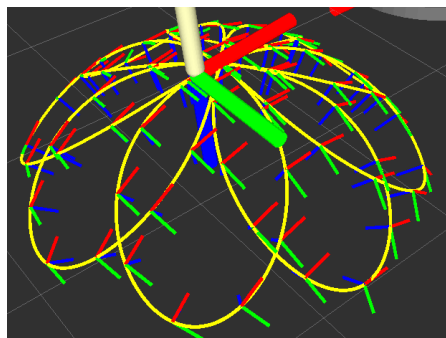


# Demo #1: Pick-and-Place





# Demo #2: Descartes



Semi-Constrained  
Path Points



Input: Path Constraints  
Output: Robot Joint Trajectory

