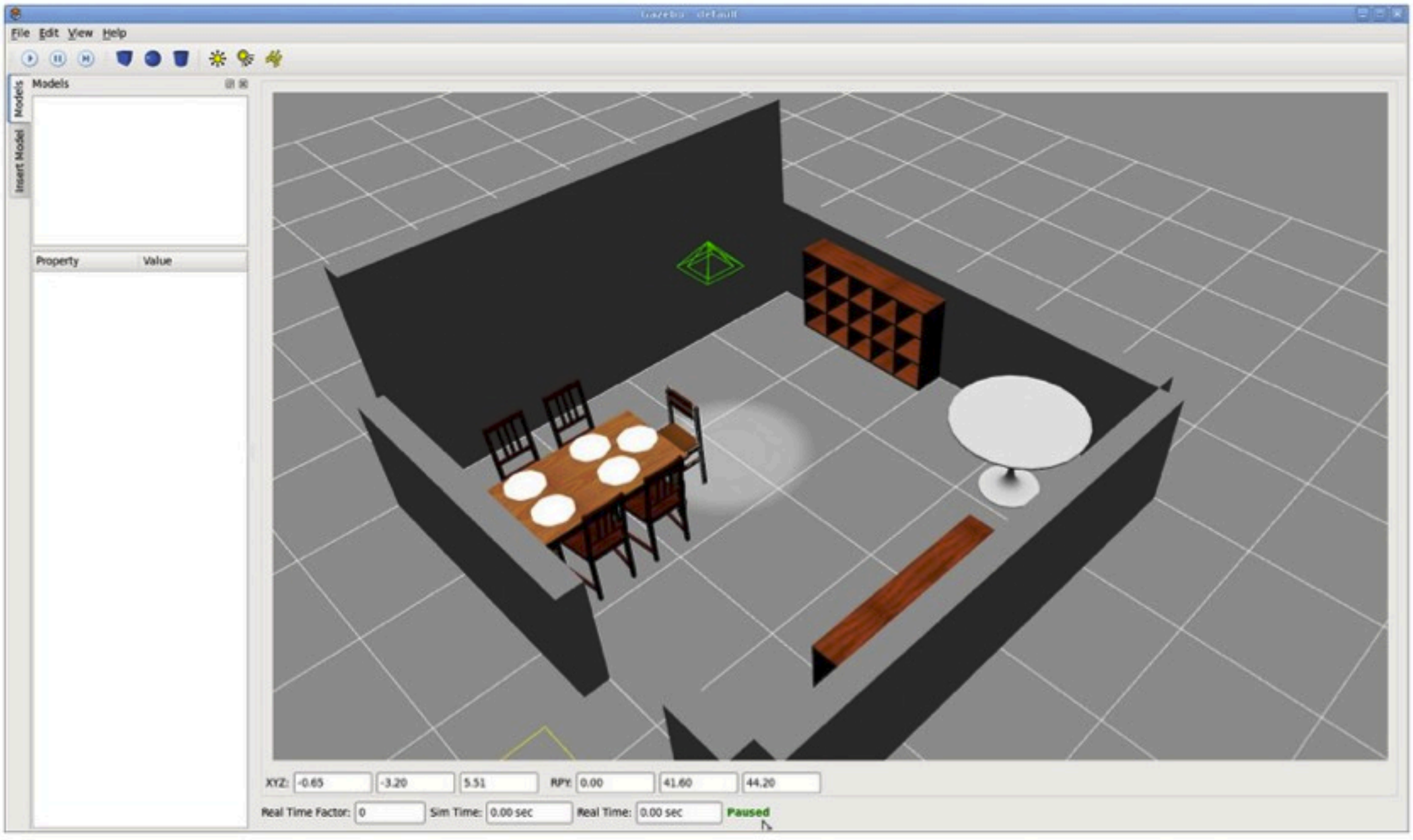
Juergen Hess
(Uni Freiburg)

Caroline Pantofaru
(Willow Garage)

Schedule

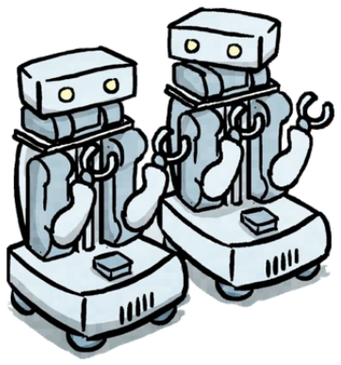
- Monday: Tutorials, guided tour through Freiburg 6pm
- Tuesday: Hackathon
- Wednesday: Hackathon, 5pm leave for the reception
- Thursday: Hackathon
- Friday: Hackathon, 1-5pm presentation of the results
- Begin in the morning: 9:15am

The ICRA Sushi Challenge



http://mobilemanipulationchallenge.org/

- Meet new people
- Learn
- Have fun!



The Sushi Tutorial

Sachin Chitta
Caroline Pantofaru
Jenny Barry
Ioan Sucan
Vincent Rabaud
Jon Binney
Steve Cousins

The Willow Team

- Sachin Chittta
- Caroline Pantofaru
- Jenny Barry
- Ioan Sucan
- Jon Binney
- Bhaskara Marthi
- Vincent Rabaud
- Ben Cohen
- Michael Phillips
- Daniel Benamy
- Steve Cousins

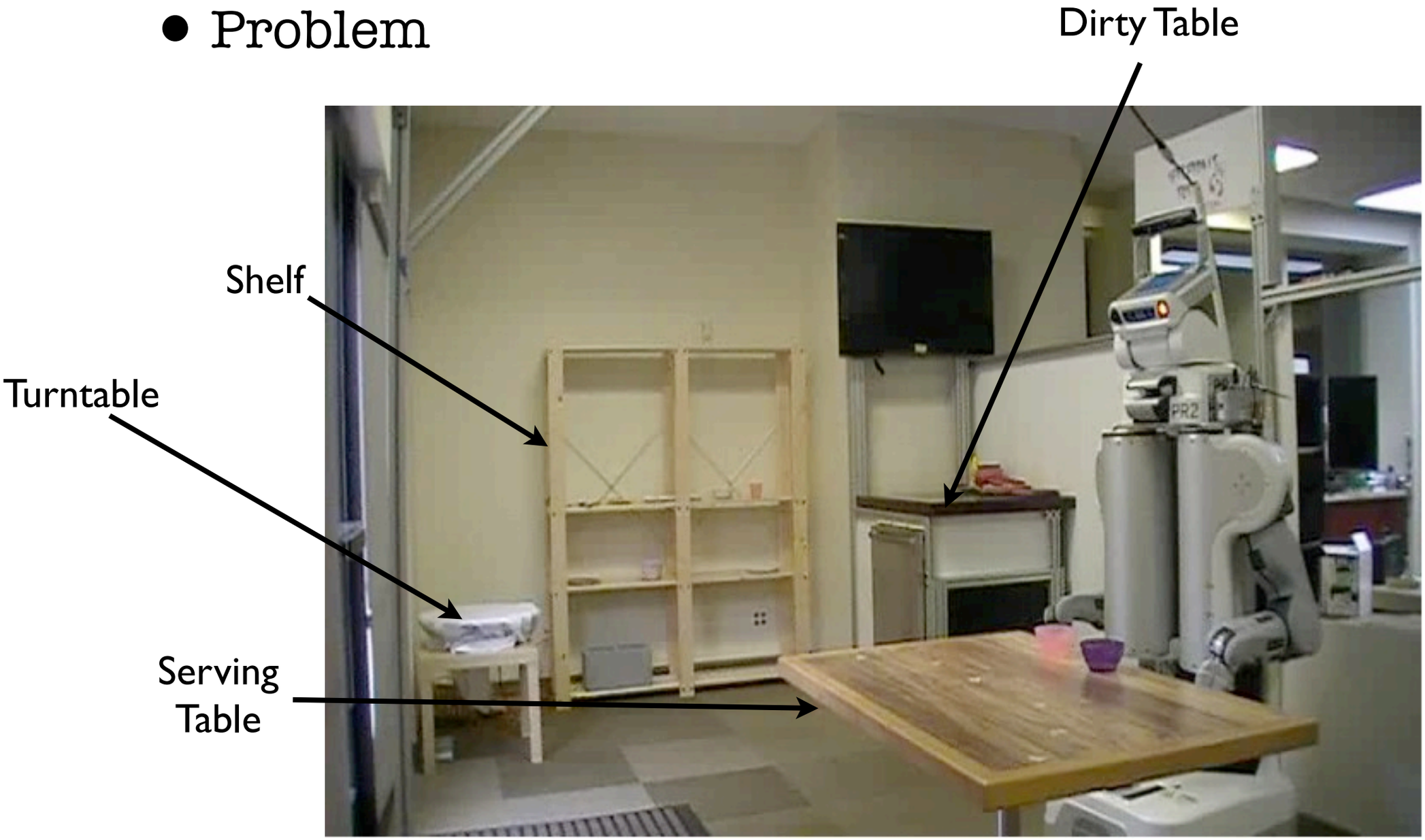
In collaboration with the whole PR2 and ROS development teams at Willow Garage and the PR2-Beta and ROS Community

Tutorial Program

- Introduction
  - current state
  - challenges
- Tutorial
  - setup, logistics
  - basic tutorials

Introduction

- Problem



Approach

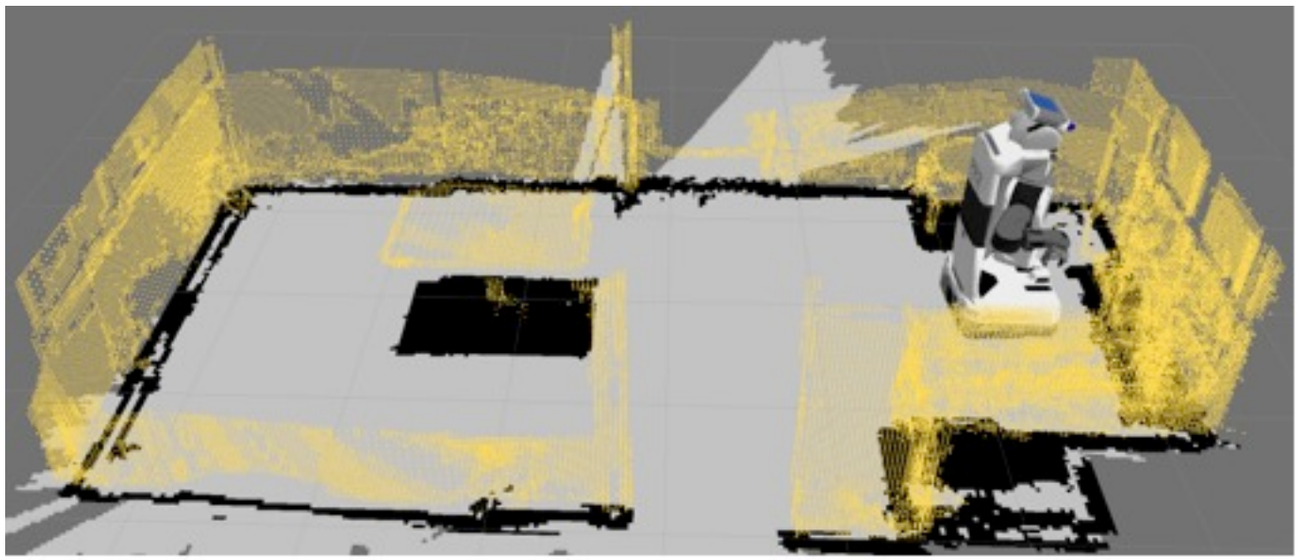
- Results - initial hackathon at Willow

Both videos are 4x

Current State

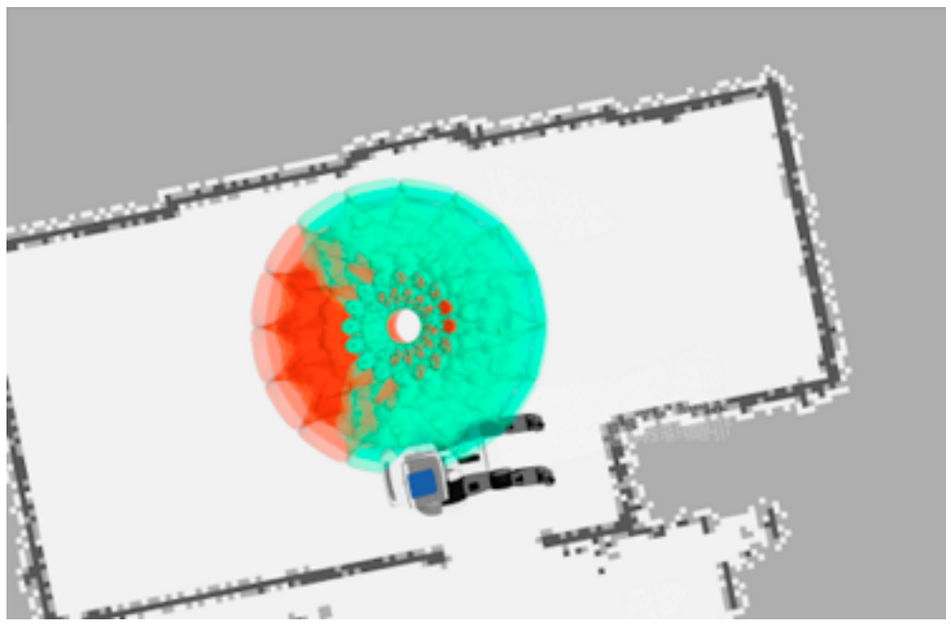
- Simple Python API for mobile pick and place
  - mobility/navigation
  - manipulation
  - perception
  - world-state

Mobility/Navigation



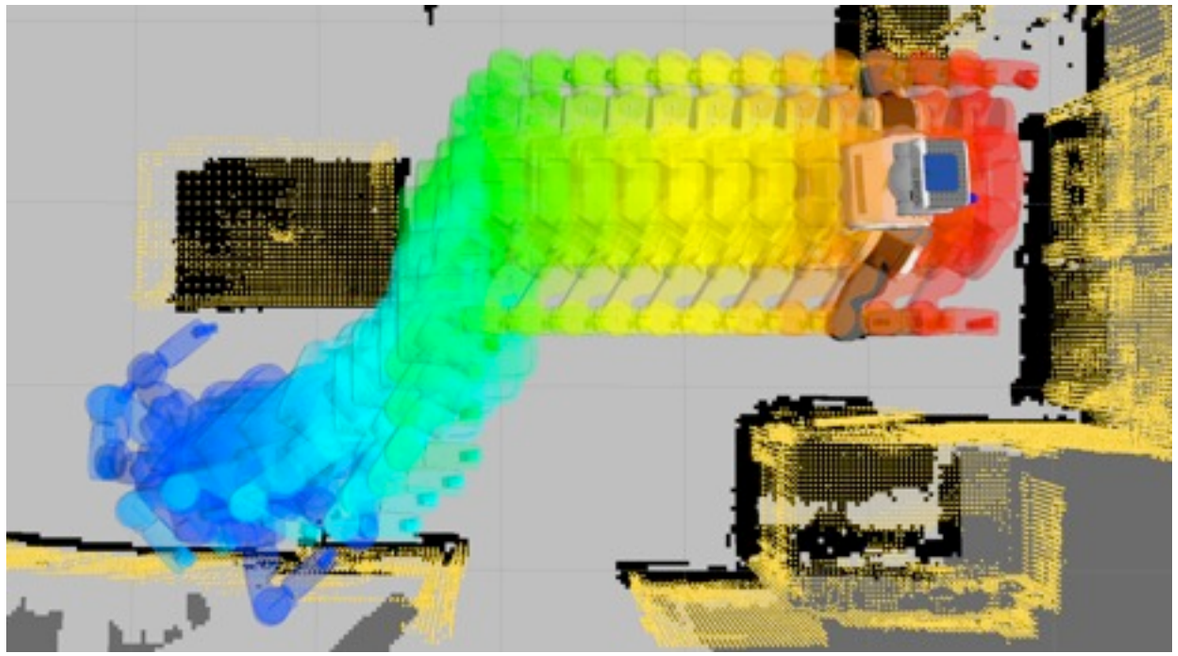
2D + 3D maps (using Octomap)

Advanced Tutorial - we have already done this for you



Fast full 3D collision checking -
Find base pose given object location

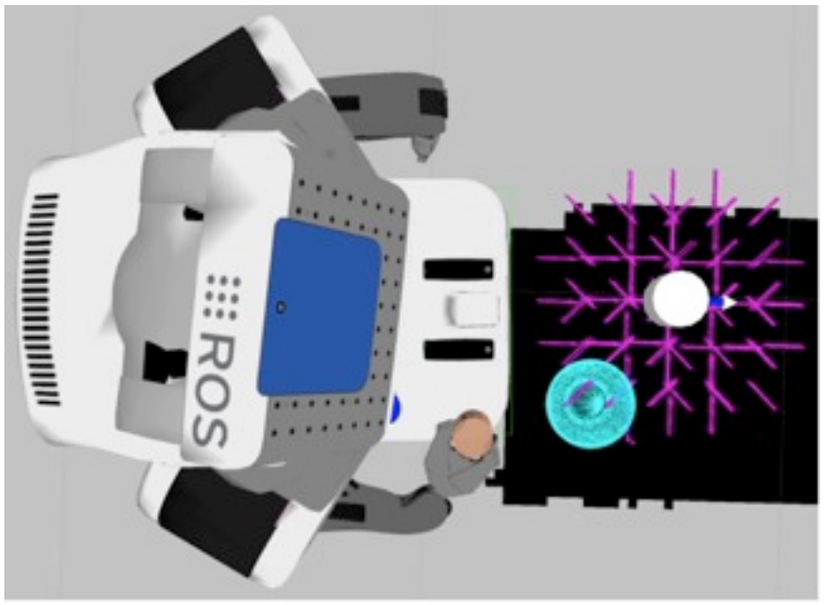
Mobility/Navigation



Fast full 3D collision checking + SBPL Lattice Planner - 3D navigation

- No use of live sensor data - robot won't stop for you!
- Not optimized code - planning can be a little slow sometimes
- Simple Python API

Manipulation



Manipulation Pipeline + Escape behaviors (for robustness)

- Manipulation picks up and puts down objects from known locations
  - wrapped nicely in a python API
  - if given an object label (optional), will pick up corresponding object from location

Manipulation

- Manipulation integrates
  - pick and place for cups, bowls, glasses
  - experimental behaviors for plates
  - experimental behaviors for silverware
- Teams can choose to work on (Jenny, Ioan and Sachin can help)
  - manipulation for plates (e.g. pickup individual plates from stacks)
  - pick and place for silverware
  - manipulation from turntable
  - two-handed behaviors
  - constrained planning
  - better use of live sensor data

MoveIt! - Coming Soon

- MoveIt!
  - new effort to develop core C++ libraries for manipulation
  - lightweight ROS wrappers
  - plugin API for planners
    - ❖ planning in parallel
    - ❖ run multiple planners,
  - planning with constraints
  - fast pick and place
  - better introspection
  - more collision checking capabilities
  - motion planning benchmarks
  - better visualization
  - expected to land with ROS Groovy

Perception

- Assumes known approximate locations of objects and place locations (in map frame)
  - you will have to provide these
  - no semantic notion of tables
- Currently only integrates capability to detect rotationally symmetric objects (same as manipulation pipeline)
- Teams are welcome to integrate more advanced perception capabilities, e.g. (Caroline, Vincent and Jon will help you with this)
  - detecting silverware, plates
  - build up world-state using perception
    - locations of tables/objects
  - Tracking/Recognition of objects on turntable

World-State

- Ability to maintain world-state
  - adding surfaces (tables/shelves)
  - adding objects
  - basic data association

Teams

Team 1: TUM Robot

Christian Dornhege (Freiburg)

Dejan Pangeric (TUM)

Georg Bartels (TUM)

Jihoon Lee (Brown)

Steven Gray (Penn)

John Schulmann (Berkeley)

Team 2: TUM Robot

Jan Wulfing (Freiburg)

Nicolas Engelhard (Freiburg)

Lorenz Mosenlechner (TUM)

Rebecca Pierce (Penn)

Yohei Kakiuchi (JSK)

Team 3: Freiburg Robot

Felix Endres (Freiburg)

Thomas Ruhr (TUM)

Jonathan Mace (Brown)

Dan Lazewatsky (WashU)

Guido Manfredi (LAAS)

Inaba Masayuki (JSK)

Team 4: Leuven Robot

Juergen Hess (Freiburg)

Moritz Tenorth (TUM)

Andreas Hertle (Freiburg)

Stephen Brawner (Brown)

Agata Kargol (WashU)

Koen Buys (Leuven)

Team 5: Freiburg Robot

Armin Hornung (Freiburg)

Gheorge Lisca (TUM)

Trevor Jay (Brown)

Yiannis Gatsoulis (Ulster)

Enea Scioni (Leuven)

David Lu (WashU)

Team 6: Leuven Robot

Tobias Spingenberg (Freiburg)

Mehmet Isik (TUM)

Christopher Crick (Brown)

Lorenzo Riano (Ulster)

Dominick Vanthienen (Leuven)

Andrew Dornbush (CMU)

Tutorials

- Wiki page - https://kforge.ros.org/Sushi/trac/
- If you have your own computer
  - set it up now (follow instructions on the Wiki)
  - use Freiburg ROS repository mirror to speed things up
- Robots are already setup
  - you will need to setup the Sushi repo under your own login
- All desktops are setup
  - you will need to setup the Sushi repo under your own login here as well

Tutorials

- Some tutorials can be run in simulation - navigation
- Others need to be run on the robot
- Run basic tutorials in the following order
  - Navigation
  - Perception
    - ❖ includes world-state tutorial
  - Manipulation
- Octomap + 2D map has already been created for you
  - takes some time to do

Tutorials

- By the end of the day all teams can do
  - mobile pick and place of one object from a table to table, or shelf to table

Tutorials

- Best of Luck!!