An introduction to

PART 2

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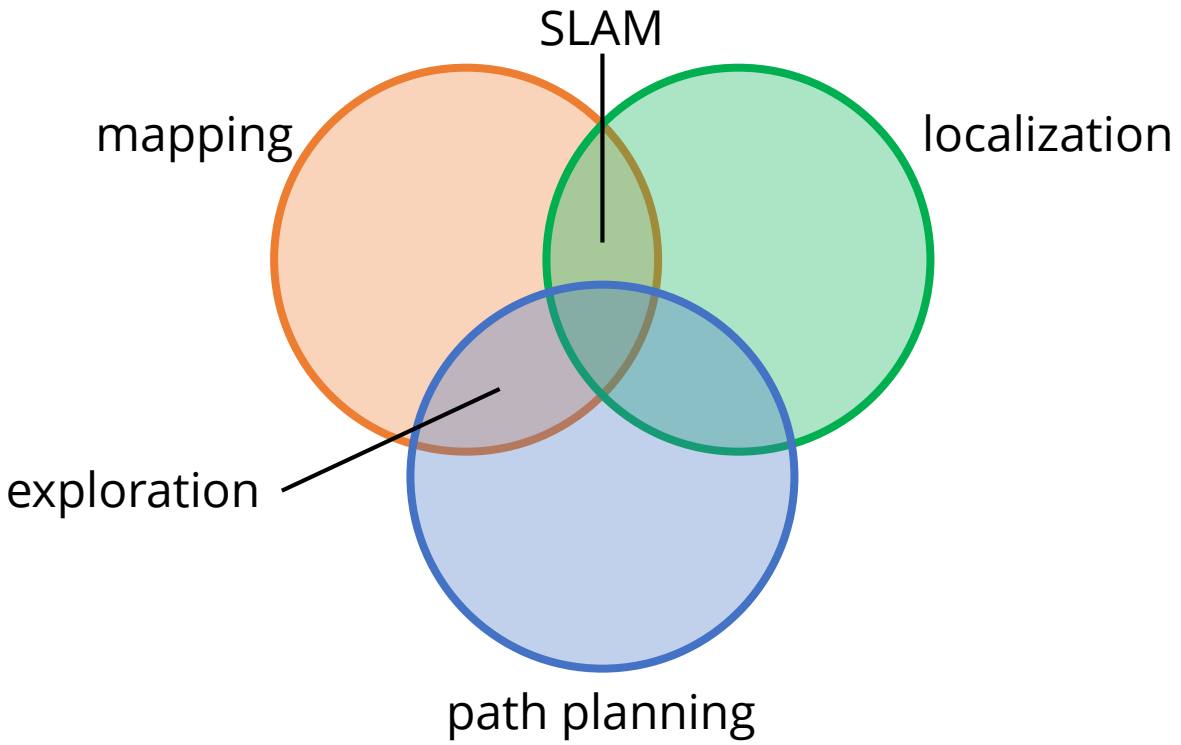
ROS

From sensors to navigation

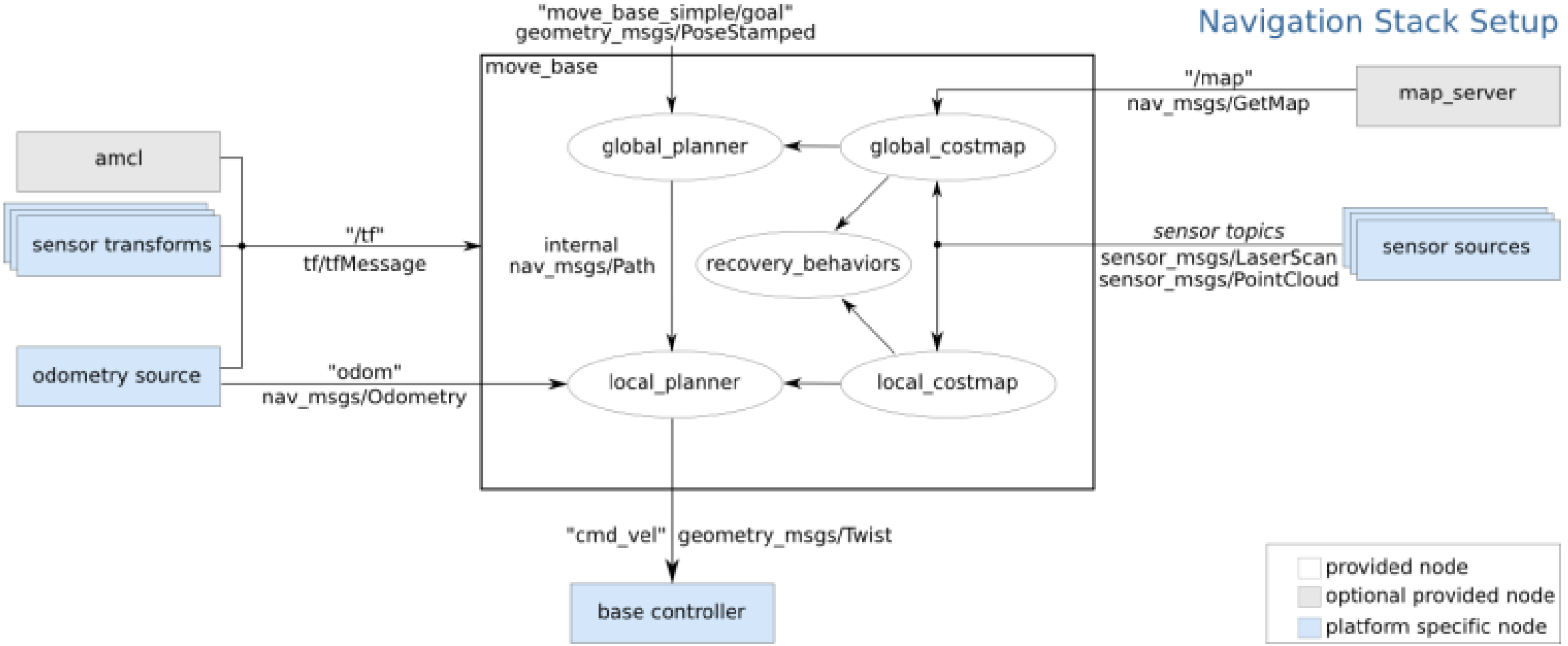


From [Grisetti, Burgard, Stachniss]

for moving autonomously the robot should be able to understand the environment from its sensor measurement

ROS

ROS Navigation Stack



ROS

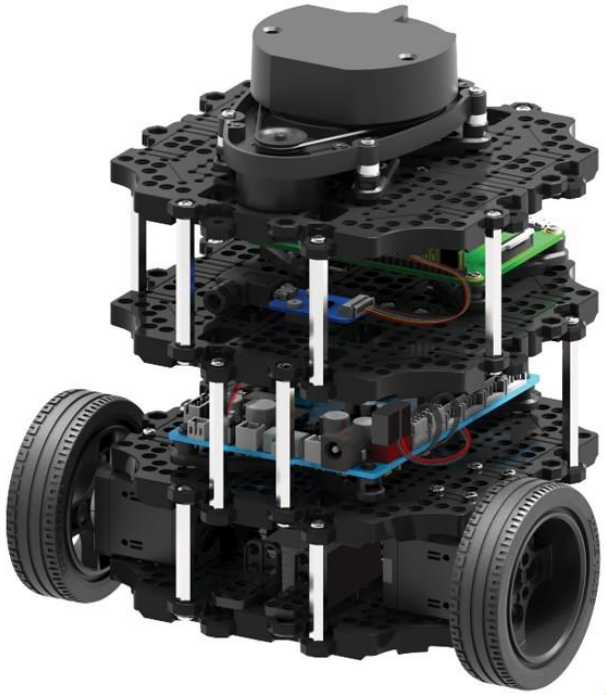
Today

1. Autonomous Navigation + GAZEBO simulations + Rviz
2. SLAM + Turtlebot3
3. Autonomous Exploration: simulation vs real robot

ROS

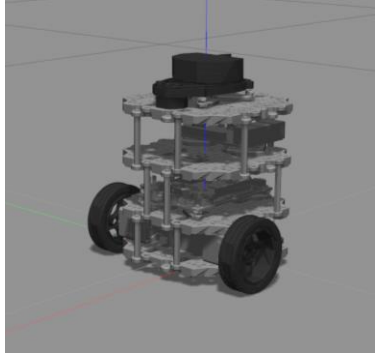
Robot: Turtlebot3

- 360° rotating (cheap) laser range scanner
- easy to add (and build) new layers and sensors
- Raspberry Pi 3+
- Multiple-machine configuration is needed robot + your laptop

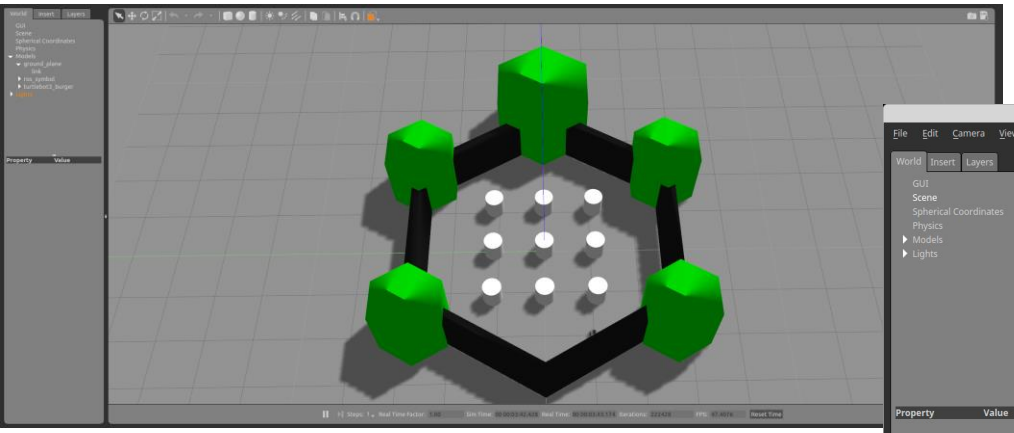


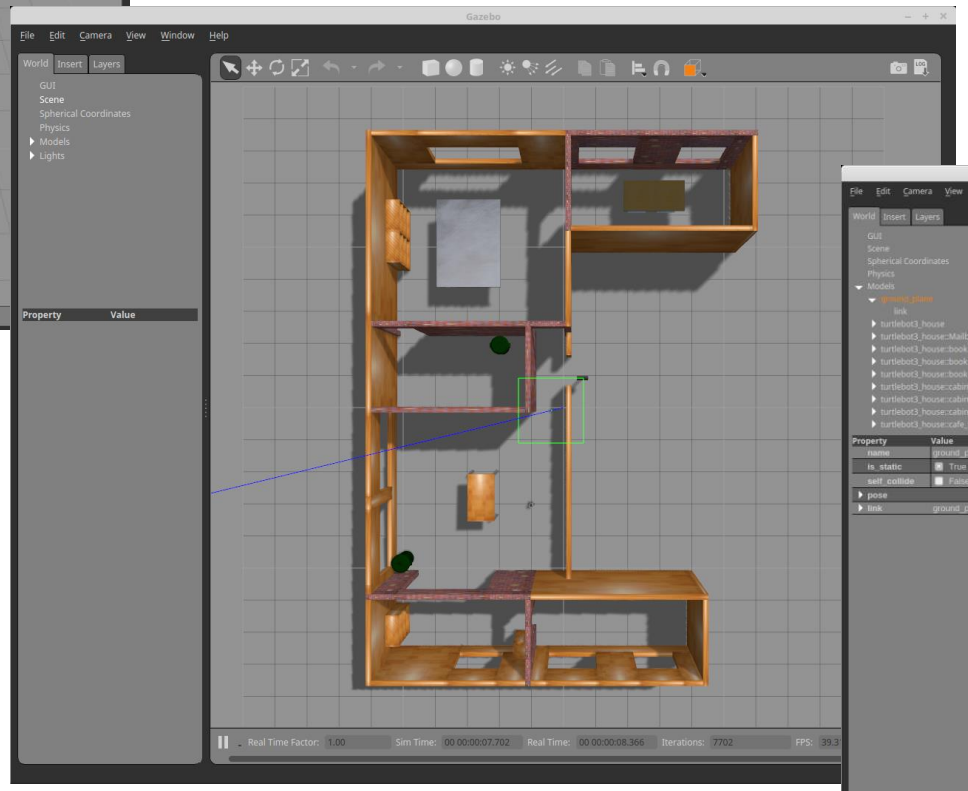
ROS

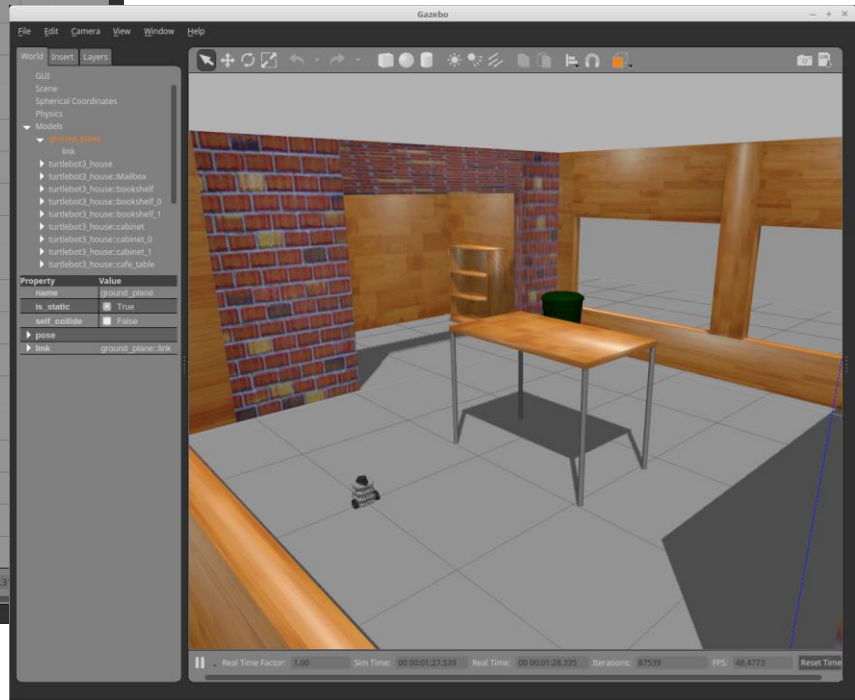
Simulations: Gazebo



Accurate turtlebot 3D robot model + different environments



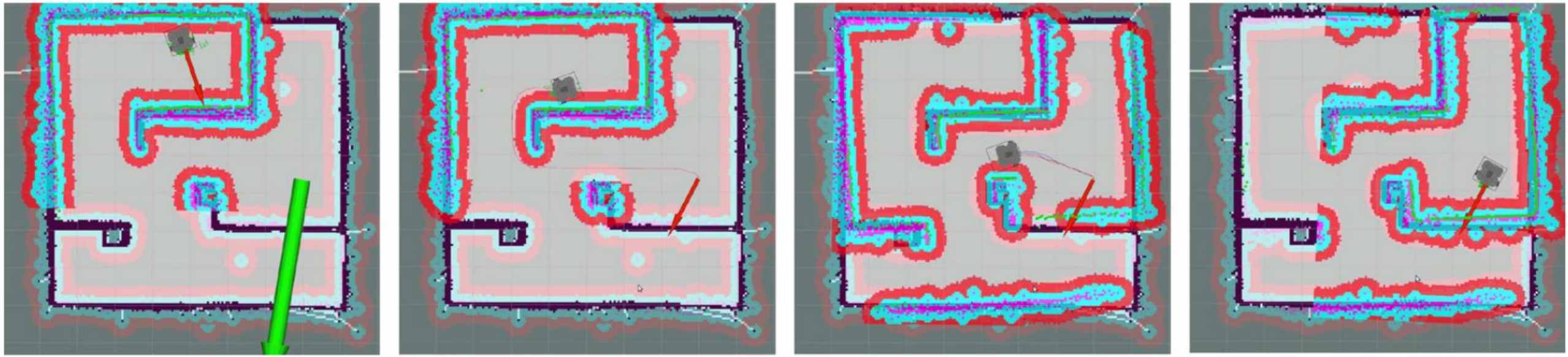




ROS

Autononomous Navigation

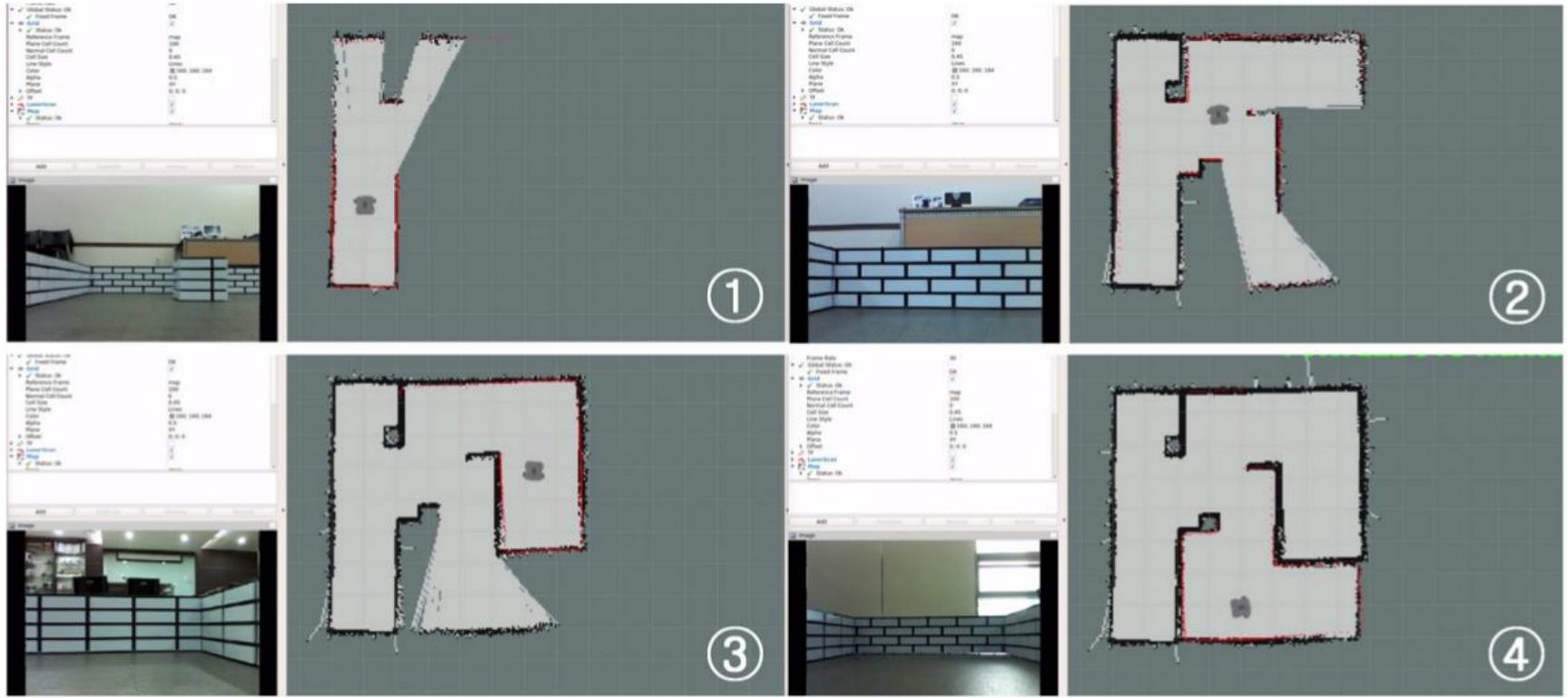
- Map is known
- Initial localization of the robot using Rviz
- Give manually to the robot a goal location



ROS

SLAM + teleoperation

- Turtlebot3 Raspberry PI: only sensors drivers + robot CORE
- Laptop: SLAM algorithm + Rviz + Teleoperation node

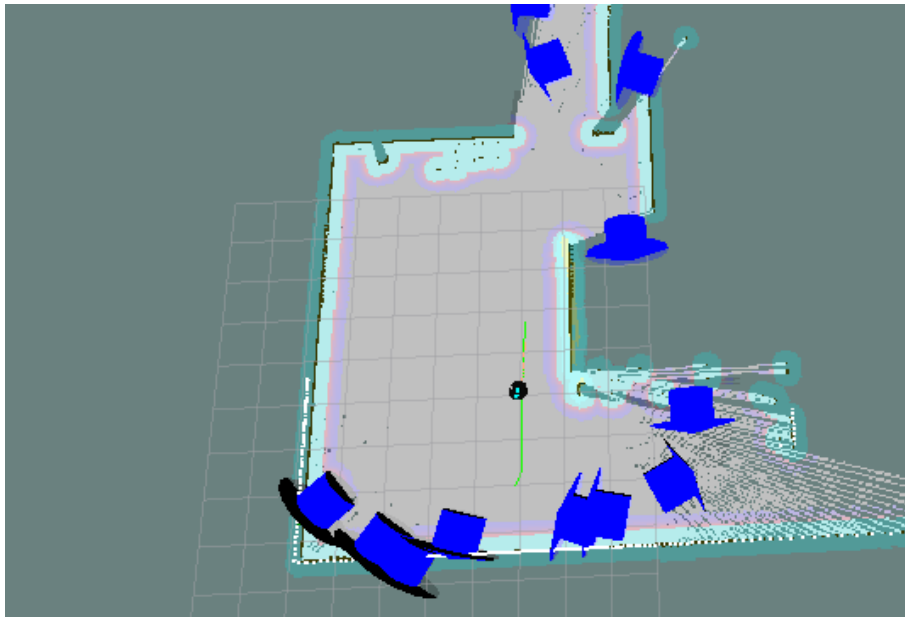


Autonomous Exploration

frontiers = boundaries between known and unknown part of the map

Map is unknown, incrementally built

1. Select the best frontier from a list
2. Go there
3. Update map with new sensor readings
4. Goto 1



We use an available ROS package fully integrated with navigation stack (explore_lite)

ROS

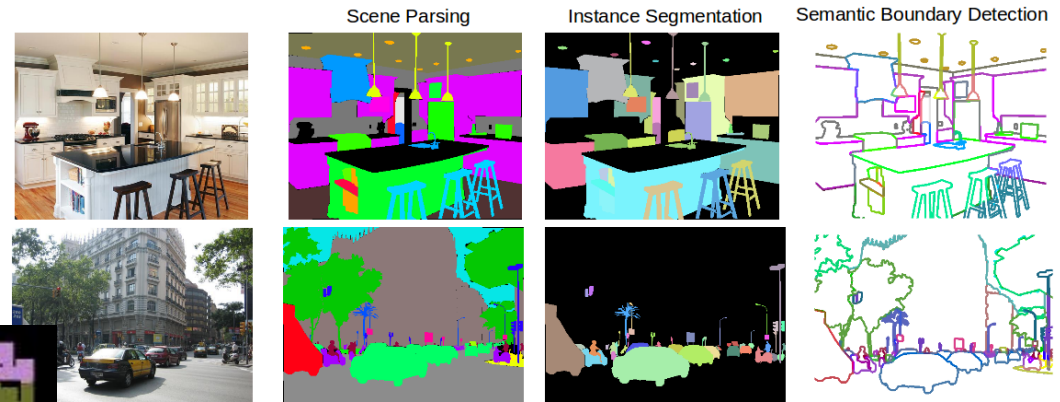
Ideas for project

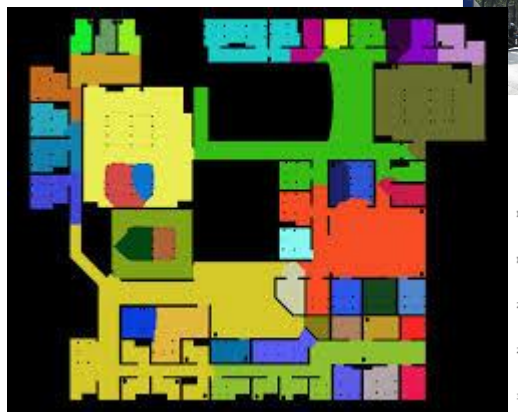
- Navigation and simulations are given by ROS
- Other more-complex packages can be used
  - Integration with open-pose, autonomous exploration, vison-related tasks
- Integration of other libraries / sensors + new applications

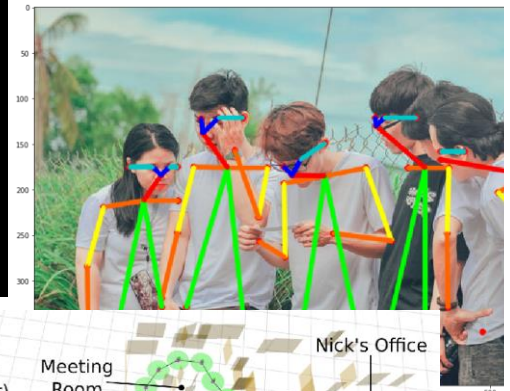
ROS

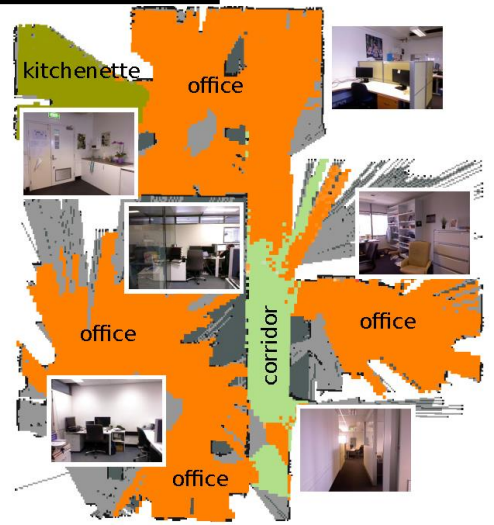
Ideas for projects

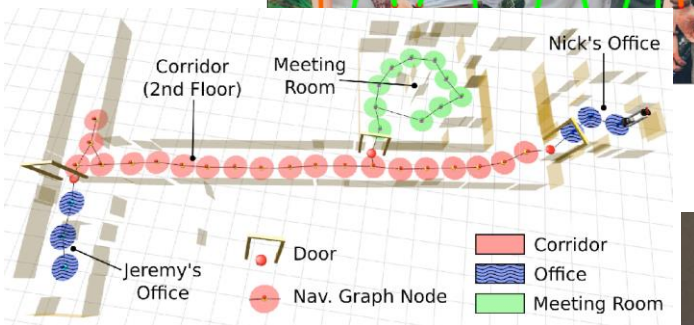
- Multi-robot systems
  - Communication
  - Exploration
  - Coordination
- Reasoning with metric maps
  - segmentation
  - object / feature detection
  - Exploration
  - detection of walls from metric maps / feature classification
- Human-robot interaction
  - service Robots
  - robot-games
- Integration with Computer Vision tools
  - Object recognition
  - Segmentation
  - People detection
  - Adaptation of the behavior of the robot to vision inputs
- Integration with VR / AR
  - Hololens
  - Oculus
  - Application (e.g. Search and Rescue)

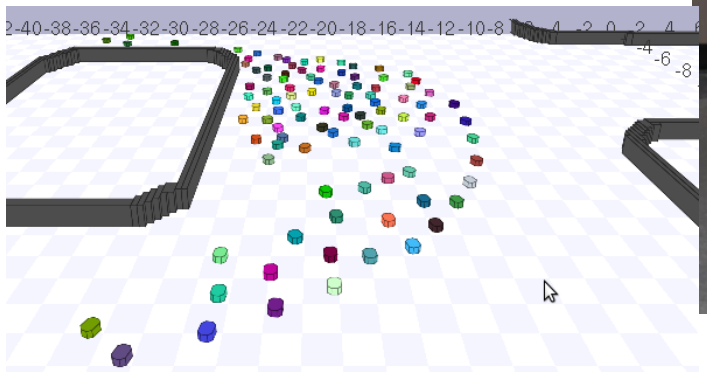












ROS