



Open Source Robotics

17 September 2013

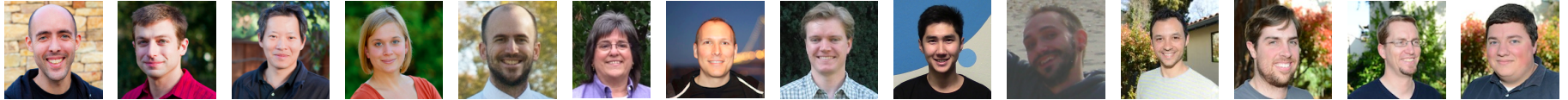
Morgan Quigley, Ph.D.



Open Source Robotics Foundation



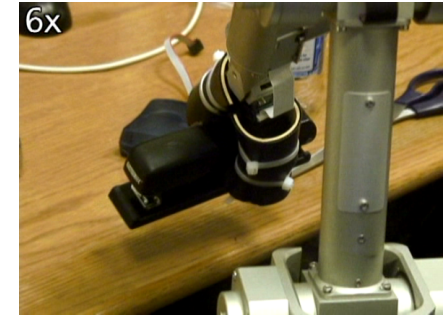
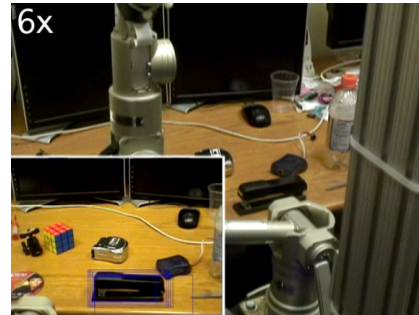
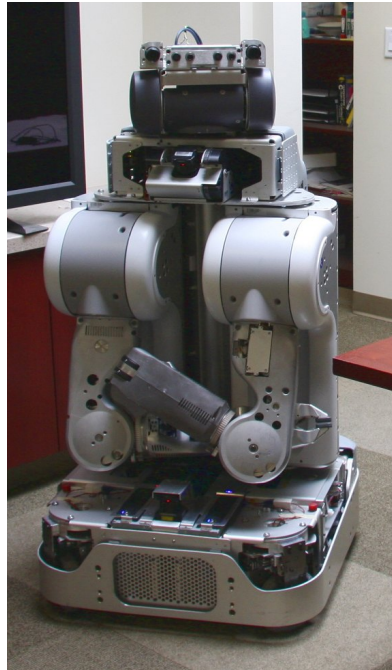
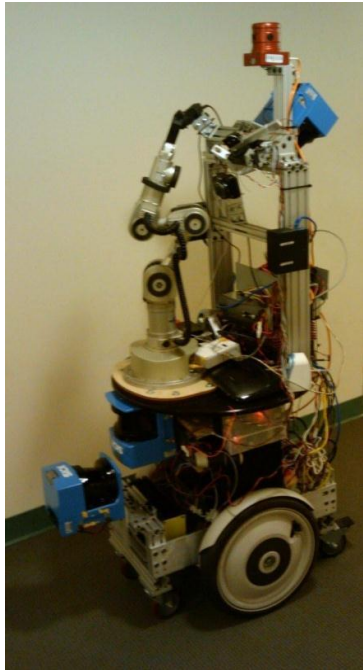
Open Source Robotics Foundation



“...to support the development, distribution, and adoption of open source software for use in robotics research, education, and product development.”

<http://osrfoundation.org>

ROS: The Early Days (c.2007)

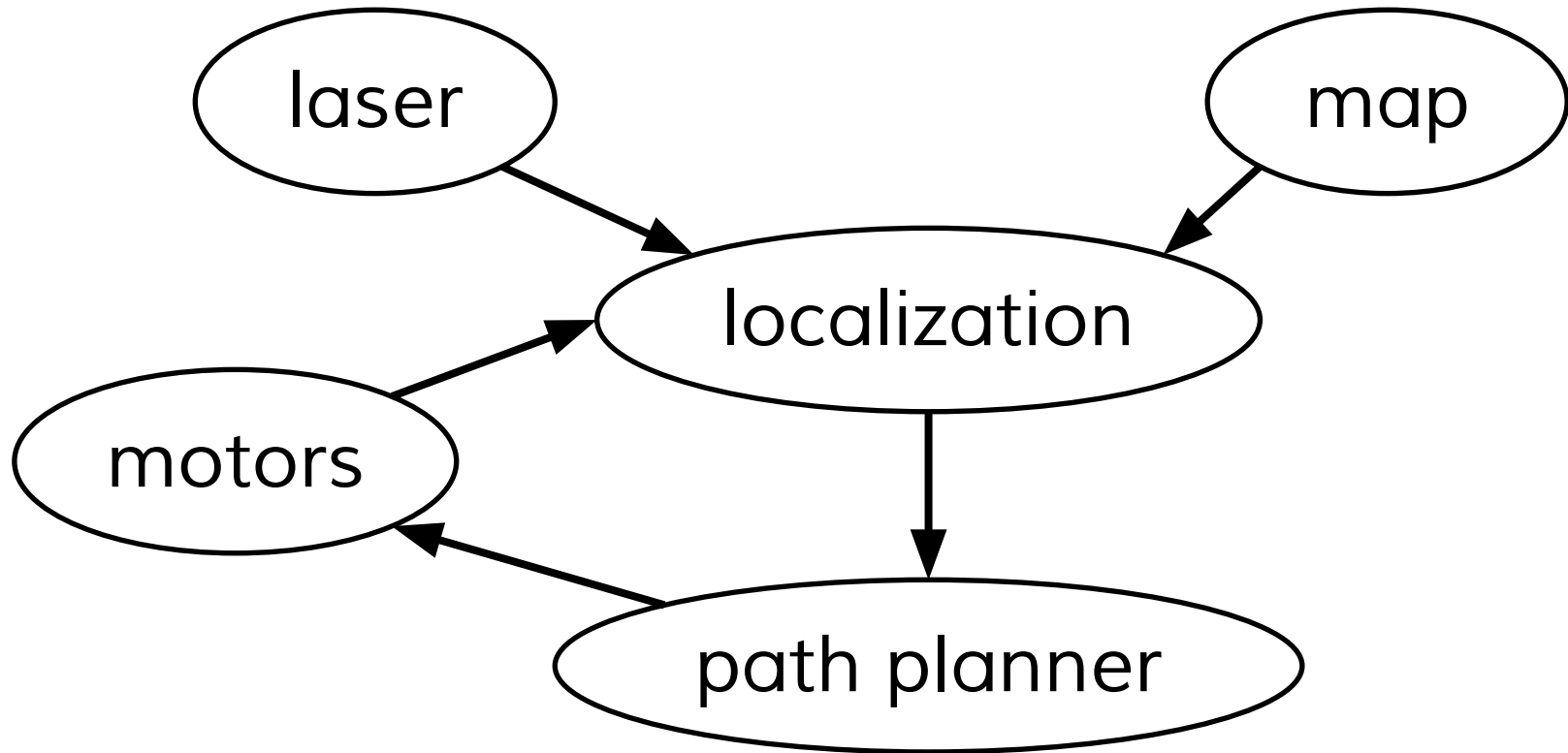


"please fetch the stapler from my office"

Integrative AI = lots of integration work

How can we reduce the pain?

ROS: Dynamic Computation Graphs



bubbles = POSIX processes. **no pre-defined structure.**

start / stop / restart / crash / debug independently

arrows = peer-to-peer message streams

replace any component with your own!

open-source is a starting point for rapid-prototyping

ROS Tools

motion
planning

navigation

knowledge
base

vision

sensor
fusion

hardware
drivers

browser
plugins

GUIs

logging /
playback

speech

plotting

embedded
bridge

real-time
visualization

mapping

android
bridge

simulation

task
planning

ROS Tools: Hardware Drivers

- cameras
- depth cameras
- laser scanners
- robots
- audio
- inertial units
- GPS
- joysticks
- etc...



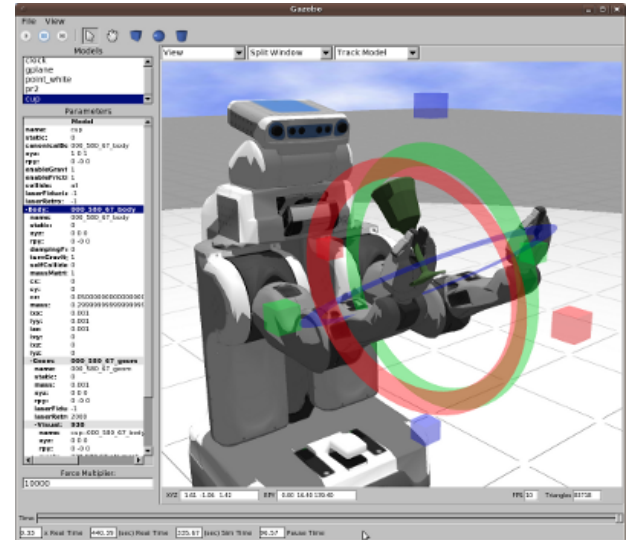
ROS Tools: 2D Navigation

- localization
- path planning
- 3D obstacle avoidance
- mapping (SLAM)

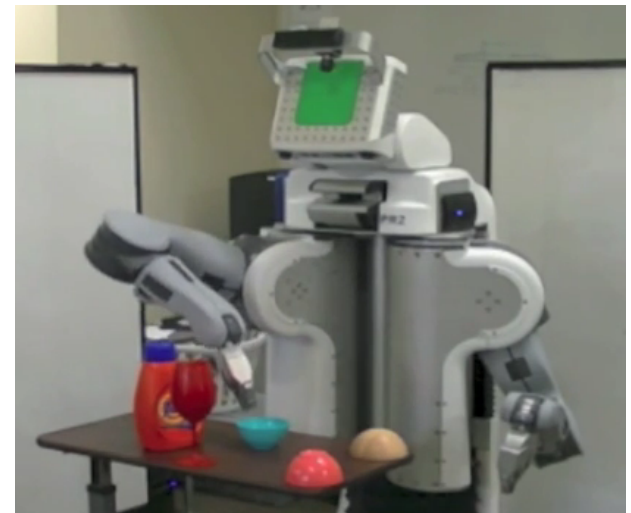


ROS Tools: Motion Planning

- kinematic modeling
- integrated sensing
- constraint generation
- trajectory smoothing
- trajectory following
- GUI plugins

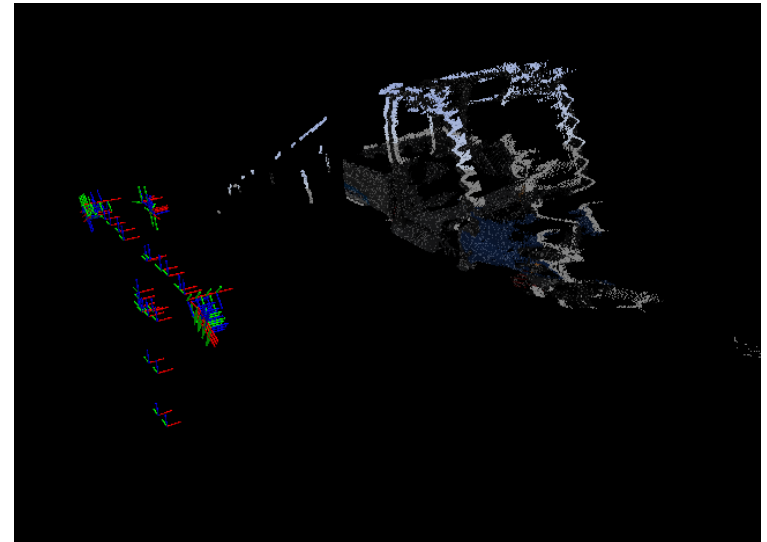


<http://moveit.ros.org>



ROS Tools: Visualization

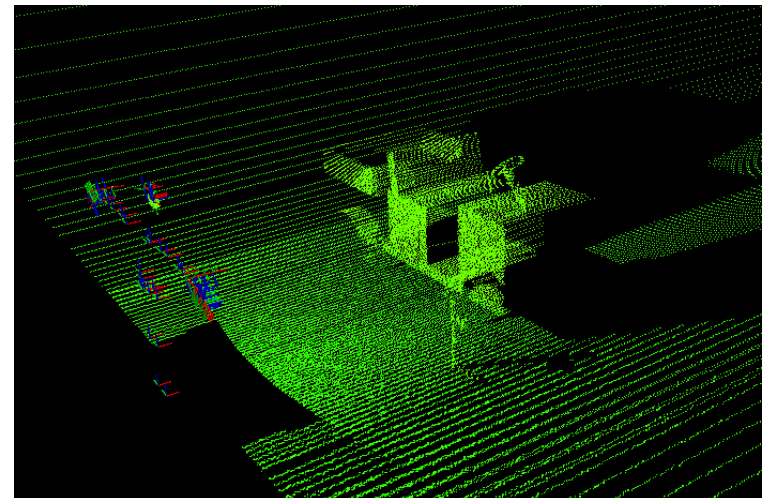
- Qt- and plugin-based
- plot common datatypes
- live 3D visualizations



The screenshot displays the ROS GUI interface. At the top, there is a web browser showing the ROS.org website. Below it, a 'Publisher' window shows a table of topics and their configurations:

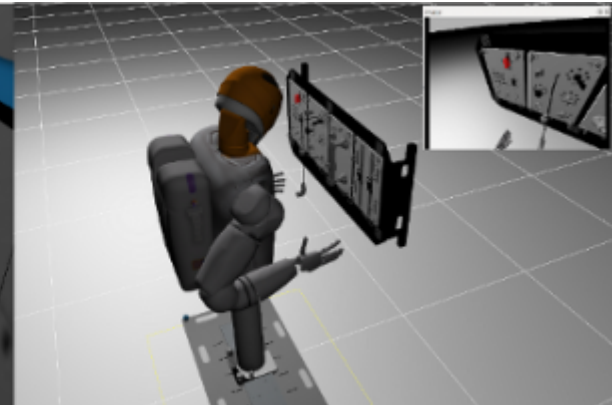
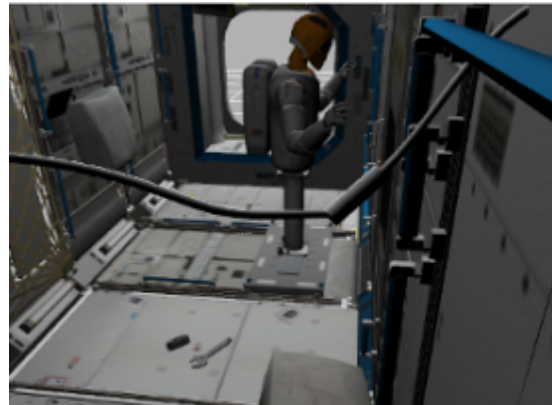
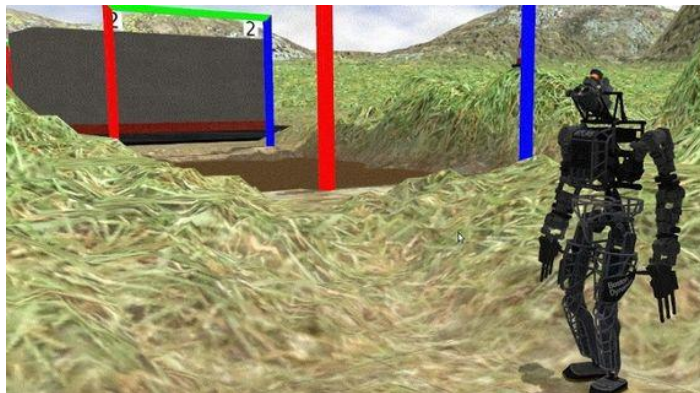
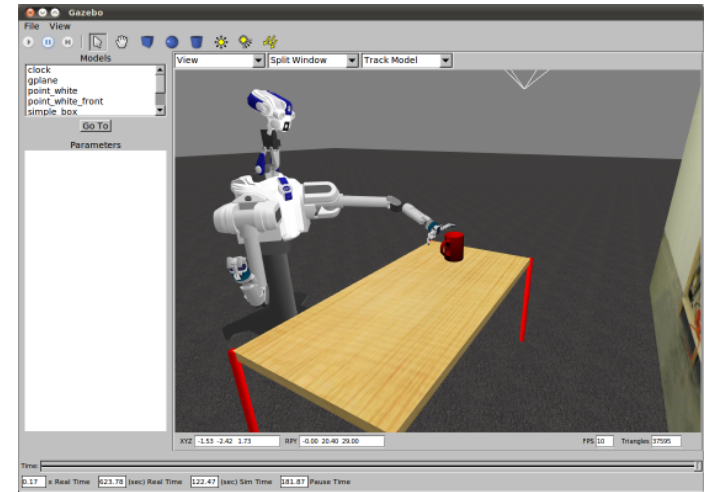
Topic	Type	Rate	Enabled	Expression
/cmd_vel2	std_msgs/Float32	10.00	True	cos(t/20)*20
data	float32			
/cmd_vel3	std_msgs/Float32	5.00	True	sin(t/20)*10
data	float32			

Below the publisher is a console window displaying system messages, and a plot window showing two sinusoidal waves (red and blue) over time, representing the data from the publishers. The plot axes are labeled with the topic names: /cmd_vel2/data and /cmd_vel3/data.

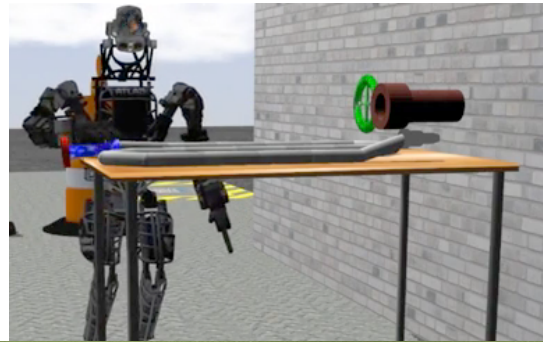
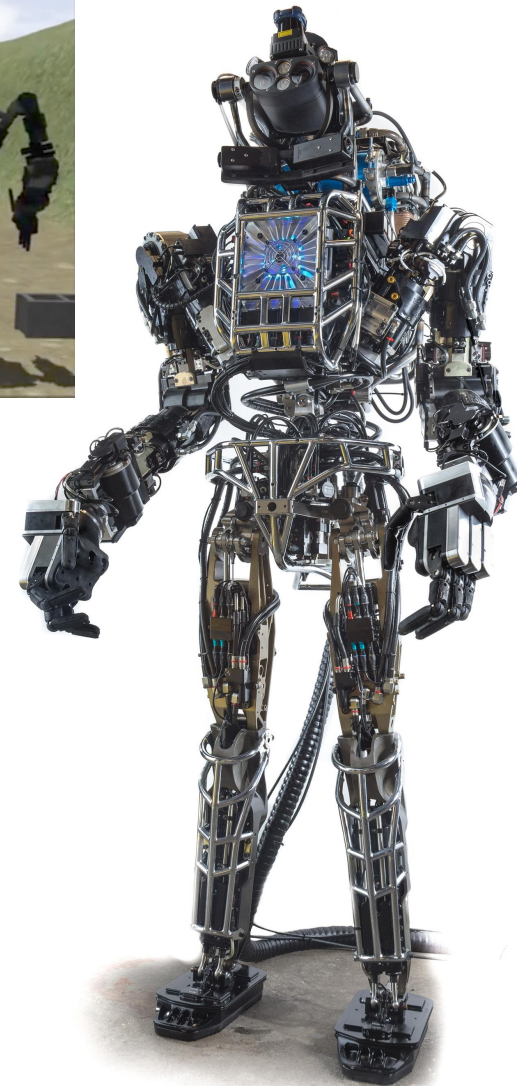
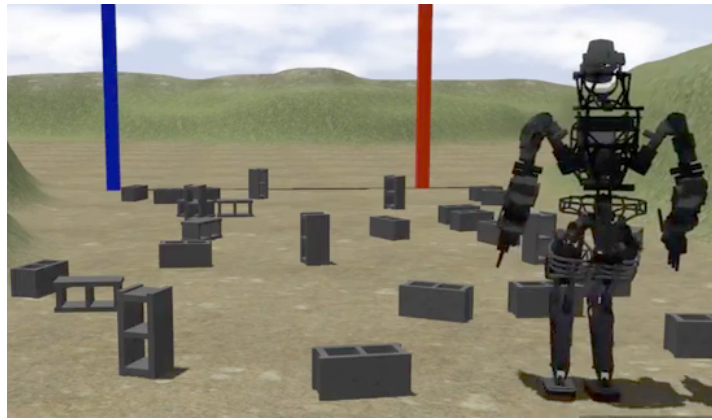
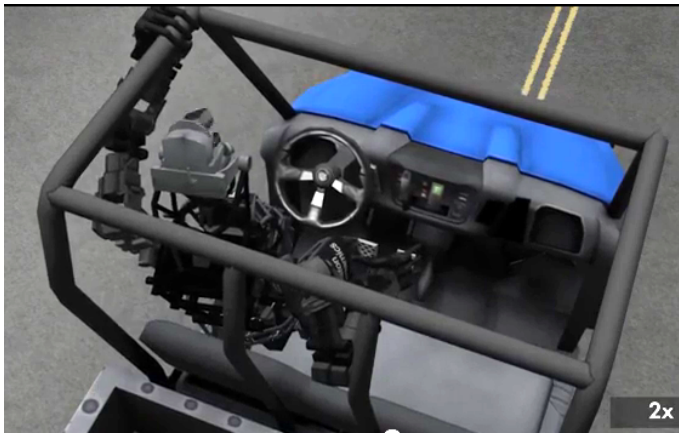


ROS Tools: Simulation

- Gazebo: 3D dynamic
- Stage: 2D navigation, static
- Many more talk to ROS
- Everything downstream can't tell the difference



Showcase: DARPA Virtual Robotics Challenge



http://ros.org

The screenshot shows the ROS.org website homepage. At the top, there is a navigation bar with the ROS.org logo and links for 'About', 'Support', and 'answers.ros.org'. Below this is a dark blue header with 'Documentation', 'Browse Software', 'News', and 'Download' buttons. The main content area is titled 'Documentation' and contains introductory text about ROS, followed by sections for 'Install', 'Getting Started', 'Contribute', 'Support', 'Mirrors', 'Software', 'Robots/Hardware', and 'Publications, Courses, and Events'. A right-hand sidebar contains 'Wiki' and 'Page' sections with various links and a 'More Actions' dropdown menu.

http://answers.ros.org

The screenshot shows the ROS Answers website homepage. It features a search bar at the top with the text 'ALL UNANSWERED' and a search icon. Below the search bar, it displays '9,227 questions' and sorting options: 'Sort by > by date by activity by answers by votes RSS'. A list of questions is shown, each with a title, tags, and a summary of votes and answers. For example, the first question is 'publish an integer' with 1 answer and 1 view. The right-hand sidebar includes 'Contributors' with a grid of user avatars and 'Tags' with a list of tags and their counts, such as 'fuerte x 9', 'groovy x 7', and 'Kinect x 5'.