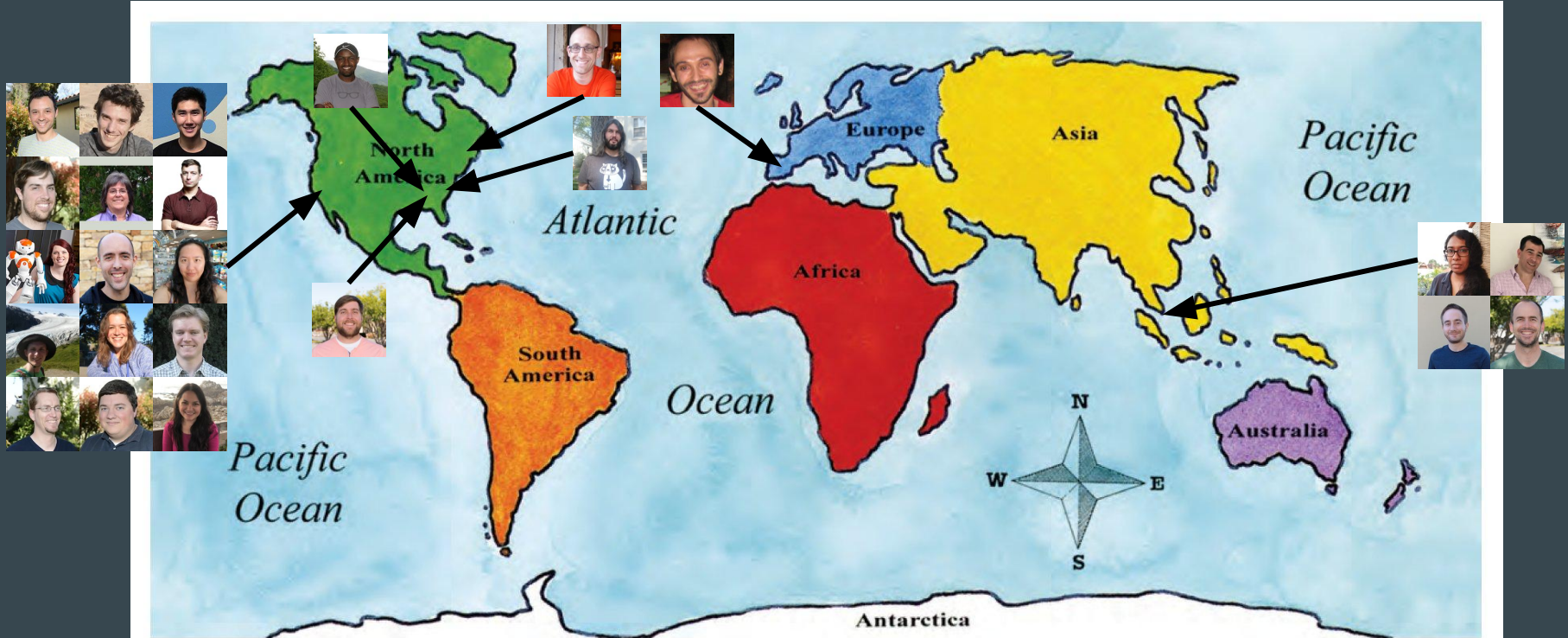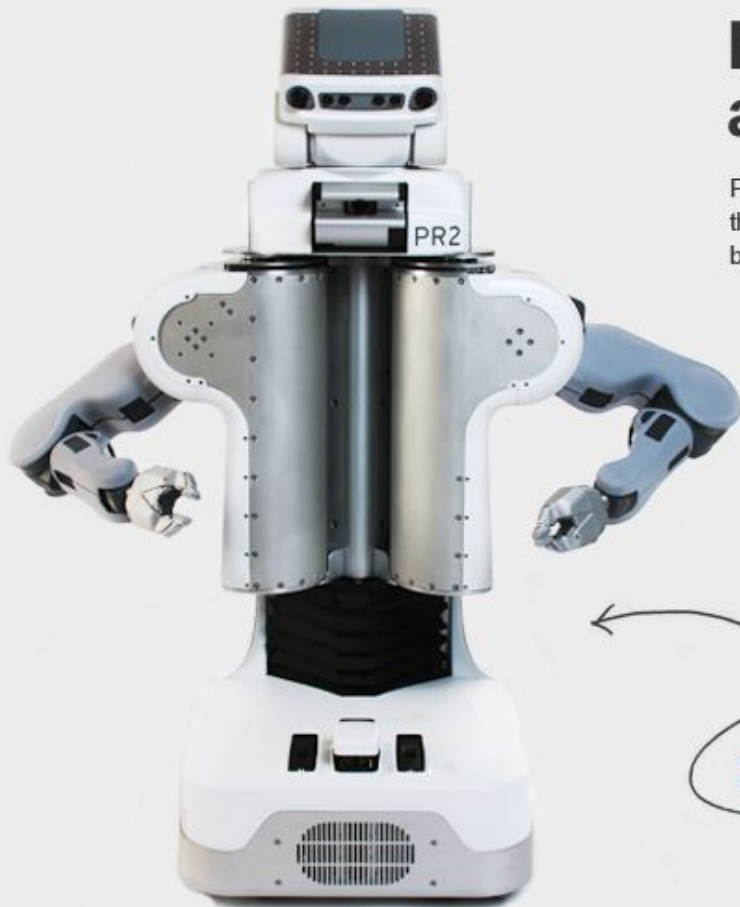# What's next for ROS?

• • •

The Organization

Open Robotics

We support the development, distribution, and adoption of open software and hardware for use in robotics research, education, and product development.

The Team

History: From lab to product

Robot for Research and Innovation

PR2 is a robotics research and development platform that lets you innovate right out of the box. No more building hardware and software from scratch.

LOOK INSIDE

20 December 2008 Navigation

Milestone 1 Reached!

Submitted by Anonymous on Sat, 12/20/2008 - 00:42

We cleanly passed our first major milestone this morning, with one of the Alpha PR2 robots (Gandalf) auto kilometers two days in a row. Gandalf had been doing a π-kilometer run each day for the past two weeks, the milestone complete until we had two consecutive clean runs. In the process, we improved the navigati avoid low obstacles (scooters are popular here, and weren't seen by the first version of the software), to m uncharted territory when stuck, and of course by fixing a few bugs.

This milestone is very important: It demonstrates the hardware of the PR2 (except arms), from casters to to sensors. It demonstrates the software on the robot from the device drivers to the executive, from the co

ROS 0.4
mango tango
http://ros.sourceforge.net

10 February 2009
First advertised release
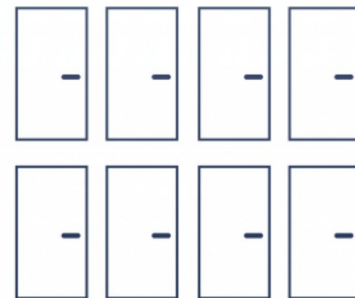
7 May 2009
Second advertised release

Plug 3
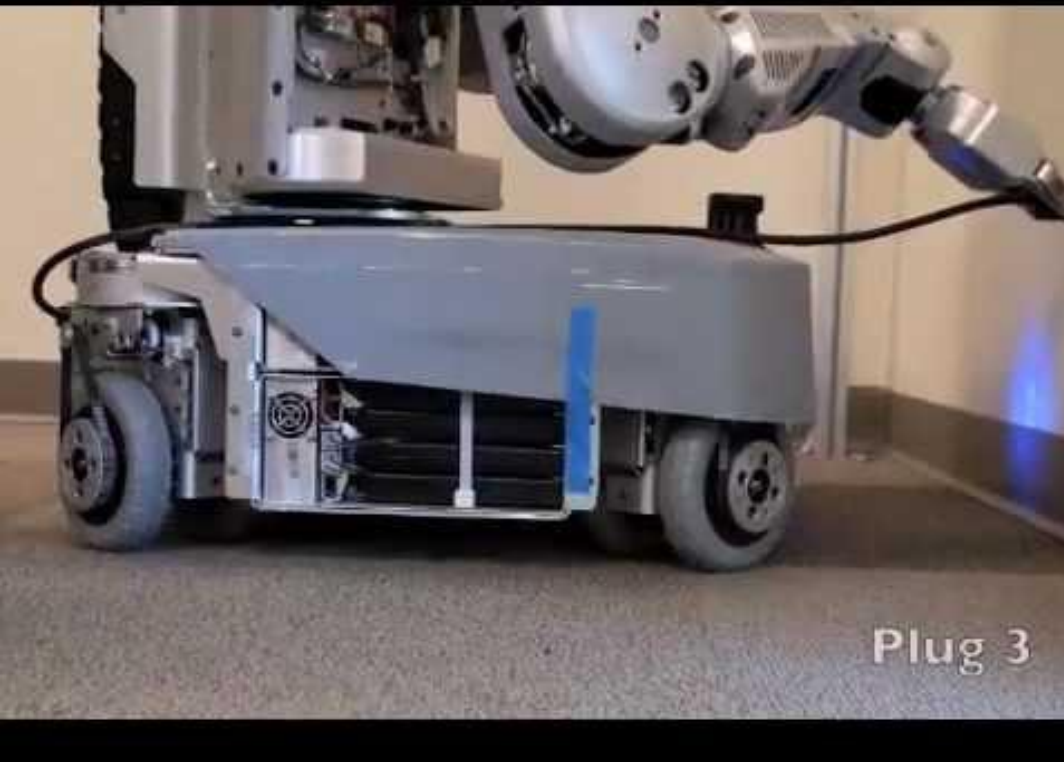
1 June 2009
Navigation + manipulation

Milestone 2 Reached!

Submitted by Anonymous on Mon, 06/01/2009 - 21:17

26.2

Today at 6pm, one of our PR2 alpha robots successfully completed Milestone 2 by performing a circuit of 10 plugin goals in just under an hour. It had previously completed the first part of the milestone, which was successful navigation around the office for 26.2 miles (a marathon).The first

22 January 2010
ROS 1.0
PR2s offered to labs

Milestone 3 Complete: PR2 Betas Ready and ROS 1.0

Submitted by admin on Fri, 01/22/2010 - 17:42

Today, we finished our third milestone! Simply put, ROS has reached 1.0 status. We also recently unveiled and the PR2 Beta Program, which will distribute approximately 10 PR2 robots at no cost.

Of course, it's a lot more than that. Since work began on Milestone 3, there are now:

- 203 ROS software tutorials
- 29 ROS Stacks at 1.0 status, which contain a total of 186 ROS Packages
- 21 Completed Use Cases, requiring well over one hundred user studies

17 September 2012
First ROS-based commercial (non-research) robot

Rethink ROS

By Tully Foote on September 17, 2012 10:22 PM | No Comments | No TrackBacks

*Cross Posted from the Open Source Robotics Foundation Blog*

There's exciting news out of Boston today with the launch of Rethink Robotics's new robot. Rethink Robotics is developing a family of low cost and highly intelligent robots that can perform simple tasks in a manufacturing environment, increasing the productivity of the people around them. Rethink Robotics was founded by Rodney Brooks, former Director of the MIT Computer Science & Artificial Intelligence Laboratory, and co-Founder of iRobo

Rethink's robots can be taken out of the box, taught a task by anyone, and sta eliminating the need for systems integration. They are safe to interact with peo easy to train and retrain on the fly. They are nothing like any existing industrial

While all of this is very exciting for the robotics industry, and certainly for our fr personally find most exciting is the role played by ROS in today's news. Rethin words of CEO Scott Eckert, "built upon ROS." We had some hint from Rethink ROSCon 2012 that they were doing something with ROS, but we were very pl hear that ROS is such a central part of Baxter.

(some of the) ROS-based products available today
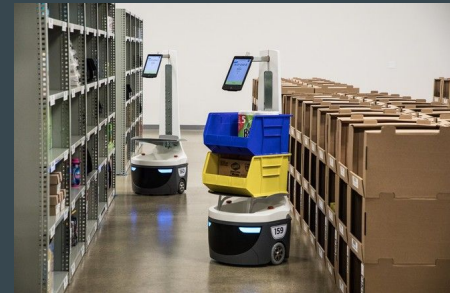
Gazebo: Simulate your robot(s)

Importance of Simulation

Design

Prototype configurations and sensor placement.

Experiment with different scenarios.

Testing

Simulation based CI

Scale up with cloud computing

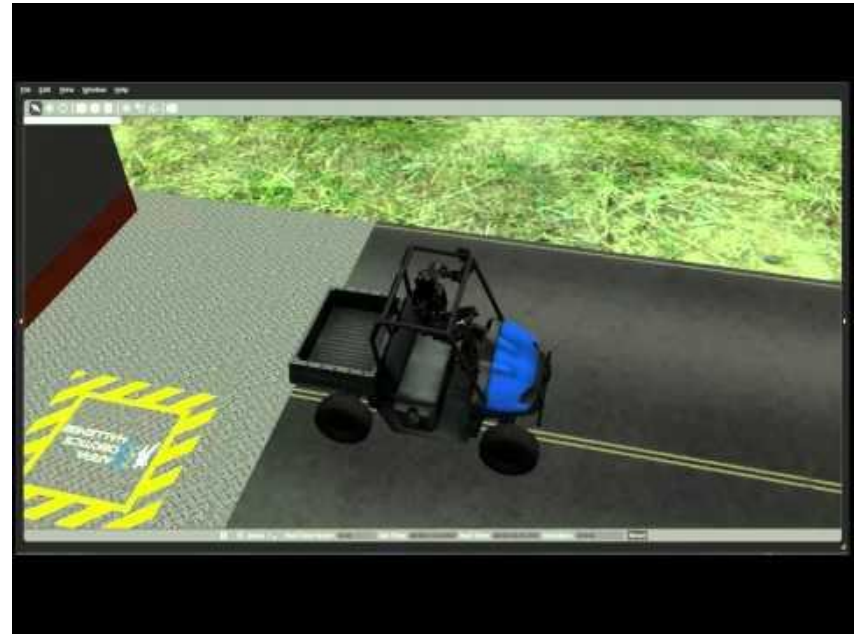Tools to understand and debug tests

Productivity

Reduce constraint on shared hardware

Less overhead with software-only system

Simulation is very safe

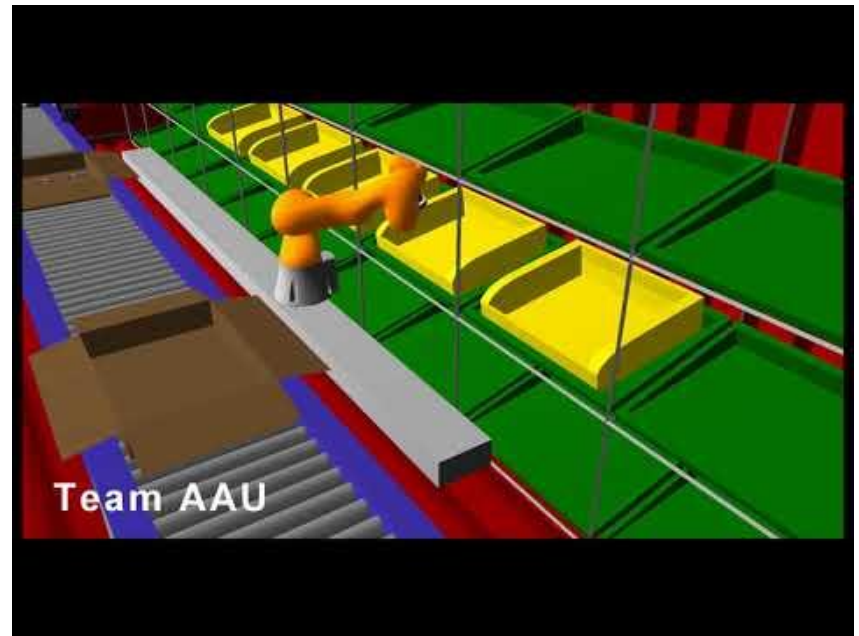# Simulation: Robots for Disaster Response

Virtual Robotics Challenge, 2013

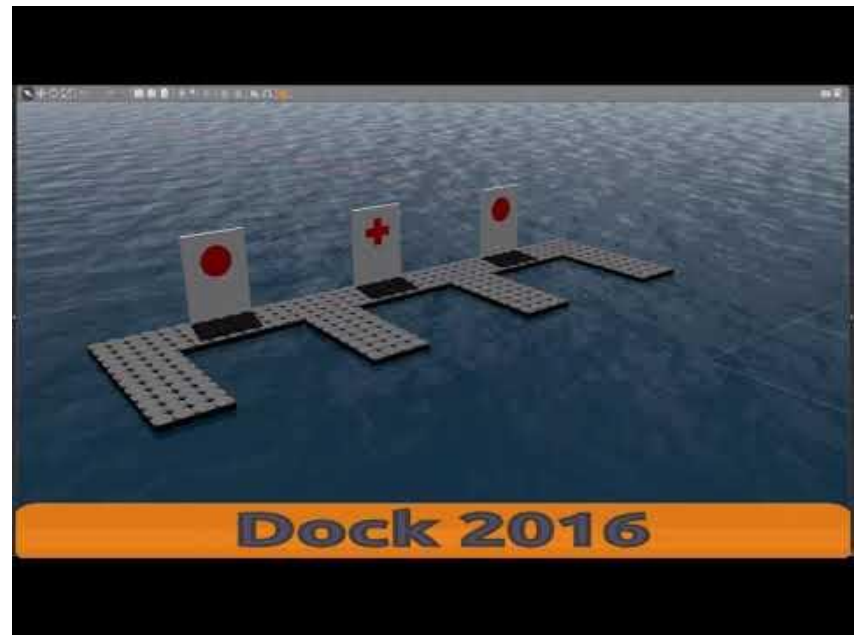# Simulation: Robots for Planetary Exploration

Space Robotics Challenge, 2017

Simulation: Robots for Industrial Automation

Agile Robotics for Industrial Automation Competition, 2018
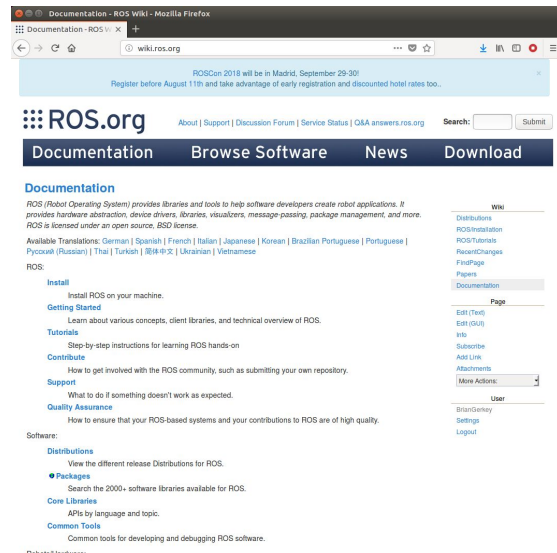
Simulation: Boats for Ocean Monitoring

Virtual Maritime Robotics Challenge, 2019

Metrics: Community size & health

Documentation

The ROS wiki

- 178K monthly users**
  - 35% annual increase*
- 1.49M annual users***
- 24.48M annual page views***

- Source: Google Analytics
- * July 2018 vs. July 2017
- ** Month ending July 31, 2018
- *** Year ending July 31, 2018
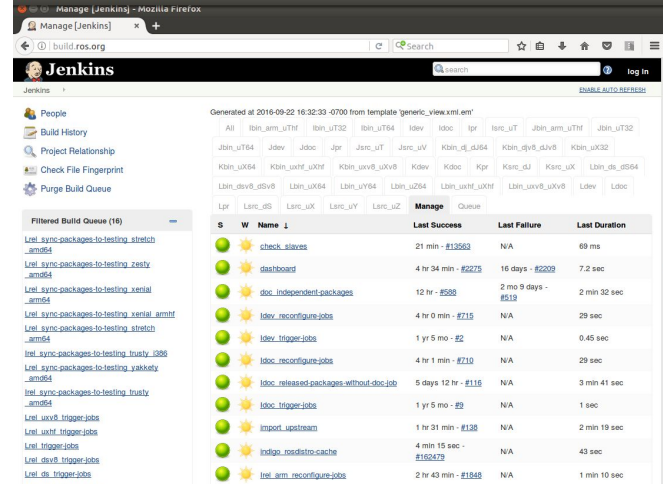
Documentation

The ROS wiki

1.	🇺🇸	United States	**34,710** (19.08%)
2.	🇨🇳	China	**31,946** (17.56%)
3.	🇯🇵	Japan	**15,518** (8.53%)
4.	🇩🇪	Germany	**12,711** (6.99%)
5.	🇮🇳	India	**8,400** (4.62%)
6.	🇵🇭	Philippines	**7,235** (3.98%)
7.	🇰🇷	South Korea	**6,790** (3.73%)
8.	🇬🇧	United Kingdom	**4,325** (2.38%)
9.	🇹🇼	Taiwan	**4,233** (2.33%)
10.	🇫🇷	France	**3,725** (2.05%)

- Global impact: USA constitutes 19% of users***
- Partial translations in 14 languages

- Source: Google Analytics
- * July 2018 vs. July 2017
- ** Month ending July 31, 2018
- *** Year ending July 31, 2018

Binary packaging

The ROS build farm

- 327K monthly downloaders**
  - 41% annual increase*
- 16.2M monthly binary packages downloaded**
  - 21% annual increase*
- 5.9TB monthly download traffic**
  - 25% annual increase*

- Source: awstats @ OSUOSL
- * July 2018 vs. July 2017
- ** Month ending July 31, 2018

ROS 2: The next generation

Goals for ROS 2

product-ready

Use industry-standard middleware (e.g., DDS)

Build in security from the beginning

Support Linux, macOS, and Windows

mission-critical

Support real-time control

Static analysis (e.g., MISRA)

Document design choices

Support safety certification

...but also familiar

Keep the core concepts from ROS 1

Distributed systems

Federated development

Permissive open source license

Timeline for ROS 2

March 2014
Work begins at
Open Robotics

August 2015
Alpha 1: first ROS
2 release

December 2016
Beta 1

July 2018
Bouncy Bolson:
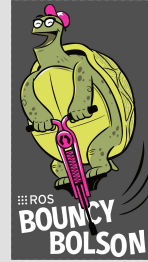first distro with
external packages

December 2018
Crystal Clemmys

September 2014
First ROSCon talk
on ROS 2

July 2016
Alpha 7: first
TurtleBot 2 demo

December 2017
Ardent Apalone:
first distro

September 2018
TurtleBot 3 runs
ROS 2

(some of the) Companies supporting ROS 2 development

ROS 2 & Gazebo Use Case: Automotive

Open non-competitive features
Safety and security
do not differentiate.

Shared Engineering

Example: ROS Navigation

A path planner and obstacle avoidance library.

Forked and modified by numerous companies, who contribute upstream.
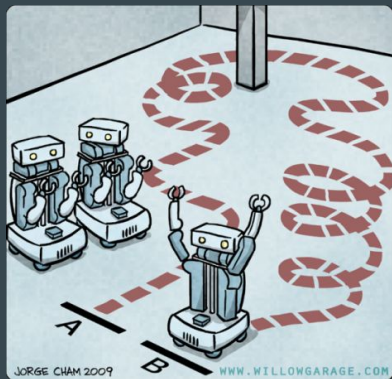
Goal: Reference implementations

High quality, best in class implementation of commonly required components.

Vendors customize as needed, but also contribute upstream.

Anecdote: ABS Brakes

- Concept existed for many years
- Companies modified and applied their own features

Simulation: Automobiles

Wide range of assets
Or import Collada, STL, or OBJ files

Autonomous vehicles require hundreds of millions of miles (or more) to prove reliability. [1]

1. Kalra, Nidhi and Susan M. Paddock. Driving to Safety: How Many Miles of Driving Would It Take to Demonstrate Autonomous Vehicle Reliability?. Santa Monica, CA: RAND Corporation, 2016.

Software Platforms

https://github.com/ApolloAuto/apollo

https://github.com/CPFL/Autoware

".. an open, reliable and secure software platform for its partners to develop their own autonomous driving systems ..." -- http://apollo.auto

"We use the latest technologies, such as ROS (Robot Operating System), and are able to see the results quickly and directly in the vehicle. It is extremely exciting to be working on such an important area for the future." -- André Müller, BMW

Hardware Platforms

Autonomous Stuff

Supplies components and engineering services for automotive autonomy.

https://github.com/astuff

Dataspeed ADAS Kit

Complete solution to control throttle, brake, steering, and shifting.

https://bitbucket.org/DataspeedInc/

Successful Exit: HERE

Mar 2014

HERE mapping fleet
running ROS

Dec 2015

Nokia Closes Its
$2.8B Sale of HERE to
the Audi, BMW, And
Daimler Car
Consortium

Successful Exit: Cruise Automation

Mar 2016

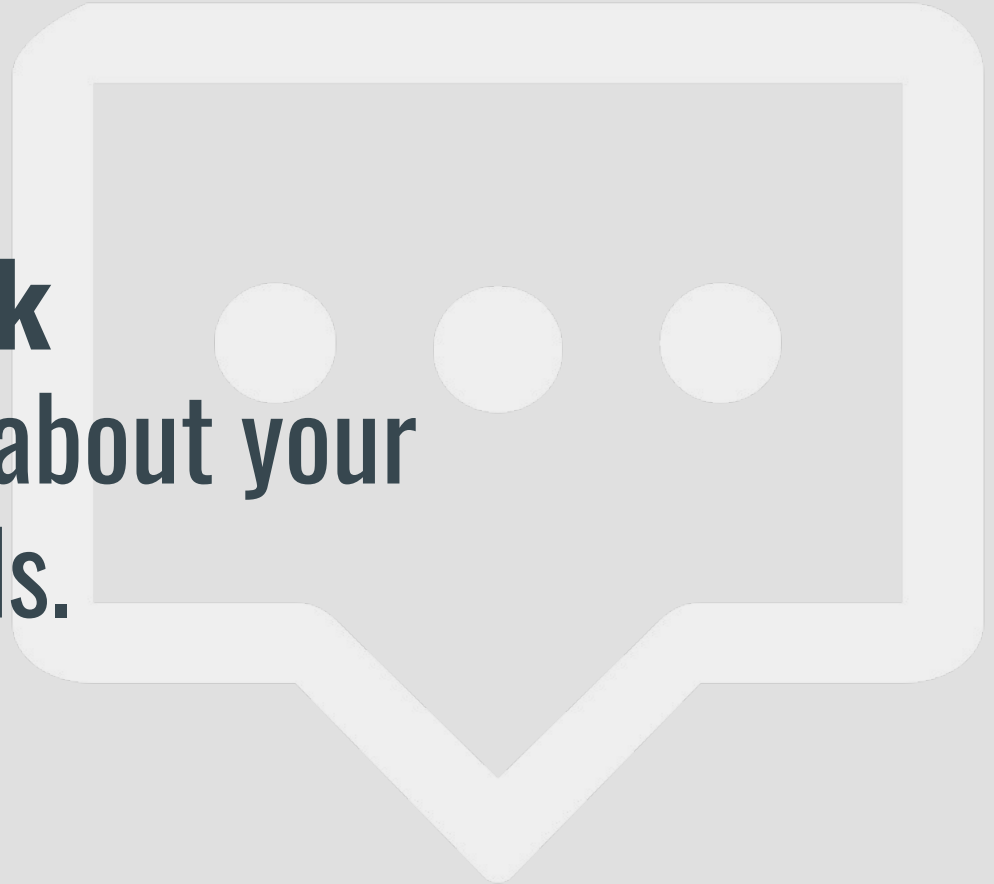"GM reportedly spent over $1 billion on a tiny startup that holds a key to the future of driving" -- Business Insider

Sep 2018

"Cruise Automation's self driving car runs on top on ROS" -- ROSCon 2018 program

Philosophy: Be active in open source

Provide Feedback
Let projects know about your problems and needs.

Private communication

ros@openrobotics.org | sim@openrobotics.org

Contribute
Upstream code when possible.

What?

- Bug fixes and patches
- Tools and applications that don't affect value proposition.

Why?

- Less code for you to maintain.
- More testing.
- Build a user group.

Publicize

Share your experience.
Support publication of your usage.

http://www.ros.org/
http://gazebosim.org/

https://www.openrobotics.org

We're hiring!