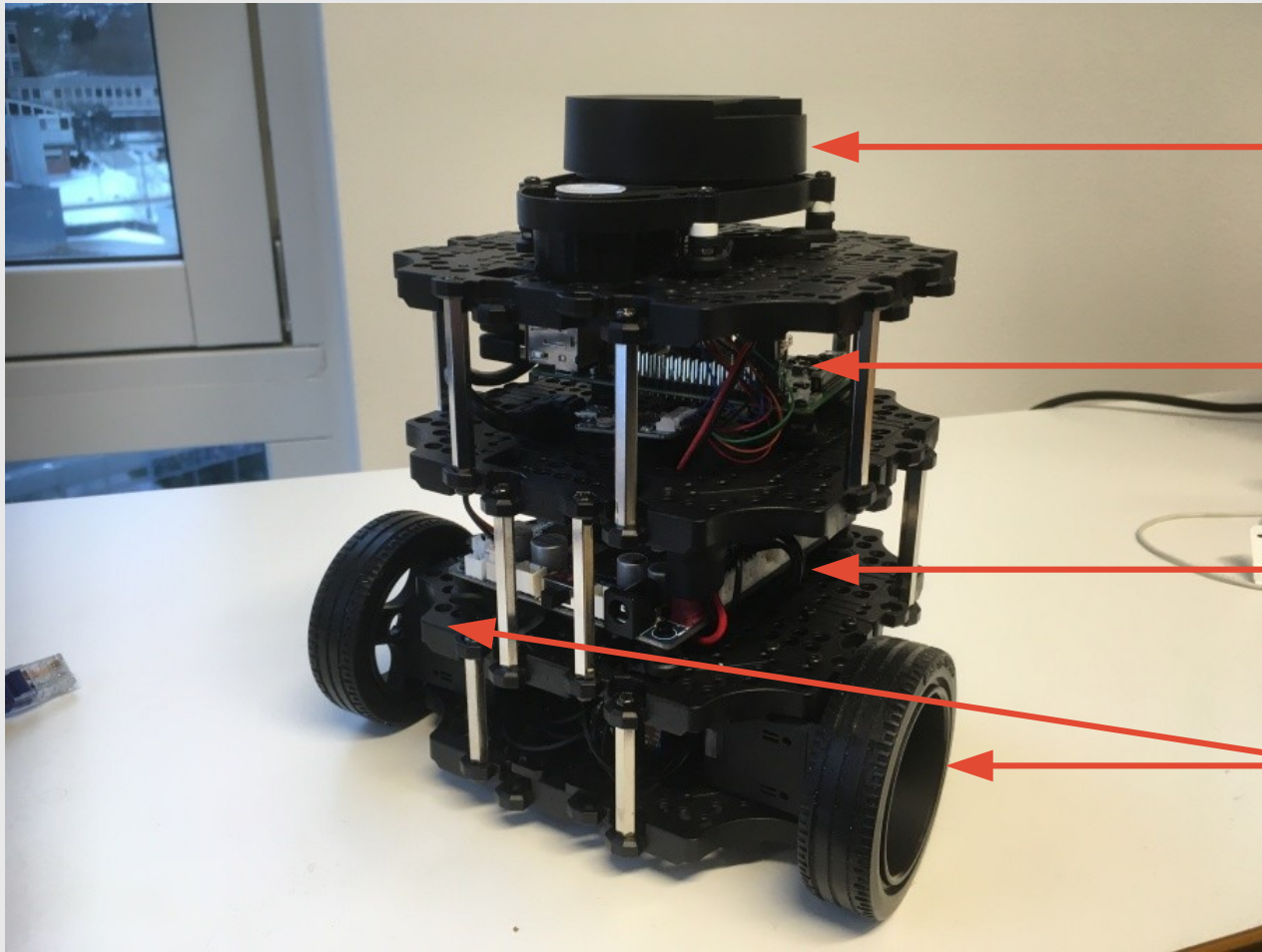


# Porting the Robot Operating System (ROS) to FreeBSD

Trenton Schulz



# You have a robot & its different parts...



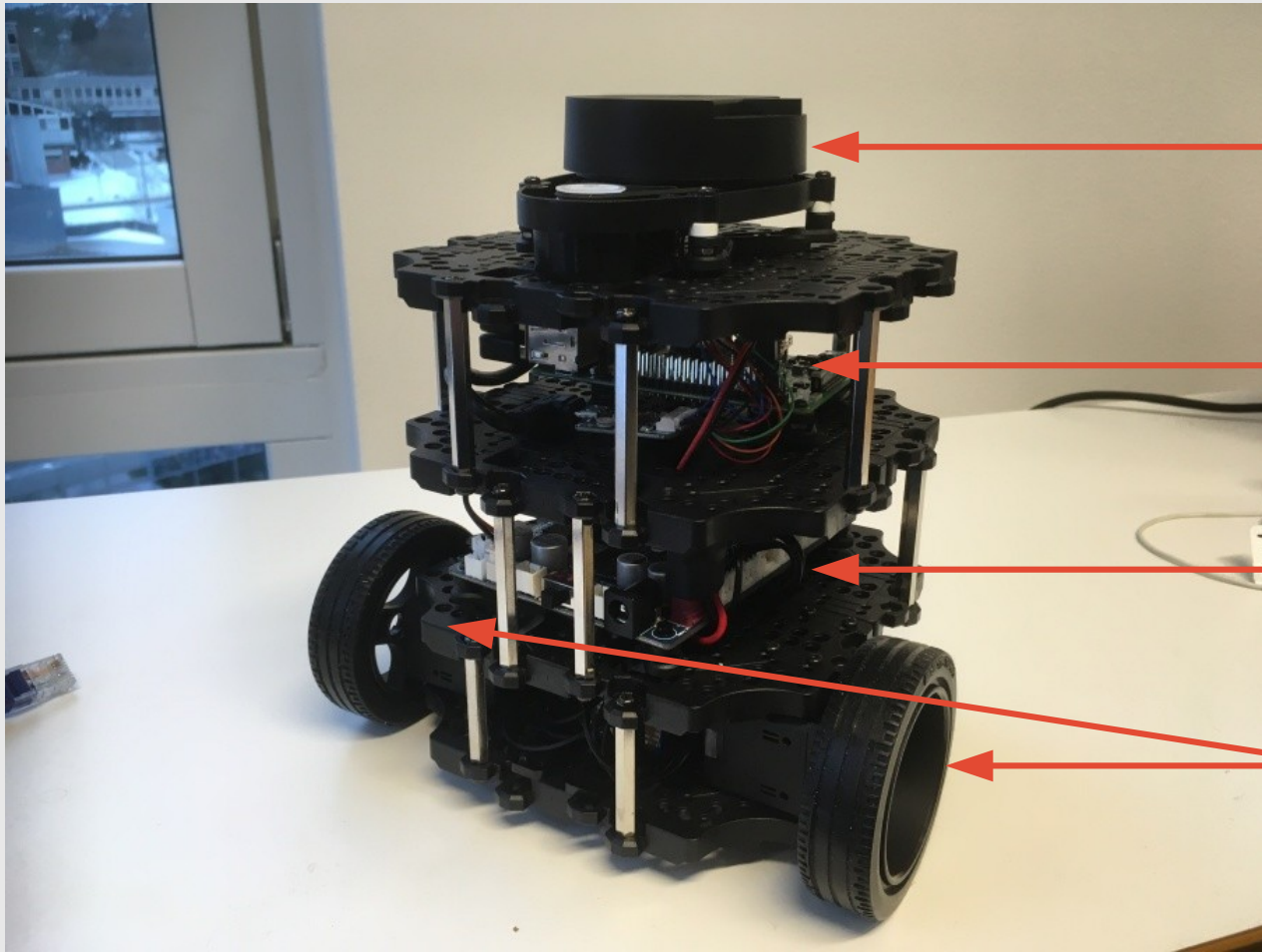
Sensors

CPU

Control Module

Motors & Wheels

# You need software to handle tasks



Read data from sensors

Navigation, Odometry, Command

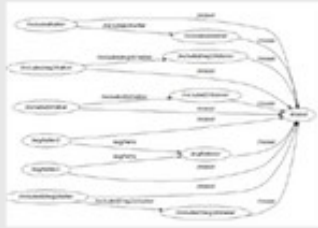
Control hardware

Start and Stop

# ROS is more than an operating system

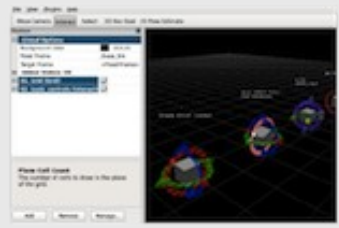


=



Plumbing

+



Tools

+



Capabilities

+















Ecosystem

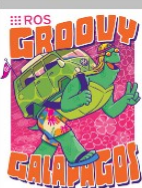







# Now imagine you have lots of different robots and you want to share the code...

The screenshot shows the ROS Robots website interface. At the top left is the ROS Robots logo, and at the top right are a menu icon and a search icon. Below the header is a section titled "Find a robot by category:" with four filter buttons: "Aerial" (with an airplane icon), "Component" (with a wrench icon), "Manipulator" (with a robotic arm icon), and "Marine" (with a boat icon). A large red circle is overlaid on the "Manipulator" button, containing the text "141 Robots!". Below this is a "Recently Added" section with two robot cards. The first card is for "CRANE-X7", showing a red and white robotic arm, with the category "manipulator" and a "Website" link. The second card is for "TIAGo++", showing a small white and black robot, with the category "ground" and a "Website" link.

Source: robots.ros.org

# ROS follows a release similar to Ubuntu

Distro	Release date	Poster	Tuturtle, turtle in tutorial	EOL date
ROS Melodic Morenia (Recommended)	May 23rd, 2018			May, 2023 (Bionic EOL)
ROS Lunar Loggerhead	May 23rd, 2017			May, 2019
ROS Kinetic Kame	May 23rd, 2016			April, 2021 (Xenial EOL)
ROS Jade Turtle	May 23rd, 2015			May, 2017
ROS Indigo Igloo	July 22nd, 2014			April, 2019 (Trusty EOL)
ROS Hydro Medusa	September 4th, 2013			May, 2015

ROS Groovy Galapagos	December 31, 2012			July, 2014
ROS Fuerte Turtle	April 23, 2012			--
ROS Electric Emys	August 30, 2011			--
ROS Diamondback	March 2, 2011			--

Source: <http://wiki.ros.org/Distributions>

# Porting ROS to FreeBSD keeps open source honest

- Most parts of ROS are under a BSD or BSD-style license
- ROS mostly deals with infrastructure, tools, and communication, not drivers for robots—which should be cross-platform by nature

# FreeBSD had ROS, but not anymore

## [ros](#) Robot Operating System - core utilities

1.4.10\_3 [devel](#)    



DEPRECATED: Unsupported upstream, see <http://wiki.ros.org/Distributions>



This port expired on: 2015-11-01

There is no maintainer for this port.

Any concerns regarding this port should be directed to the FreeBSD Ports mailing list via [ports@FreeBSD.org](mailto:ports@FreeBSD.org)



**Last Update:** 2015-11-01 21:30:48

**SVN Revision:** [400630](#)

**License:** BSD3CLAUSE

**SVNWeb :** [Homepage](#)

### Dependency lines:

- `ros>0:devel/ros`

No installation instructions: this port has been deleted.





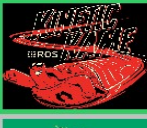







The package name of this deleted port was: `ros`

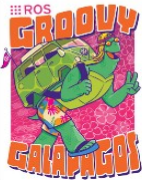







**PKGNAME:** `ros`

Source:  
[freshports.org](http://freshports.org)



# FreeBSD had Diamondback from 2011

Distro	Release date	Poster	Tuturtle, turtle in tutorial	EOL date
ROS Melodic Morenia (Recommended)	May 23rd, 2018			May, 2023 (Bionic EOL)
ROS Lunar Loggerhead	May 23rd, 2017			May, 2019
ROS Kinetic Kame	May 23rd, 2016			April, 2021 (Xenial EOL)
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ROS Fuerte Turtle	April 23, 2012			--
ROS Electric Emys	August 30, 2011			--
ROS Diamondback	March 2, 2011			--

# ROS has instructions for building from scratch

## Select Your Platform

### Supported:



Ubuntu Artful amd64  
Bionic amd64 armhf arm64



Debian Stretch amd64 arm64



Windows 10 amd64

[Source installation](#)

### Experimental:



Arch Linux Any amd64 armhf aarch64



Gentoo



### Construction zone

The following links are referring to previous ROS distributions installation instructions and have not been updated since.



OS X (Homebrew)



OpenEmbedded/Yocto

# Building from Source has 3 big steps

1. Install prerequisites (rosdep and friends)
2. Use those tools to create a source checkout
3. Build it



Use jails!!!

# Step 1: We have some things in system & ports, but not everything

- We have: clang, boost, cmake, ninja, many Python libraries—ROS works *best* with Python 2.7(!)
- Missing: rosdep, rosinstall-generator, rosinstall, wstool (plus their dependencies)

# ROS Enhancement Proposals (REPs)

## Explain how ROS is set up

- REP 3 Target Platforms
- REP 125 rosdep2
- REP 141 ROS distribution files

Source: <https://www.ros.org/reps/rep-0000.html>

### [\[REP Source\]](#)

**REP:** 0  
**Title:** Index of ROS Enhancement Proposals (REPs)  
**Last-Modified:** [2019-09-11](#)  
**Author:** ROS Developers  
**Status:** Active  
**Type:** Informational  
**Created:** 13-Jul-2000

### Introduction

The REP contains the index of all ROS Enhancement Proposals, known as REPs. REP numbers are assigned by the REP Editor, and once assigned are never changed. The [GIT history\[1\]](#) of the REP texts represent their historical record.

### Index by Category

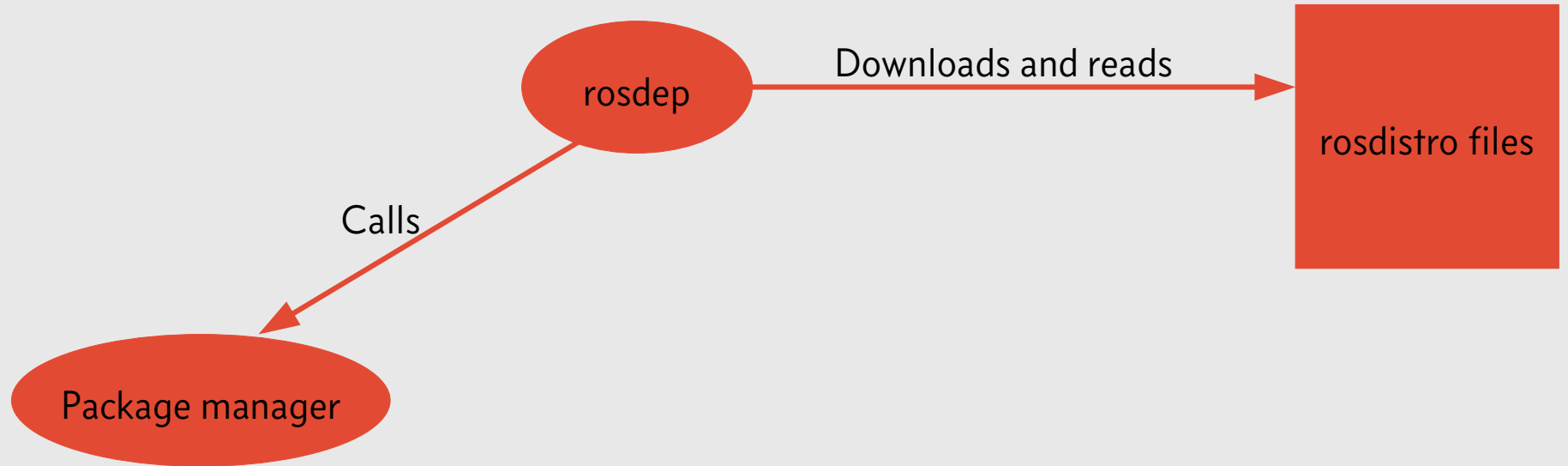
num	title	owner
---	-----	-----
Meta-REPs (REPs about REPs or Processes)		
P	<a href="#">1</a> REP Purpose and Guidelines	Conley
P	<a href="#">2</a> Scope of REP Process, REP Stacks	Conley
P	<a href="#">8</a> Style Guide for Python Code	Conley
P	<a href="#">10</a> Voting Guidelines	Conley
P	<a href="#">12</a> Sample reStructuredText REP Template	Conley

Other Informational REPs

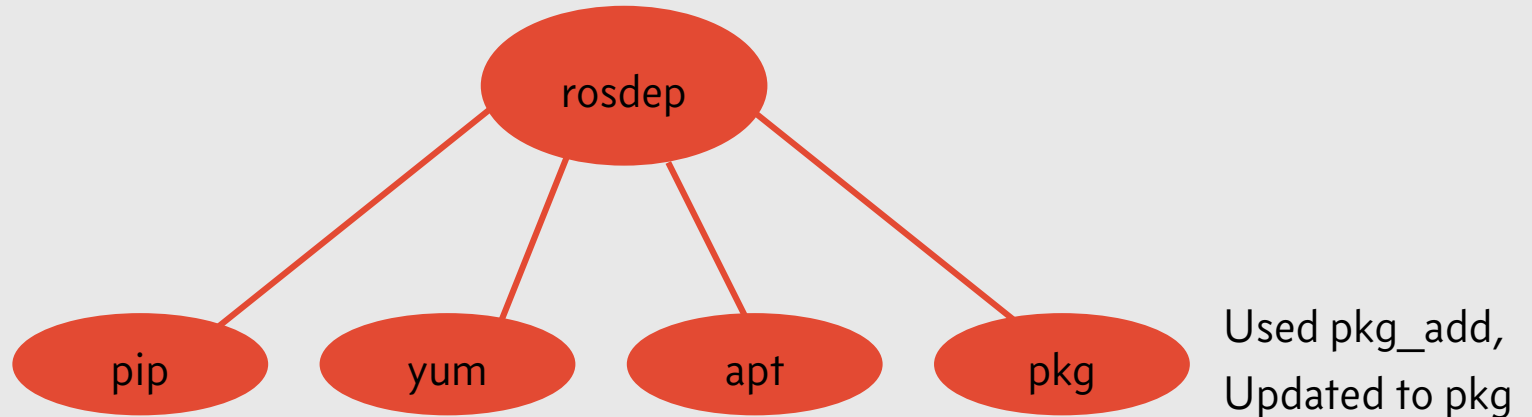
# ROS Distribution files list components and how to install them on each OS

```
bzip2:  
  
  alpine: [bzip2-dev]  
  
  arch: [bzip2]  
  
  cygwin: [bzip2]  
  
  debian: [libbz2-dev]  
  
  fedora: [bzip2-devel]  
  
  freebsd: [bzip2]  
  
  gentoo: [app-arch/bzip2]  
  
  macports: [bzip2]
```

# Rosdep installs dependencies for ROS



# Multiple package backends for rosdep





# We also need several dependent programs

- `rosinstall_generator`—get a list of components for a distro, based on `roscdistro`
- `wstool`—Cross-SCM “cloning” tool for catkin
- `ros_console-bridge`—ROS Logging for non-ROS programs

# Initialize rosdep, run rosinstall, & wstool

```
# rosdep init
```

```
$ rosdep update
```

```
$ mkdir ros_catkin_ws
```

```
$ cd ros_catkin_ws
```

```
$ rosinstall_generator desktop --rosdistro melodic --deps \  
--tar > melodic-desktop.rosinstall
```

```
$ wstool init -j8 src melodic-desktop.rosinstall
```

# Install deps, apply patches, & build...

```
$ rosdep install --from-paths src --ignore-src \  
--rosdistro melodic -y
```

```
$ patch < freebsd-ros-desktop-melodic.diff
```

```
$ ./src/catkin/bin/catkin_make_isolated --install \  
-DCMAKE_BUILD_TYPE=Release --use-ninja
```

# And everything builds... until it doesn't

- SIP causes problems generating the Python bindings (sipconfig.py issue)

Let's see a demonstration...

# I have created bugs for needed ports

- 224895—devel/ros-rosdep
- 224896—devel/ros-console\_bridge
- 224897—devel/ros-urdfdom\_headers
- 224898—devel/ros-urdfdom
- 235843—devel/ros-cautkin\_pkg
- 235844—devel/ros-rospkg
- 235845—devel/ros-roscdistro
- 240635—devel/collada-dom
- 240646—devel/ros-rosinstall\_generator
- 240637—devel/ros-rosinstall
- 240638—devel/vcstools
- 240639—devel/ros-wstool

# Rosdistro changes for FreeBSD must be pushed upstream

```
bzip2:  
  alpine: [bzip2-dev]  
  arch: [bzip2]  
  cygwin: [bzip2]  
  debian: [libbz2-dev]  
  fedora: [bzip2-devel]  
  freebsd: [bzip2]  
  gentoo: [app-arch/bzip2]  
  macports: [bzip2]
```

In the meantime, there are GitHub repo  
with the ports and a rosdistro

<https://github.com/NorwegianRockCat/FreeBSD-my-ports>

<https://github.com/NorwegianRockCat/rosdistro>

Packages and scripts:

<https://www.norwegianrockcat.com/static/eurobsd/2019/>



# Oh yeah... there is a ROS 2 as well...

**open robotics**

## Why ROS 2?

**ROS 2 (Robot Operating System 2)** is an open source software development kit for robotics applications. The purpose of ROS 2 is to offer a standard software platform to developers across industries that will carry them from research and prototyping through to deployment and production. ROS 2 builds on the success of ROS 1, which is used today in myriad robotics applications around the world.

- » **Shorten time to market**  
ROS 2 provides the robotics tools, libraries, and capabilities that you need to develop your applications, allowing you to spend your time on the work that is important for your business. Because it is open source, you have the flexibility to decide where and how to use ROS 2, as well as the freedom to customize it for your needs.
- » **Designed for production**  
Drawing on a decade of experience in establishing ROS 1 as the de facto global standard for robotics R&D, ROS 2 was built from the ground up to be industry-grade and used in production, including high reliability and safety critical systems. Design choices, development practices, and project governance for ROS 2 are based on requirements from industry stakeholders.
- » **Multi-platform**  
ROS 2 is supported and tested on Linux, Windows, and macOS, allowing seamless development and deployment of on-robot autonomy, back-end management, and user interfaces. The tiered support model allows for ports to new platforms, such as real-time and embedded OSs, to be introduced and promoted as they gain interest and investment.

**Industrial domain**  
ROS 2 is ready for use across a wide array of applications from indoor to outdoor, home to automotive, consumer to industrial.

# ROS can be brought to FreeBSD, but it needs some work

- Add the ports
- Update rosdistro and send it upstream
- Long term: create ports for the rest; look at Gazebo simulator and ROS 2