

ME4140 - ROS Workshop

Mechanical Engineering
Tennessee Technological University

Tristan Hill, Lecturer

Module 1 - ROS Overview

Module 1 - ROS Overview

- What is ROS?
- Benefits of ROS
- How does ROS work?
- Supported Hardware and Software
- Getting Started!

What is ROS?

- *The Robot Operating System (ROS) is a flexible framework for writing robot software. It is a collection of tools, libraries, and conventions that aim to simplify the task of creating complex and robust robot behavior across a wide variety of robotic platforms. - ROS WIKI*
- Open Source (BSD) Software Framework for Robotics Development
- not what you may think when you hear *operating system*

What is ROS?

Where did ROS come from?

- Developed at Stanford (mid 2000s)
- Continued by Willow Garage (2007)

Where is ROS now?

- Maintained by an international community of developers (present)
- *The ROS ecosystem now consists of tens of thousands of users worldwide, working in domains ranging from tabletop hobby projects to large industrial automation systems. - ROS WIKI*
- We are going to use ROS-Melodic (timeline)

Benefits of ROS

ROS allows us to build upon the knowledge and capabilities of the current state of robotics technology and theory.

- Hardware/Software Compatibility
- Pre-Compiled Algorithms for Robotics
- Multi-threading, Parallel Processing, Distributed Computing
- Open Source Community (BSD)

Benefits of ROS

Who is using ROS?

- Researchers
- Students
- Hobbyists
- Industry - *start ups* and *big business* (?)

Who can use ROS? You!

Benefits of ROS

Thought exercise: Think about designing a robot to move boxes from one location to another in a large room.

- Where do you begin?
- What does the robot look like?
- What major elements or components are required for the robot?

How does ROS work?

ROS is organized in a system of connected *nodes* which each node represents a different element or component in a robotic system.

- Laser
- Drive Kinematics
- Navigation
- Manipulator
- etc.

Supported Hardware and Software

Each node can have corresponding source code, executables, data files, and more. Different software languages are available.

- C++ (instructor support in ME4140)
- Python (you are on your own)
- *markup languages* such as XML and YAML (we may use some)

Pre-built software is available for interfacing with different Robots, sensors, actuators, and other components. Also, ROS can run on small board computers with limited resources.

- Robots! (Adept, Clearpath, UR)
- LIDAR (SICK, RPLidar, etc.) and Cameras (webcam, Kinect, Opti-track)
- Motor Drivers (Roboteq, ROSARIA)

Getting Started!

- ❶ First install VirtualBox from Oracle which is an application for *virtualizing* operating systems on top of an existing one.
 - 1.1 Download the install file for VirtualBox. Choose the file that matches your computer.
 - 1.2 Click the file and install VirtualBox on your computer.
- ❷ Next setup a virtual operating system to use as an environment to learn ROS.
 - 2.1 Download or copy the .iso file for Ubuntu 18.04 LTS
 - 2.2 Using VirtualBox install Ubuntu 18.04 LTS as a virtual operating system on your hard drive.
 - 2.3 Briefly test your new OS. The internet must work.
- ❸ Install ROS Melodic
 - 3.1 This is done in the *terminal* in Ubuntu. Follow the step by step instructions carefully.