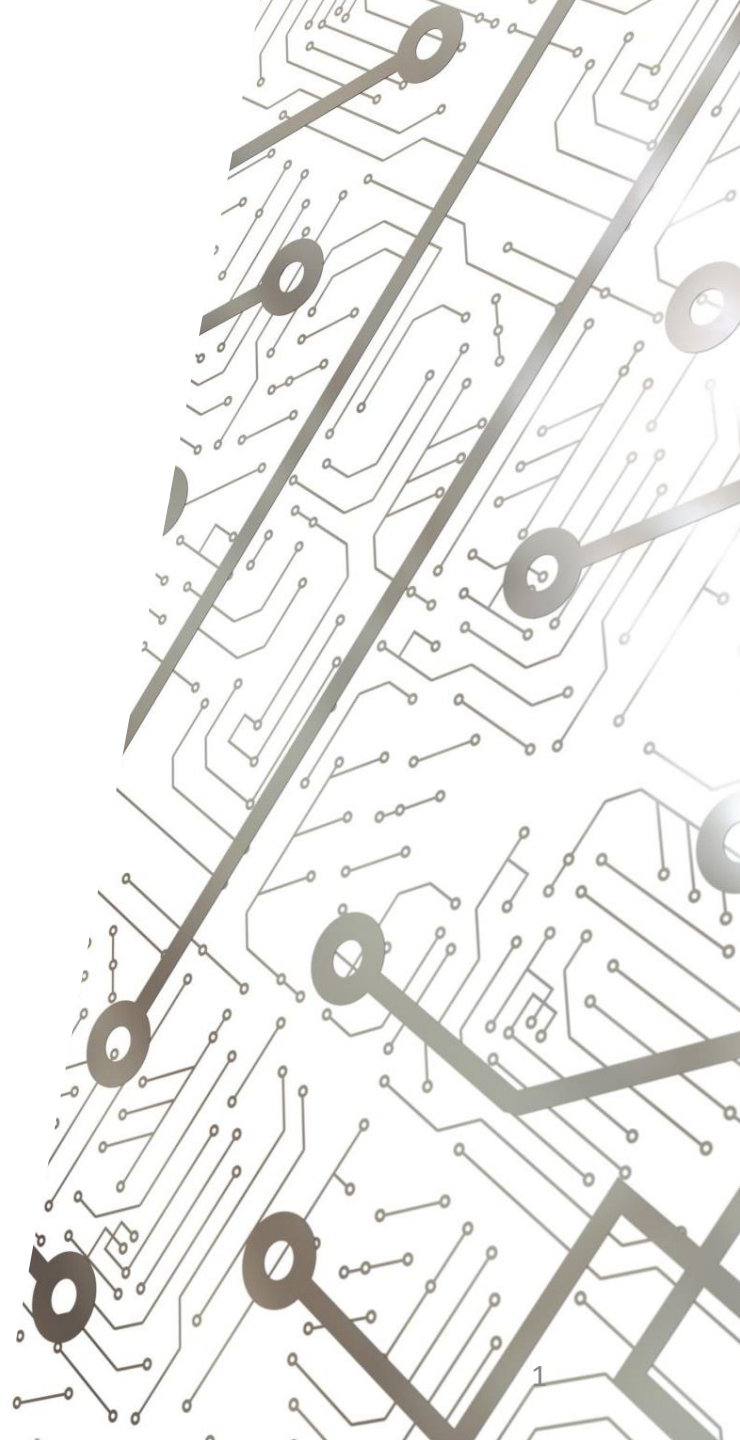
Software Lecture 1:

Introduction to ROS

(And Linux!)

Jacques Cloete



Contents

In this lecture, we shall cover:

- Overview of what ROS is
- Introduction to VirtualBox and then Ubuntu
- The Command Line

Before We Begin

- I strongly suggest bookmarking the following link: https://github.com/OxRAMSociety/RobotArm
- This is the GitHub repository for the robot arm project
- These lectures and all example scripts can be found in: Tutorials/Software Tutorials (2022)
- Have this accessible while you follow along
- If you download these lecture pdfs, you can copy+paste links and Terminal commands

What is ROS?

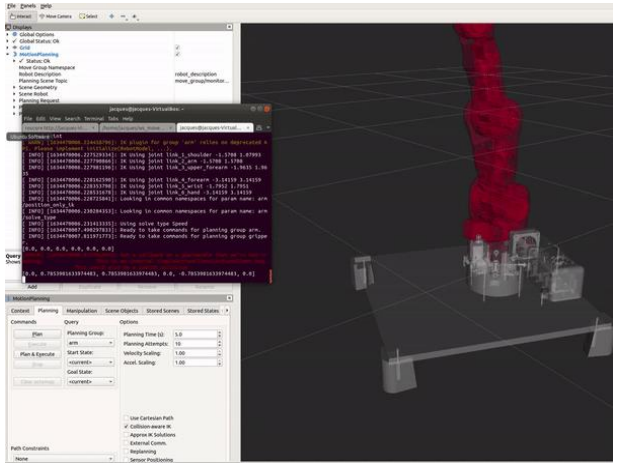
- "Robot Operating System"
(Not really an operating system!)

- Framework that allows us to easily manage complex robotics-based systems

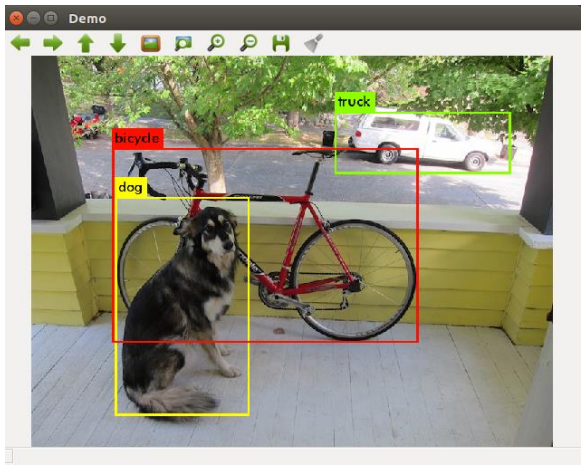
- Provides a wide array of useful software libraries and tools

- Entirely open-source (Good thing for us!)

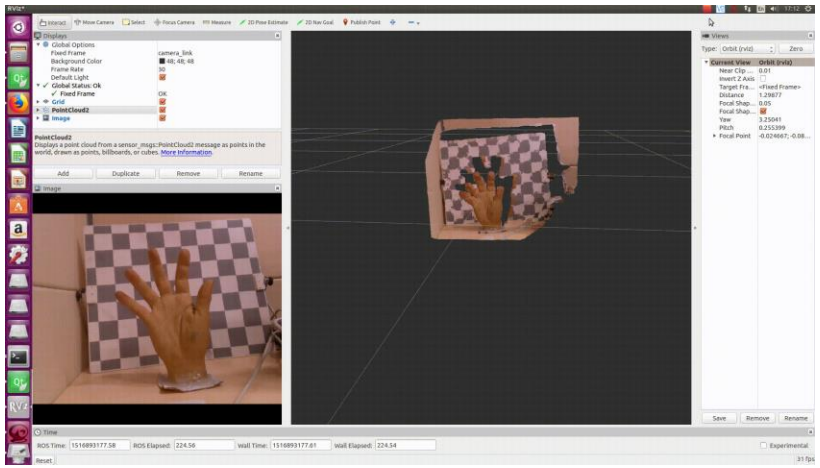
Example ROS applications?



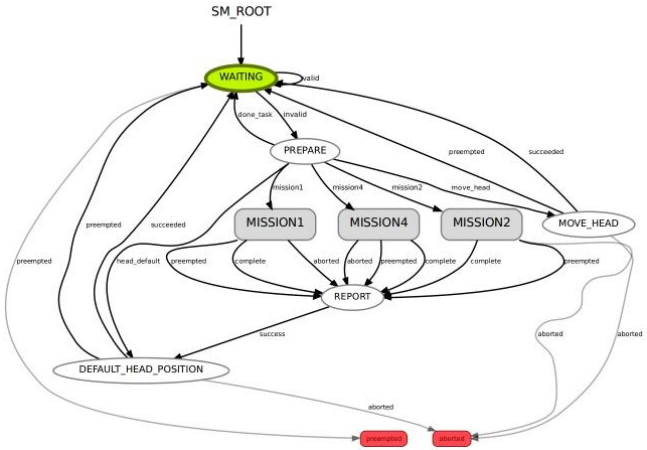
Motion-Planning



Object Detection



Analysing Point Cloud Data



State Machines

Communication with Hardware

...and so many more!

- ROS not only provides open-source packages for all these applications...
- … but also lets them all simultaneously communicate with each other in a simple, streamlined manner

Setting up a Computer for ROS

- To use ROS, you first need to have Linux on your machine
- If you have a Windows or Mac OS laptop, I suggest creating an Ubuntu virtual machine...

Installing Virtualbox

https://www.virtualbox.org/

- **Download the installer for your OS and follow the instructions to install VirtualBox**

Installing Ubuntu as a Virtual Machine

https://releases.ubuntu.com/20.04.4/

1. Download the 64-bit PC (AMD64) Ubuntu 20.04 desktop image from the above link

Important to specifically download the image for version 20.04!

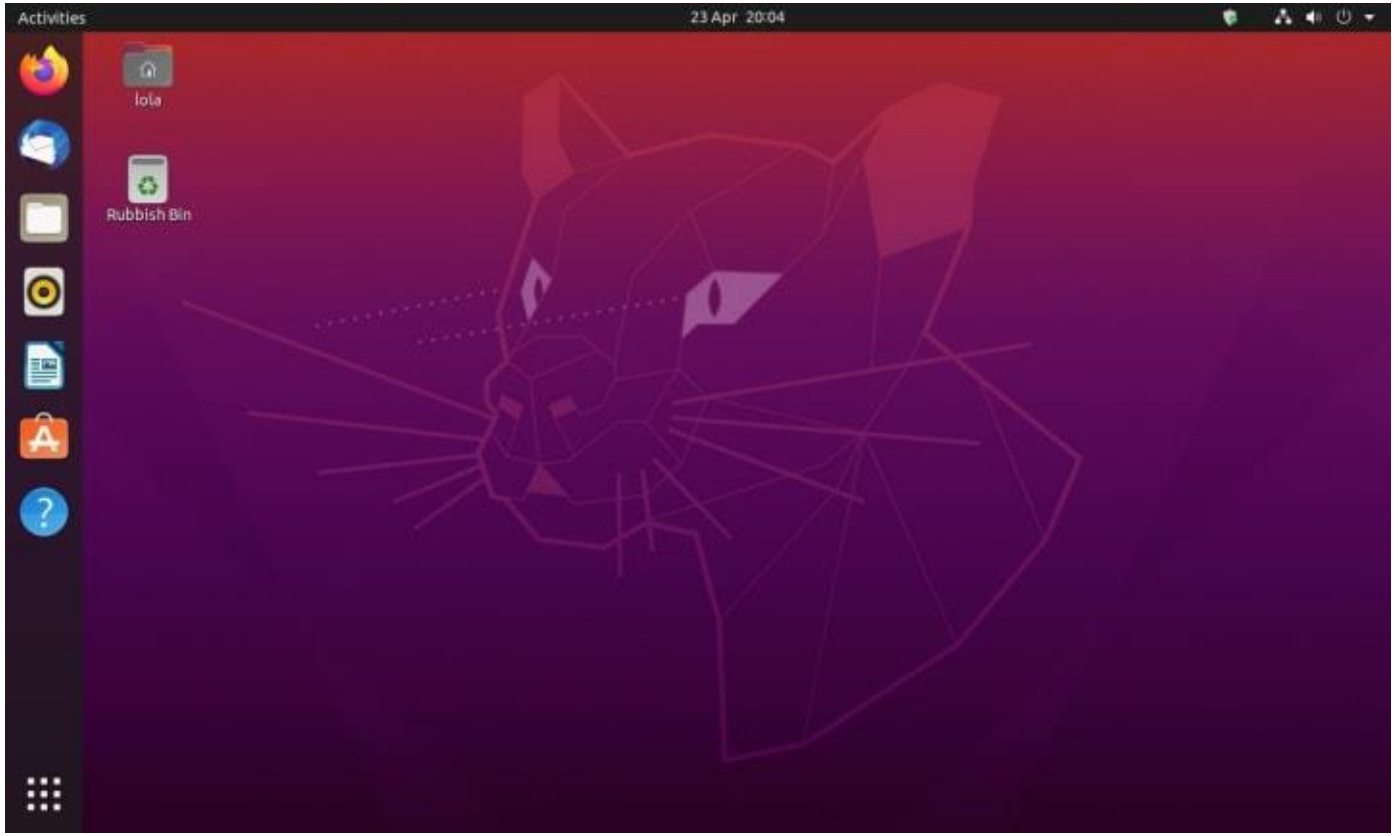
https://linuxhint.com/install_ubuntu_virtualbox_2004/

2. Open VirtualBox and follow the steps in the linked tutorial

I recommend allocating your virtual machine at least 4GB memory and 30GB storage!

Welcome to Ubuntu!

- Familiarise yourself with your Ubuntu system



The Command Line (or 'Terminal')

- Uses a text-based interface to control your computer

Commands are written in Bash, a command language

- With Linux, you will be using it A LOT! We will practice now…

1. Click 'Show Applications' (bottom-left icon on the screen) and search for Terminal

When you find it, I suggest right-clicking and adding to favourites! It will now appear in the taskbar

2. Open up Terminal

3. Type cd Documents and press Enter

This will navigate your active directory to Documents

4. Type nano Hello_World.txt and press Enter to start making a text document (named Hello_World)

5. Type Hello World! and press Ctrl+X to exit

6. Type Y (or y) to agree to the changes made, and then press Enter to write the file

7. To read the contents of the file, run cat Hello_World.txt

8. If you want to edit the file, simply run nano Hello_World.txt again

9. Let's create a new folder and move our text file into it – **run mkdir MyFolder to create a new folder (named MyFolder)**

10. **Run mv Hello_World.txt MyFolder to move the text file into the folder**

- To finish, let's clean up the mess we've made

11. **Run cd MyFolder to navigate into the folder, and then run rm Hello_World.txt to delete the text file**

12. **Run cd .. to exit out of the folder, and then run rm –rd MyFolder to delete the folder**

Basic Commands

- Navigate between folders: cd <folder path>

Note: cd .. exits the current folder

You can navigate to a specific directory in one go! Use cd ~/<entire directory (from home)>

- Opening files: cat <file name>
- Creating folder: mkdir <folder name>
- Creating/editing files: nano <file name>
- Copying files: cp <source file> <target location>
- Copying folders: cp –r <source folder> <target location>
- Deleting files: rm <filename>
- Deleting folders: rm –rd <folder name>

Many, MANY more commands exist!

https://ubuntu.com/community/Beginners/BashScripting

- Try the above link for more information on using the Command Line (and for much more practice)
- I would recommend getting familiar with it sooner rather than later – you will really value this as we start working with ROS

One Last Thing...

- When you run a command, much of the time it will provide output text saying what is happening
- Especially true when running and installing software
- DO NOT blindly enter commands without always checking the output to make sure the command was successful!
- ALWAYS check for typos, and sort out any errors that pop up upon running a command – if the command failed, that means something needs to be fixed first!

Summary

We covered:

- Overview of what ROS is
- Introduction to VirtualBox and then Ubuntu
- The Command Line

Homework: Finish setting up Ubuntu, adjust screen size, etc.

Next time, we will install ROS and start using it!

Thank You!

Any Questions? Contact jacques.cloete@trinity.ox.ac.uk

Workshop session Sunday 30th October, 10am-1pm