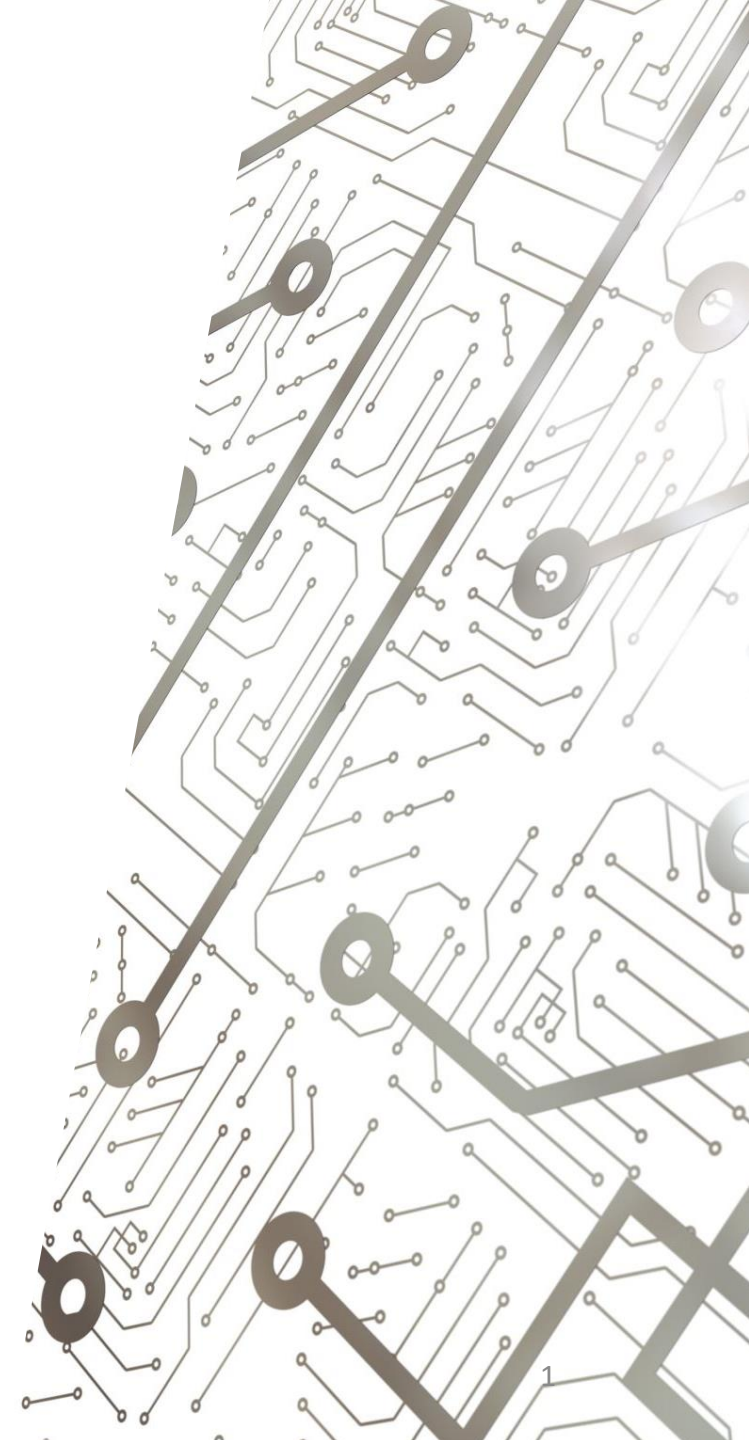




Software Lecture 1:

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

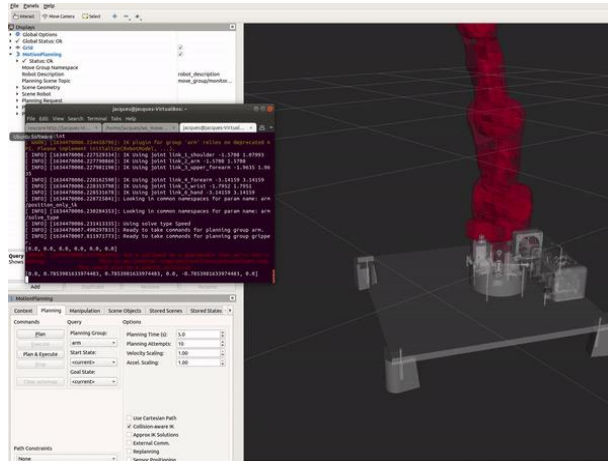
What is ROS?

- "Robot Operating System"

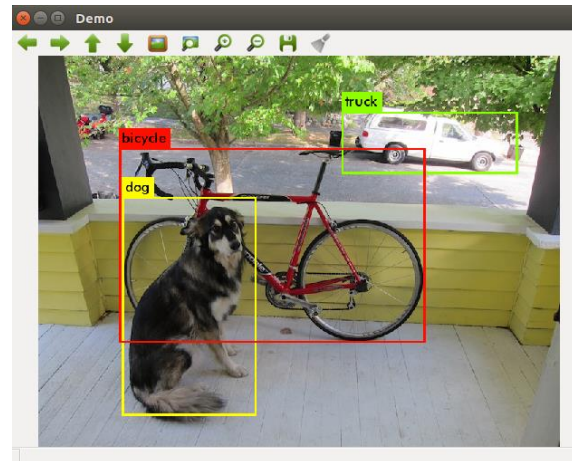
(Not really an operating system!)

- **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!)

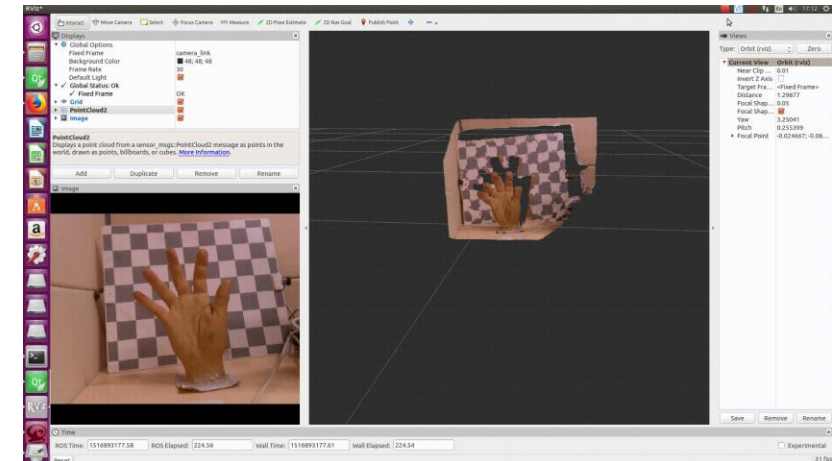
Example ROS applications?



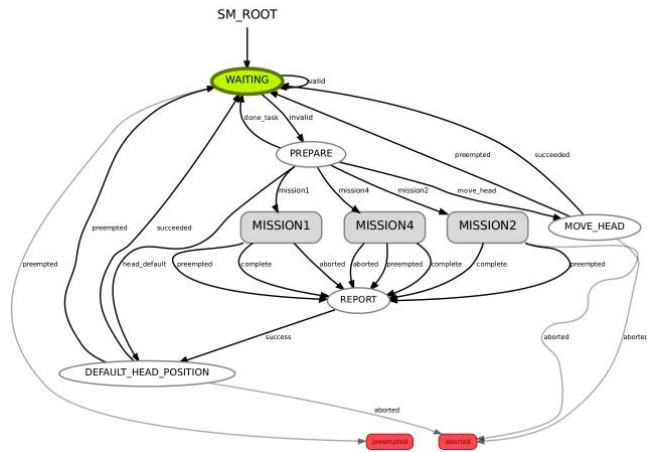
Motion-Planning



Object Detection



Analysing Point Cloud Data



State Machines

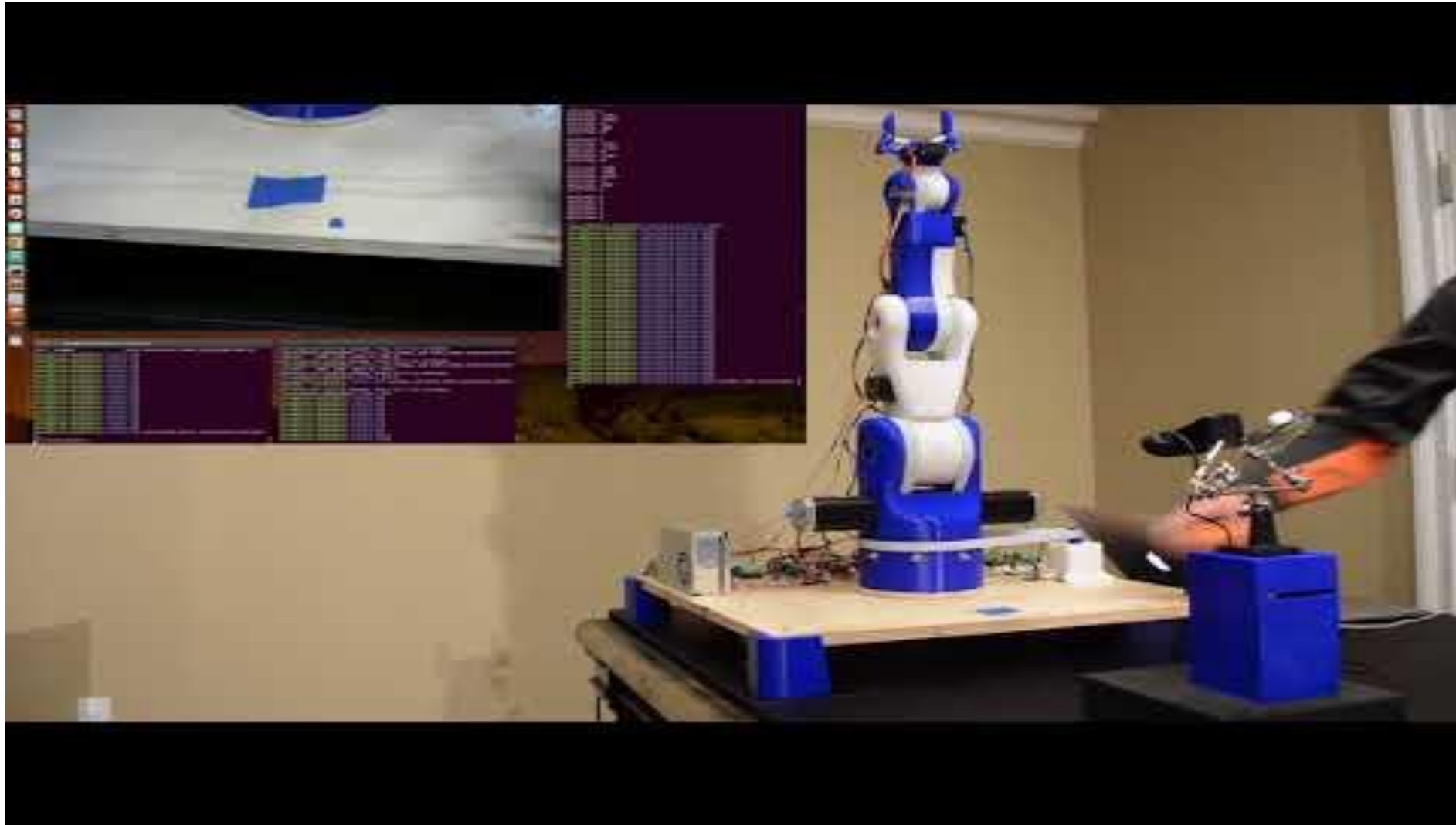


Communication with Hardware

...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

Example: Moveo with ROS



<https://www.jesseweissberg.com/moveo-with-ros>

- *Credit to Jesse Weissberg*

Setting up a Computer for ROS

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



VirtualBox



VirtualBox

Installing Virtualbox

<https://www.virtualbox.org/wiki/Downloads>

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

VirtualBox
Download VirtualBox

Here you will find links to VirtualBox binaries and its source code.

VirtualBox binaries

By downloading, you agree to the terms and conditions of the respective license.

If you're looking for the latest VirtualBox 6.0 packages, see [VirtualBox 6.0 builds](#). Please also use version 6.0 if you need to run VMs with software virtualization, as this has been discontinued in 6.1. Version 6.0 will remain supported until July 2020.

If you're looking for the latest VirtualBox 5.2 packages, see [VirtualBox 5.2 builds](#). Please also use version 5.2 if you still need support for 32-bit hosts, as this has been discontinued in 6.0. Version 5.2 will remain supported until July 2020.

VirtualBox 6.1.38 platform packages

- [Windows hosts](#)
- [OS X hosts](#)
- [Linux distributions](#)
- [Solaris hosts](#)
- [Solaris 11 IPS hosts](#)

The binaries are released under the terms of the GPL version 2.
See the [changelog](#) for what has changed.

Choose the correct installer from these

Installing Ubuntu as a Virtual Machine

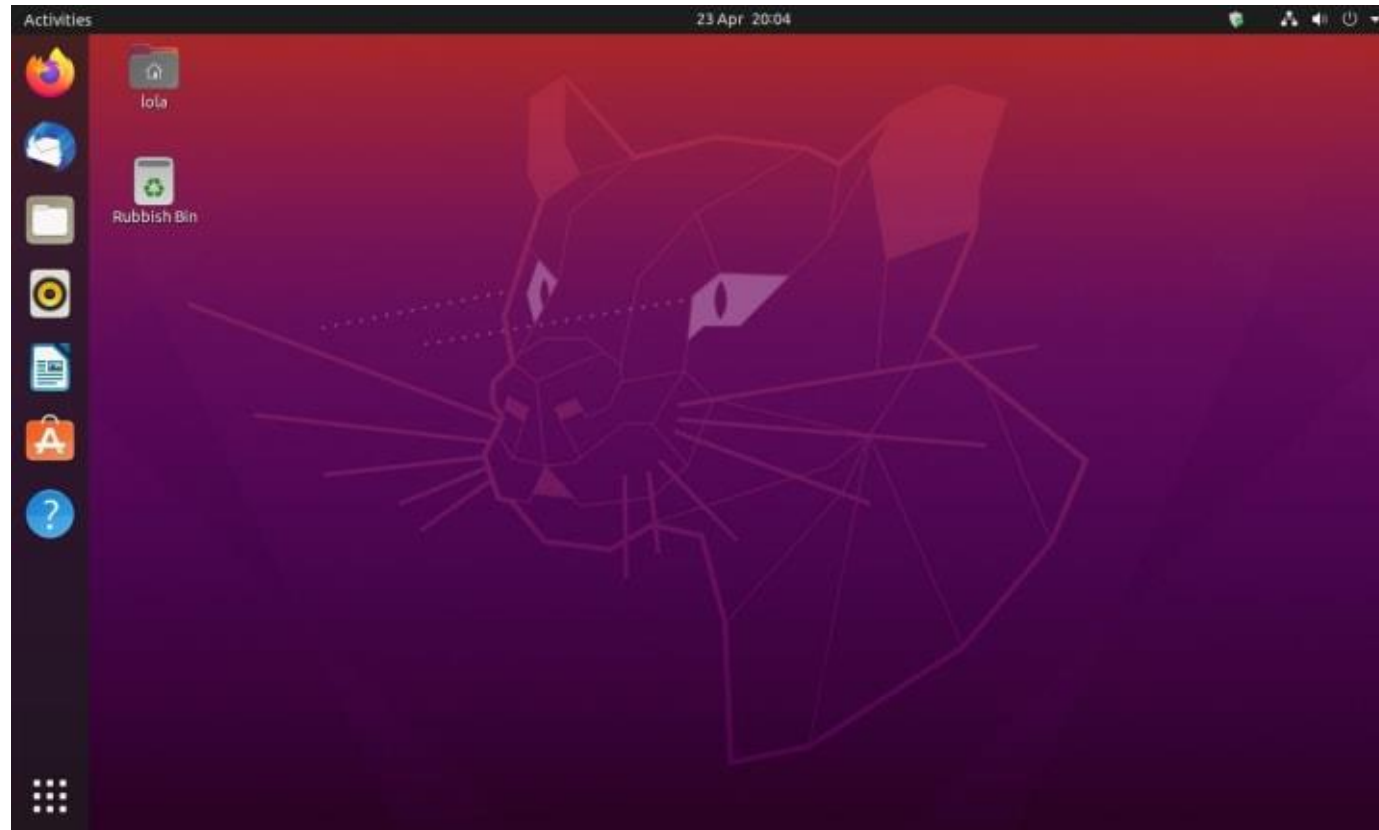
https://linuxhint.com/install_ubuntu_virtualbox_2004/

- **Follow the steps in the linked tutorial, noting the following:**
 - We want to install **Ubuntu Desktop 20.04 LTS**
 - I recommend allocating your virtual machine at least **4GB** memory and **30GB** storage
 - Installing **Virtualbox Guest Additions** is optional, but could save you from a lot of tedium



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://help.ubuntu.com/community/Beginners/BashScripting>

- Try the above link for more information on using the Command Line (and for more practice)
- I would recommend getting familiar with the Command Line 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

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

Thank You!

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