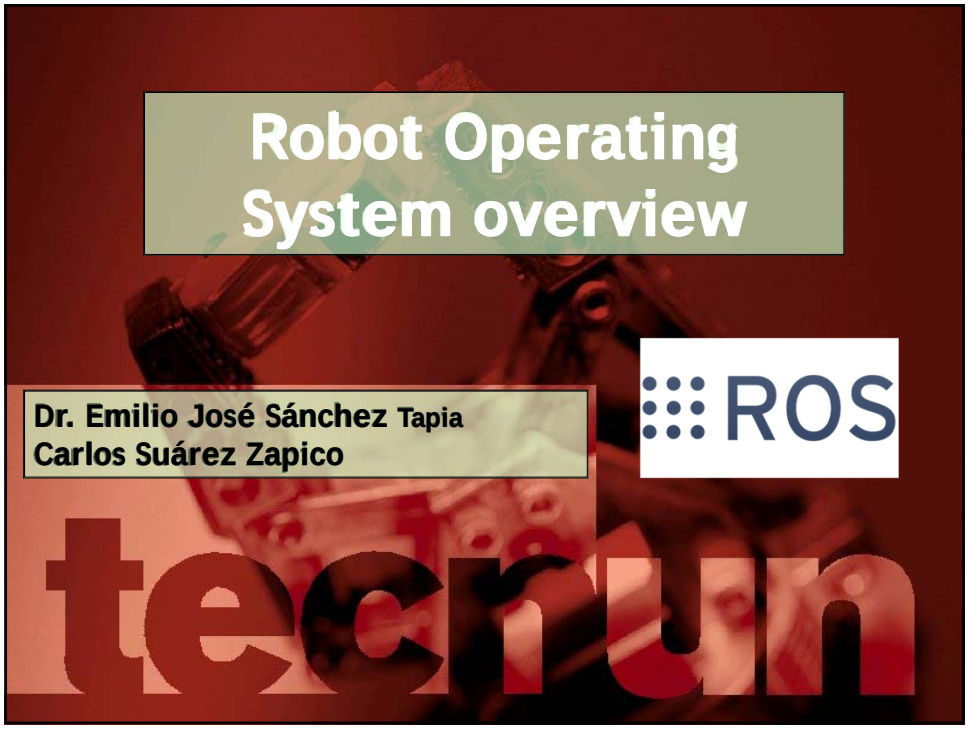
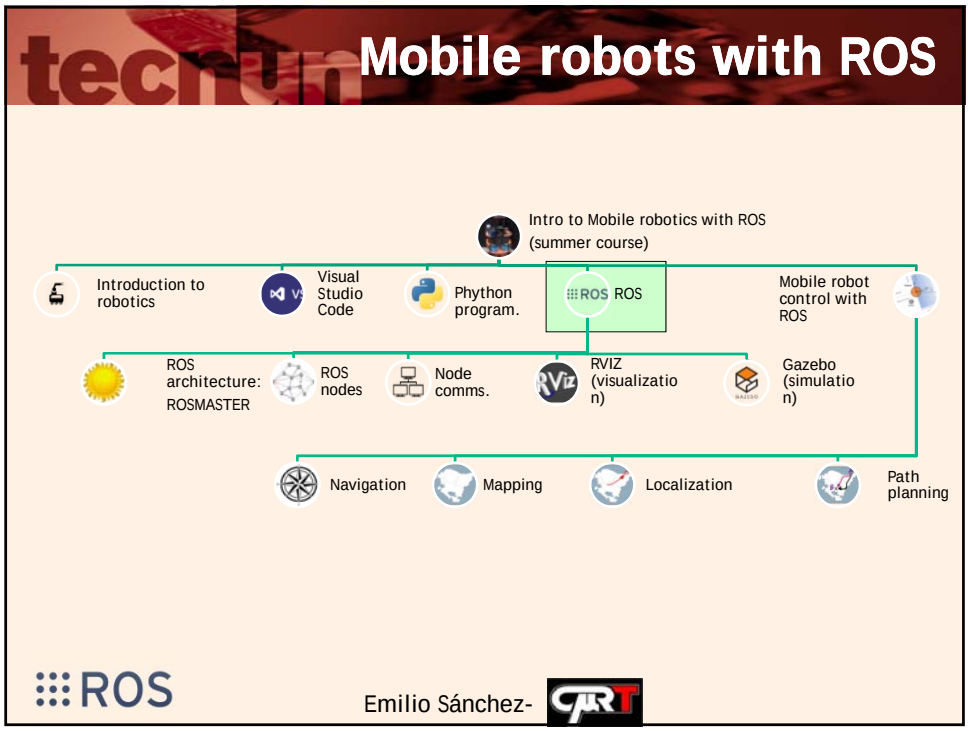

Robot Operating System overview
Dr. Emilio José Sánchez Tapia
Carlos Suárez Zapico
ROS
tecnun


tecnun
Mobile robots with ROS
Intro to Mobile robotics with ROS (summer course)
Introduction to robotics
Visual Studio Code
Phython program.
ROS
Mobile robot control with ROS
ROS architecture: ROSMASTER
ROS nodes
Node comms.
RVIZ (visualizatio n)
Gazebo (simulatio n)
Navigation
Mapping
Localization
Path planning
ROS
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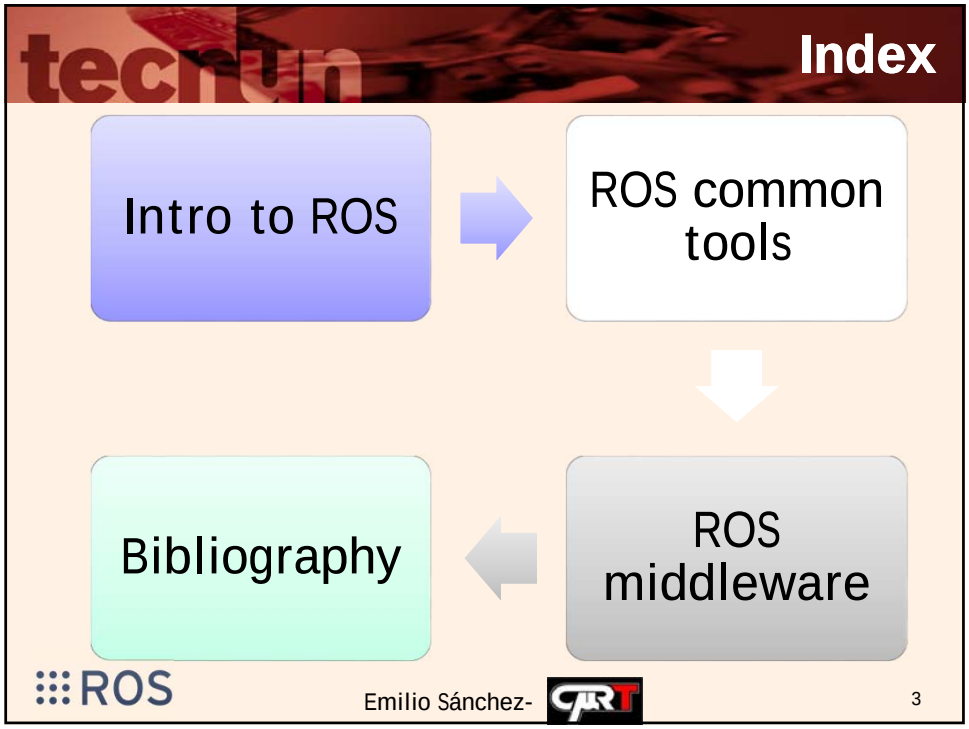
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ROS intro
ROS

ROS Features

- ROS is an open-source robot programming framework
- Not an operating system
- Installed on a linux- typically on Ubuntu
- A set of software libraries and tools that help you build robot applications that work across a wide variety of robotic platforms
- Originally developed in 2007 at the Stanford Artificial Intelligence Laboratory and development continued at Willow Garage
- Since 2013 managed by OSRF (Open Source Robotics Foundation)

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ROS Features

- **Peer to Peer**
  - ROS systems consist of numerous small computer programs which connect to each other and continuously exchange *messages*
- **Tools-based**
  - There are many small, generic programs that perform tasks such as visualization, logging, plotting data streams, etc.
- **Multi-Lingual**
  - ROS software modules can be written in any language for which a *client library has been written.* Currently client libraries exist for C++, Python, LISP, Java, JavaScript, MATLAB, Ruby, and more.
- **Thin**
  - The ROS conventions encourage contributors to create stand-alone libraries and then *wrap those libraries so they send and receive messages to/from other ROS modules.*
- **Free and open source**

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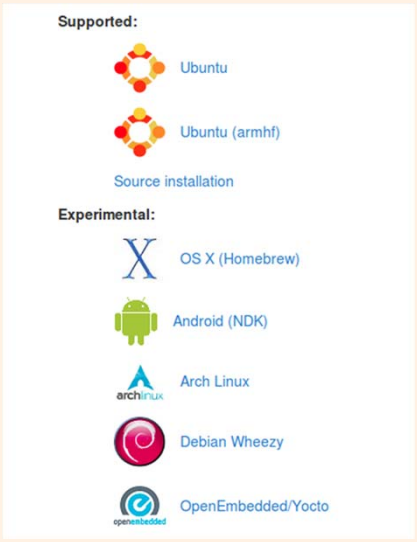
Supported Operating Systems



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ROS versions

Distro	Release date	Poster	Compatible with Ubuntu	EOL date
Lunar Loggerhead	May 23, 2017		Ubuntu Zesty(17.04), Xenial (16.04 LTS)	Current stable version: May, 2019
Kinetic Kame	May 23, 2016		Ubuntu Wily (15.10) and Ubuntu Xenial (16.04 LTS)	Current stable version: 2021-05-30
Jade Turtle	May 23, 2015			Older version, no longer supported: 2017-05-30
Indigo Igloo	July 22, 2014			Older version, yet still supported: 2019-04-30
Hydro Medusa	September 4, 2013			Old version, no longer supported: 2014-05-31

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ROS versions: last version

ROS Melodic Morenia
Released May, 2018
Latest LTS, supported until May, 2023

Ubuntu Artful (17.10), Bionic (18.04 LTS)

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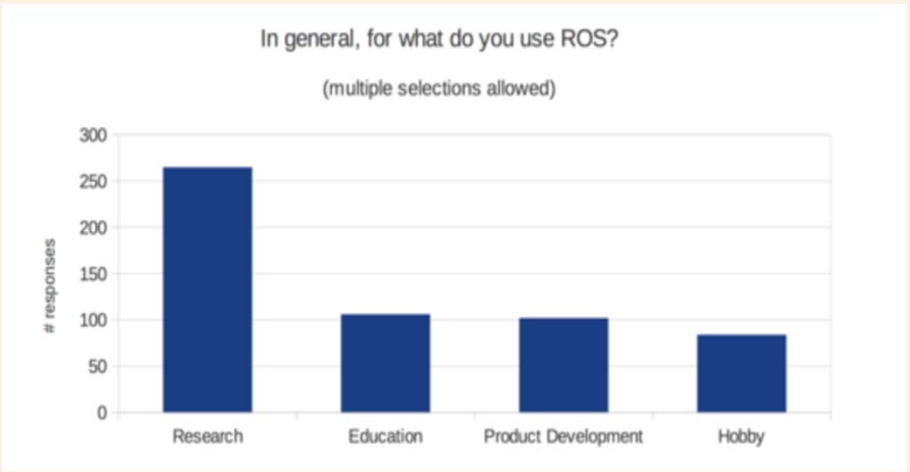
ROS Final application



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ROS application examples

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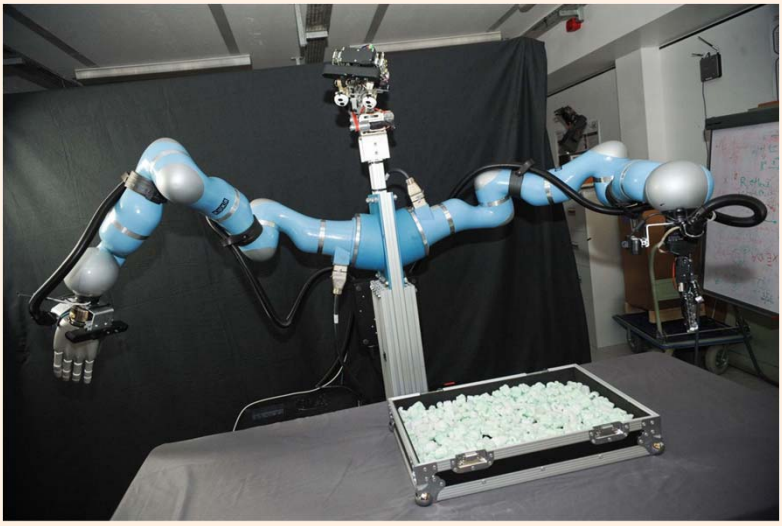
ROS application example



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Common robot platforms using ROS

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Common hardware platforms

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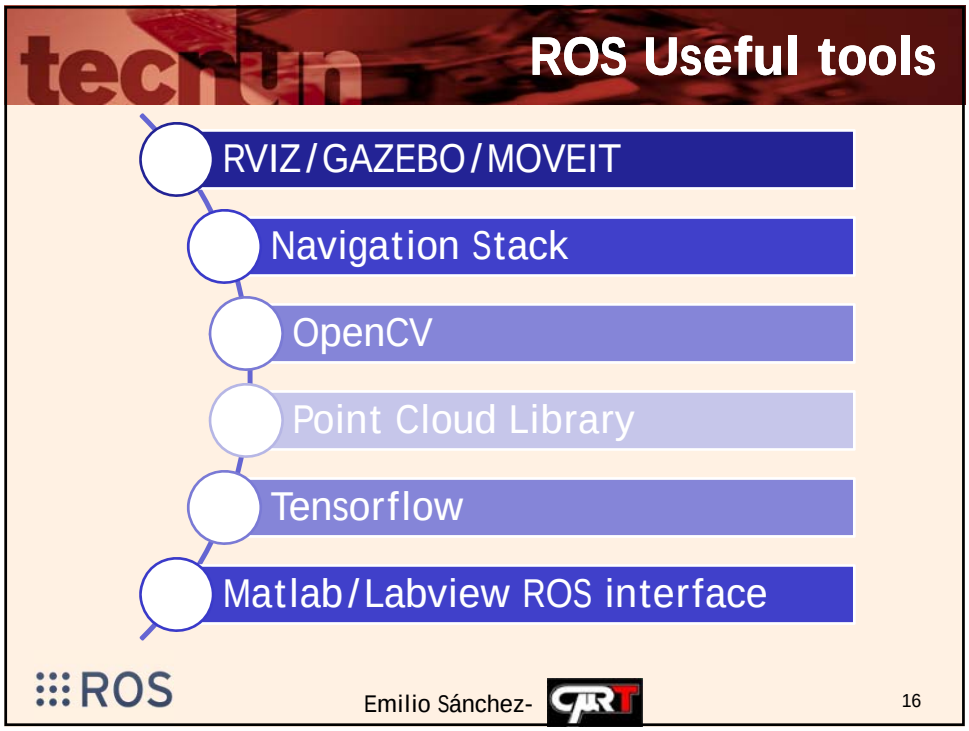
ROS common tools
ROS
tecnun


tecnun
ROS Useful tools
RVIZ/GAZEBO/MOVEIT
Navigation Stack
OpenCV
Point Cloud Library
Tensorflow
Matlab/Labview ROS interface
ROS
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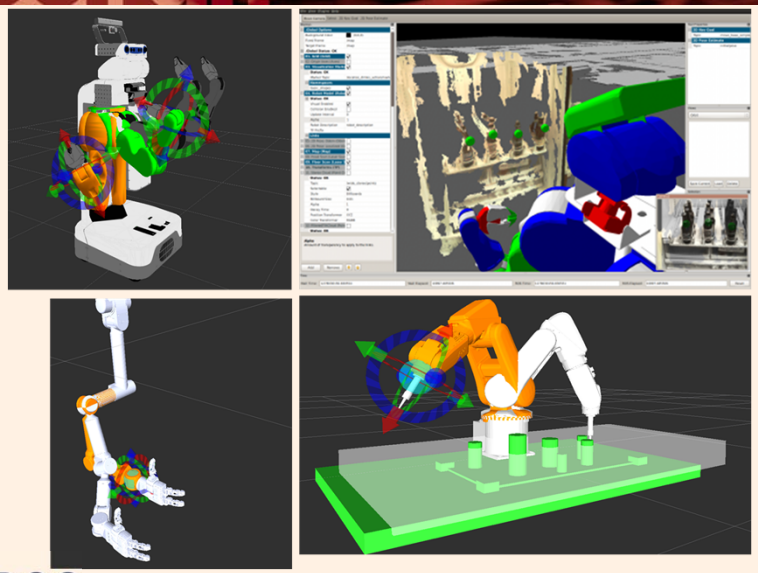
RVIZ: ROS visualiser



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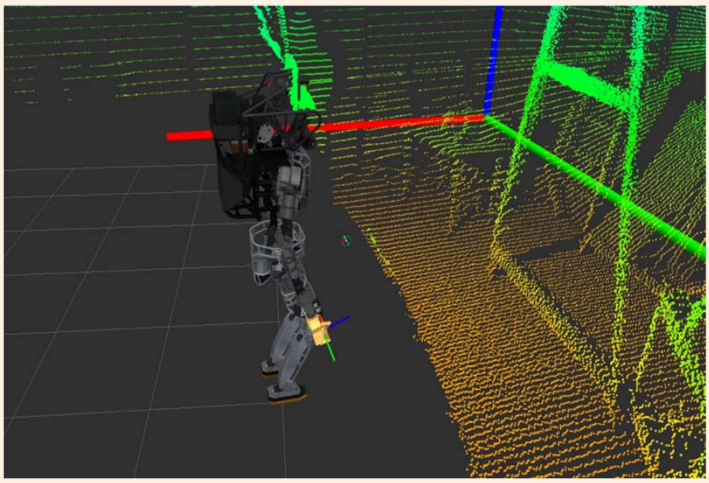
RVIZ



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GAZEBO simulator

- Similar to RVIZ but it is more than just a graphical interface, it also contains a physics engine simulator.
- Light and shadows
- Collision detection
- Dynamics (Inertia, gravity)

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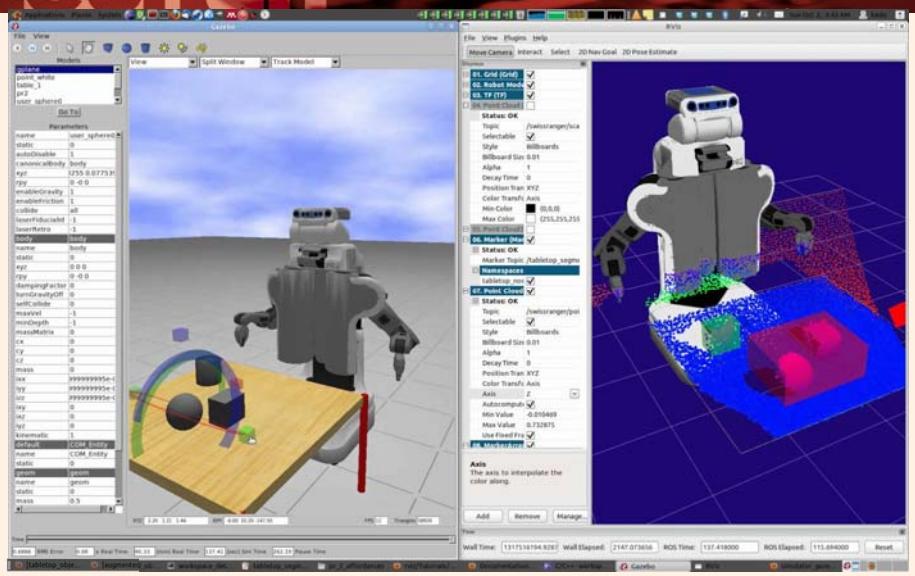
GAZEBO SIMULATOR



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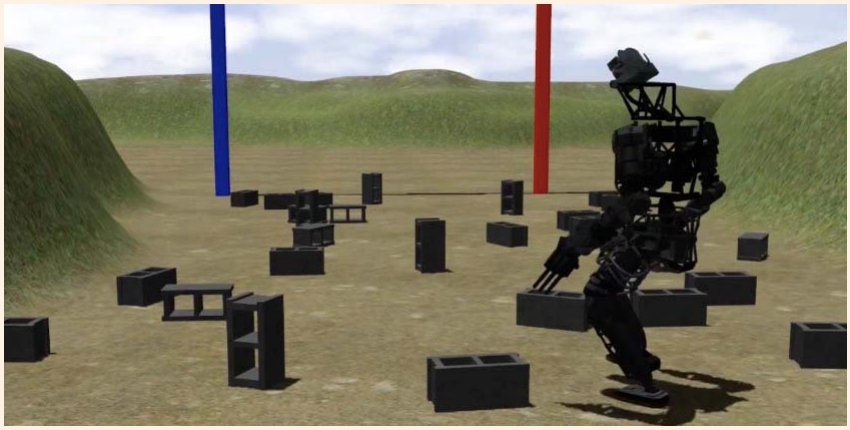
GAZEBO SIMULATOR



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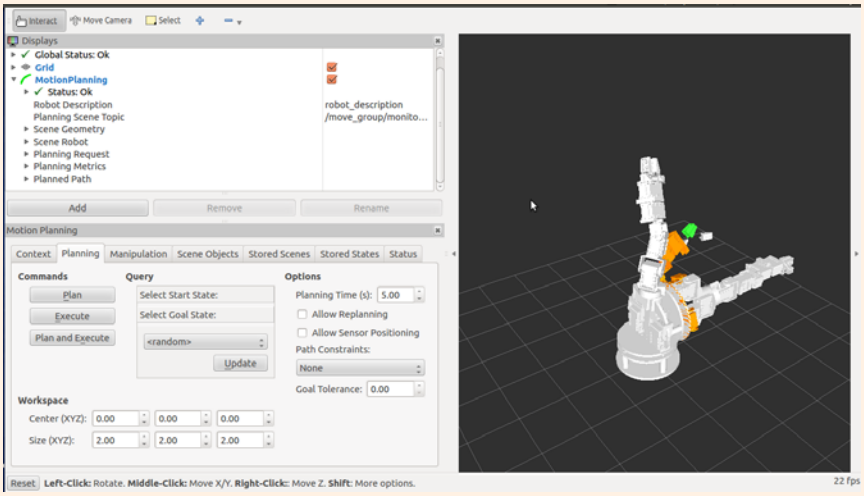
MOVEIT



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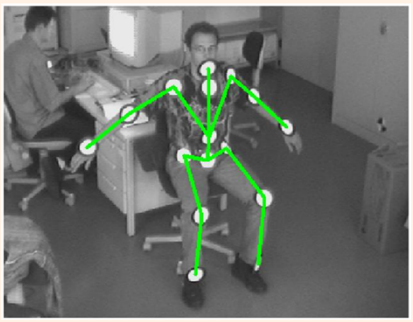
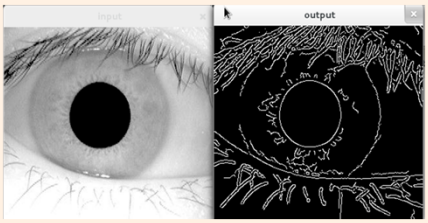
OpenCV

OpenCV





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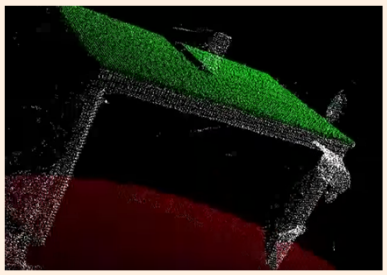
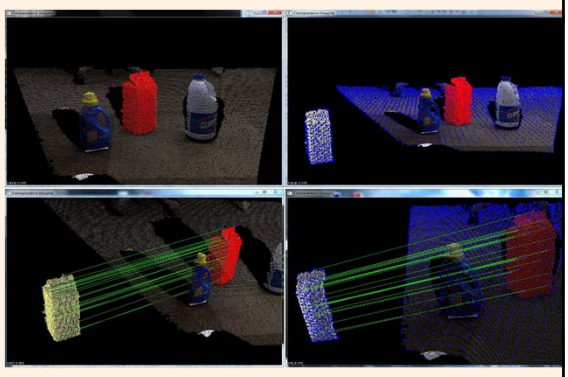
PointCloud Library

pointcloudlibrary





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TensorFlow

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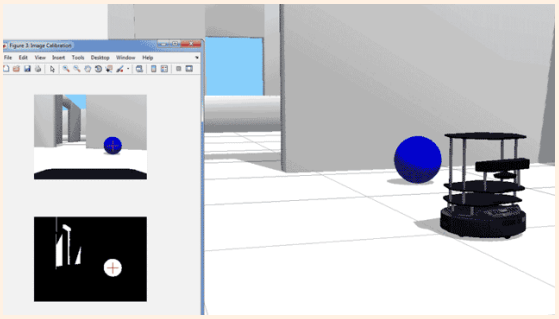
MATLAB Robotics System Toolbox



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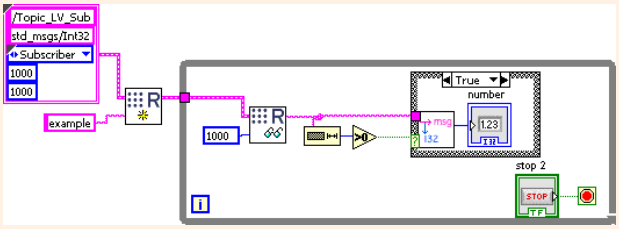
LABVIEW Robotics System Toolkit



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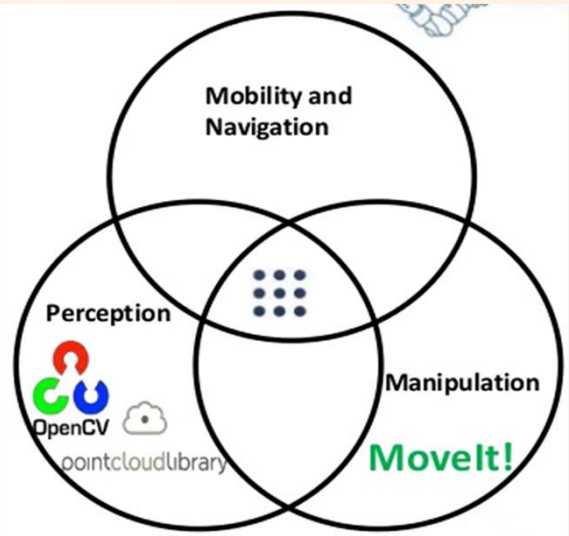
ROS Main fields of application



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ROS Middleware

- The term is most commonly used for software that enables communication and management of data in **distributed applications**.
- A *distributed system* is a model in which components located on networked computers communicate and coordinate their actions by passing messages.

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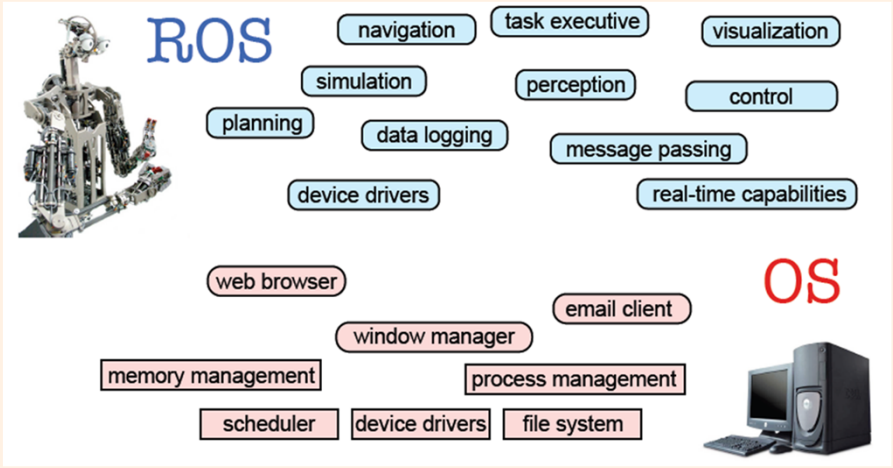
ROS



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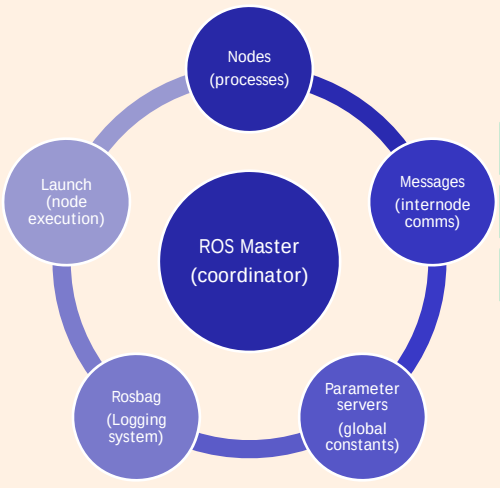
ROS Middleware components



- **Topics** — publish-subscribe
- **Services** — blocking request-respone
- **Actions** — non blocking request-resonse

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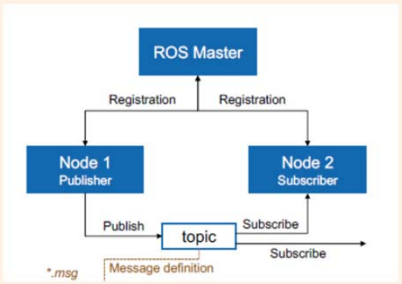
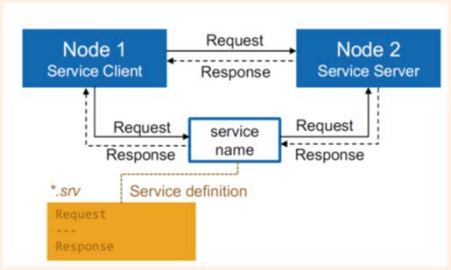
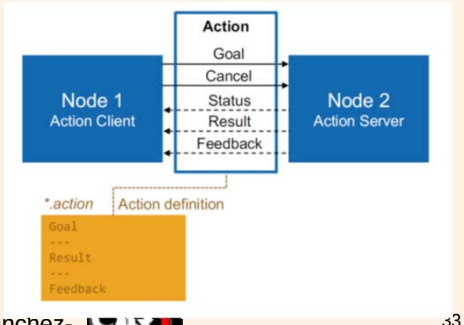
ROS Middleware: comms paradings







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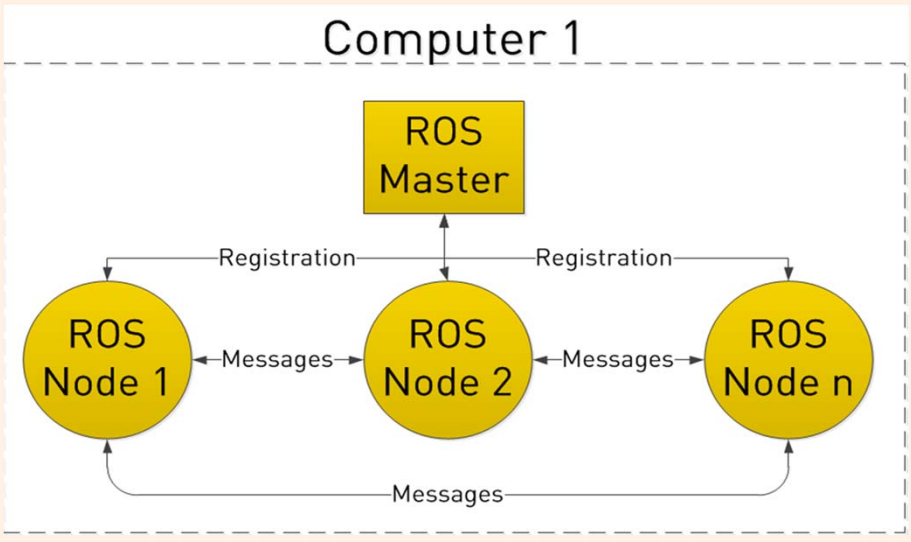
ROS in one computer



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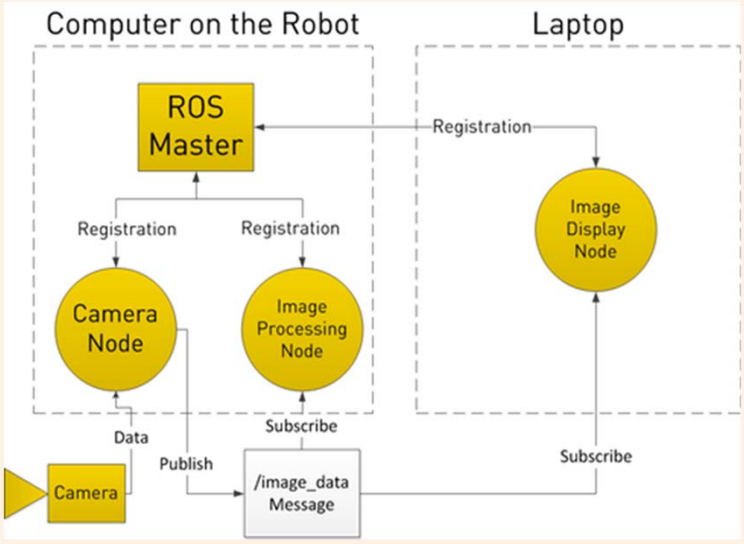
ROS in two computers



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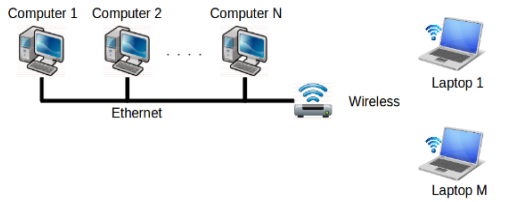
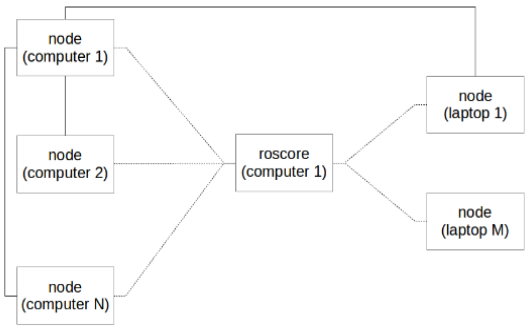
ROS distributed over n-computers





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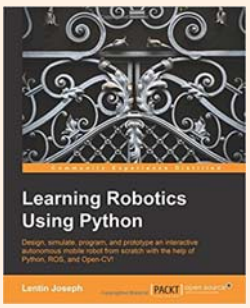

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