Robotic Manipulation Exercise 1

Introduction to ROS and git

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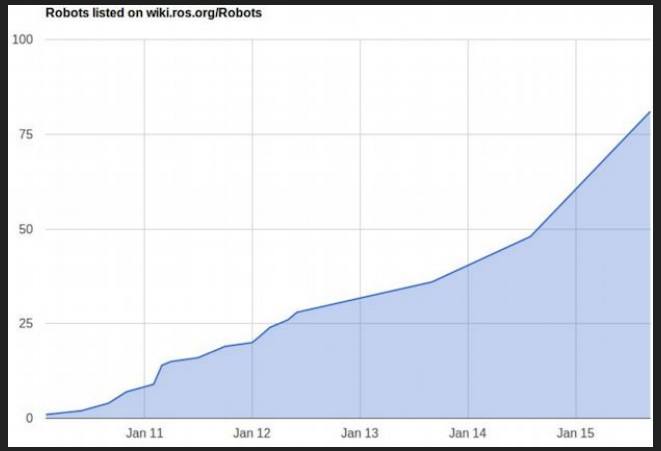
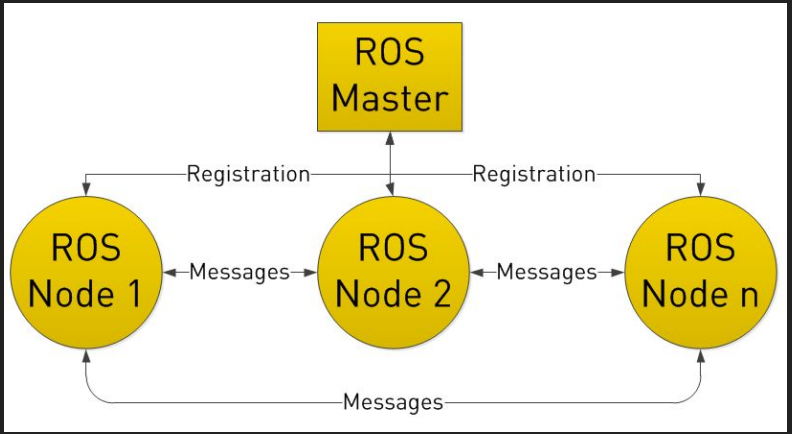
Robotic Operating System

- ROS stand for Robotic Operating System and was released 2007 by a company known as Willow Garage.
- ROS is an open-source, meta-operating system for your robot.
- ROS is designed to be modular at a fine-grained scale.
- ROS is widely used in industry and academic research



ROS concept

- ROS is build up of nodes
- ROS nodes are registered through a ROS Master
- Nodes can communicate with each other via topics
- For more in depth knowledge about ROS you can read, for example, http://wiki.ros.org/ROS/Introduction



ROS Workspace Environment

- Default workspace loaded with:

  ~ source /opt/ros/melodic/setup.zsh

- Setup ROS workspace (http://wiki.ros.org/catkin/Tutorials/create_a_workspace)

  ~ mkdir -p ~/ros/src

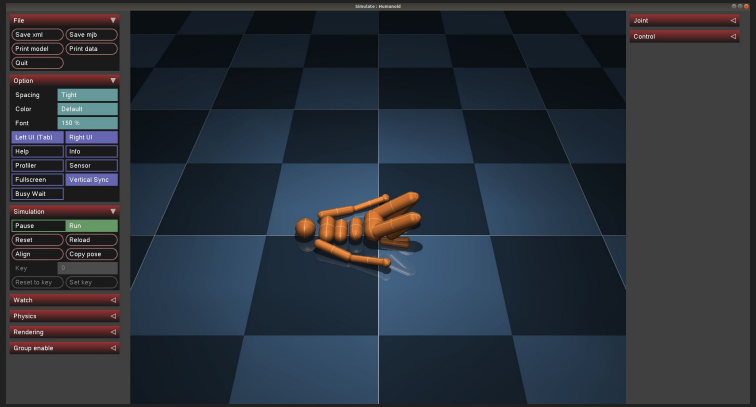
  ~ cd ~/ros

  ~ catkin_make

- Always remember to source devel/setup.bash or devel/setup.zsh in your workspace after you compiled the code in order to access the newly compiled ROS nodes.

Install MuJoCo

Download MuJoCo simulator from http://www.mujoco.org and put the simulator code as well as your MuJoCo key into the folder ~/.mujoco/, i.e.: (you can find the “mjkey.txt” file in “MyCourses > For Aalto users”)



- ls ~/.mujoco

  mjkey.txt mjpro200

- ls ~/.mujoco/mjpro200/

  bin doc include model sample

- ~/.mujoco/mjpro200/bin/simulate ~/.mujoco/mjpro200/model/humanoid.xml

Test ROS

Use three terminals

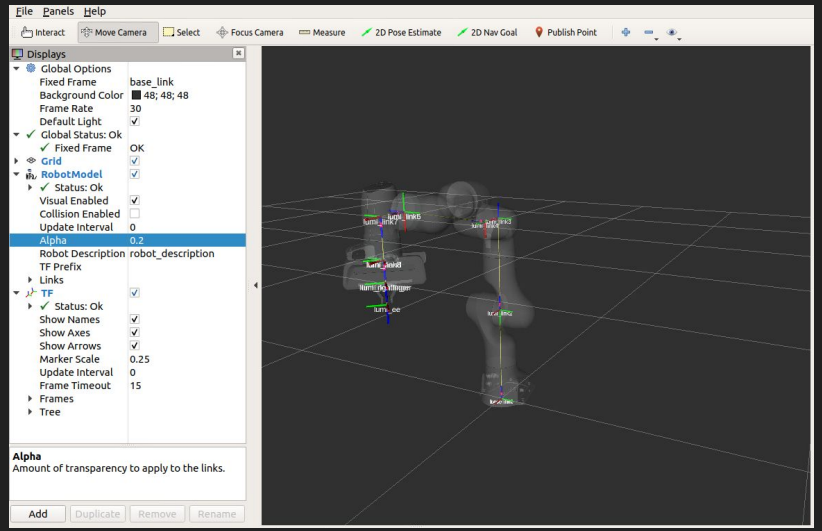
- First terminal (roscore)
  - source ~/ros/devel/setup.zsh
  - Roscore
- Second terminal (publisher)
  - source ~/ros/devel/setup.zsh
  - rostopic pub -r 1 /course_name std_msgs/String "data: 'manipulation_course'"
- Third terminal (subscriber)
  - source ~/ros/devel/setup.zsh
  - rostopic list #should print three topics
  - rostopic echo /course_name

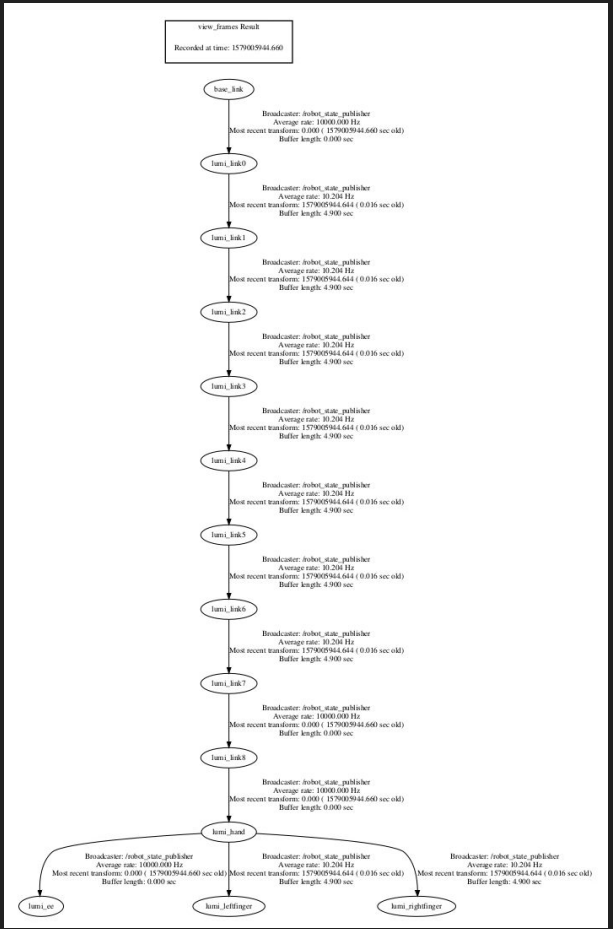
TF

- A robotic system typically has many 3D coordinate frames that change over time. These coordinate systems are naturally expressed in a transformation (TF) tree → http://wiki.ros.org/tf2
- tf maintains the relationship between coordinate frames in a tree structure buffered in time, and lets the user transform points, vectors, etc between any two coordinate frames at any desired point in time.

RViz and TF tree

- roslaunch lumi_description show.launch
- rosrun tf view frames && evince frames.pdf





Git

- git is a version-control system.
- In this course, gitlab is used for storing all exercises. If you have no previous knowledge of git and/or gitlab then please read up about it online at, e.g. https://docs.gitlab.com/ee/gitlab-basics/
- To use Aalto gitlab you need to log in to https://version.aalto.fi/ and then set up your ssh key https://docs.gitlab.com/ee/gitlab-basics/create-your-ssh-keys.html

gitlab group, forking the course material, and pushing code

- Interactive session during the exercise session.
- For the gitlab repository, we created one subgroup for each one of you. You can use the following pattern to access that:

  https://version.aalto.fi/gitlab/robotic_manipulation_students_projects_2020/<your email address without @aalto.fi>

  for example if your email address is eshagh.kargar@aalto.fi use:

  https://version.aalto.fi/gitlab/robotic_manipulation_students_projects_2020/eshagh.kargar

- On your computer, remember to always clone your newly forked exercise repository into the src directory of your ROS workspace

Exercise file system

The file system for each exercise is visualized in the figure to the right

- The src folder contains the template code you need to fix
- The feedback folder will contain the TA's feedback and points awarded
- In the report folder you will upload the exercise report as a pdf
- The docs folder will contain all necessary information for the current exercise.
- Other files are ROS specific which you do not need to touch.

```
.
├── CMakeLists.txt
├── doc
│   └── exercise1.pdf
├── feedback
├── package.xml
├── report
└── src
    └── ros_intro.cpp
```

What did we not cover?

- Specifically to ROS, we did not cover concepts such as:
  - ROS Services http://wiki.ros.org/Services,
  - ROS Parameter Server http://wiki.ros.org/Parameter,
  - ROS Bags http://wiki.ros.org/Bags,
  - and much more http://wiki.ros.org/ROS/Concepts.
- With respect to Git we did not cover concepts such as
  - Git Branching and Merging https://git-scm.com/book/en/v2/
  - Git-Branching-Basic-Branching-and-Merging
  - git-diff https://git-scm.com/docs/git-diff
  - and much more http://thepilcrow.net/ explaining-basic-concepts-git-and-github/
- You will probably not need to master nor need these concepts during the course, but it is good to know about them.