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rosin-project.eu

ROS-I Academy Training

tf

MASCOR Institute

Mobile Autonomous Systems and Cognitive Robotics Institute (MASCOR)

2017ff

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Outline

- Motivation
- tf for sensors
- tf in navigation
- Features & Notations

Motivation

Transformations

A moving robot system usually has many 3D coordinate frames with over time changing transformations. Transformations are essential for robot **perception**, **localization** and **motion control**.

Motivation

Task

Provide high level access to transformations for calculation between reference frames.

Options:

- Manually monitor joint states and manually calculate frame transformations
- ...

tf for sensors

⟵ TF ⟶

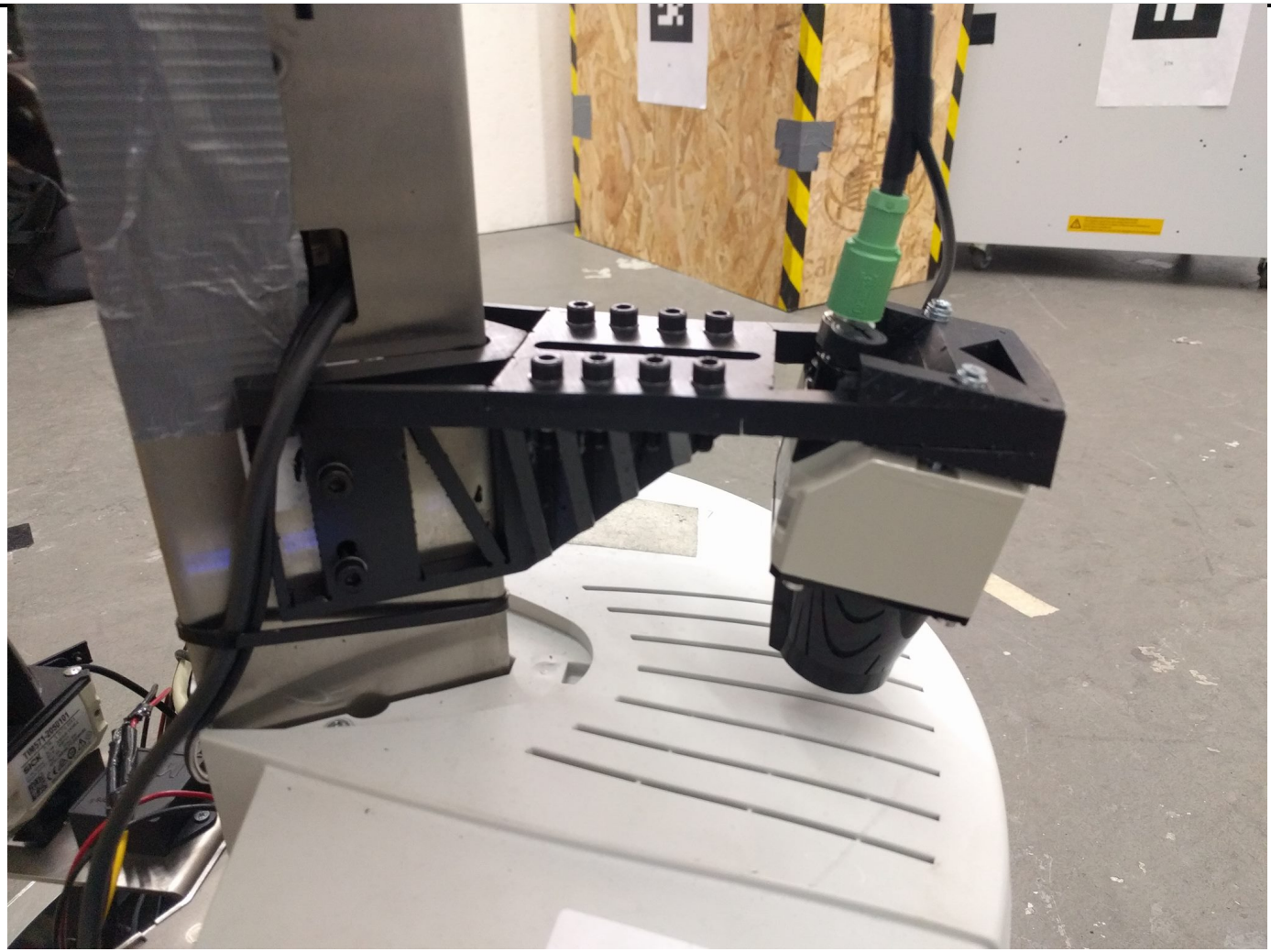
- Position and orientation of sensor devices

tf

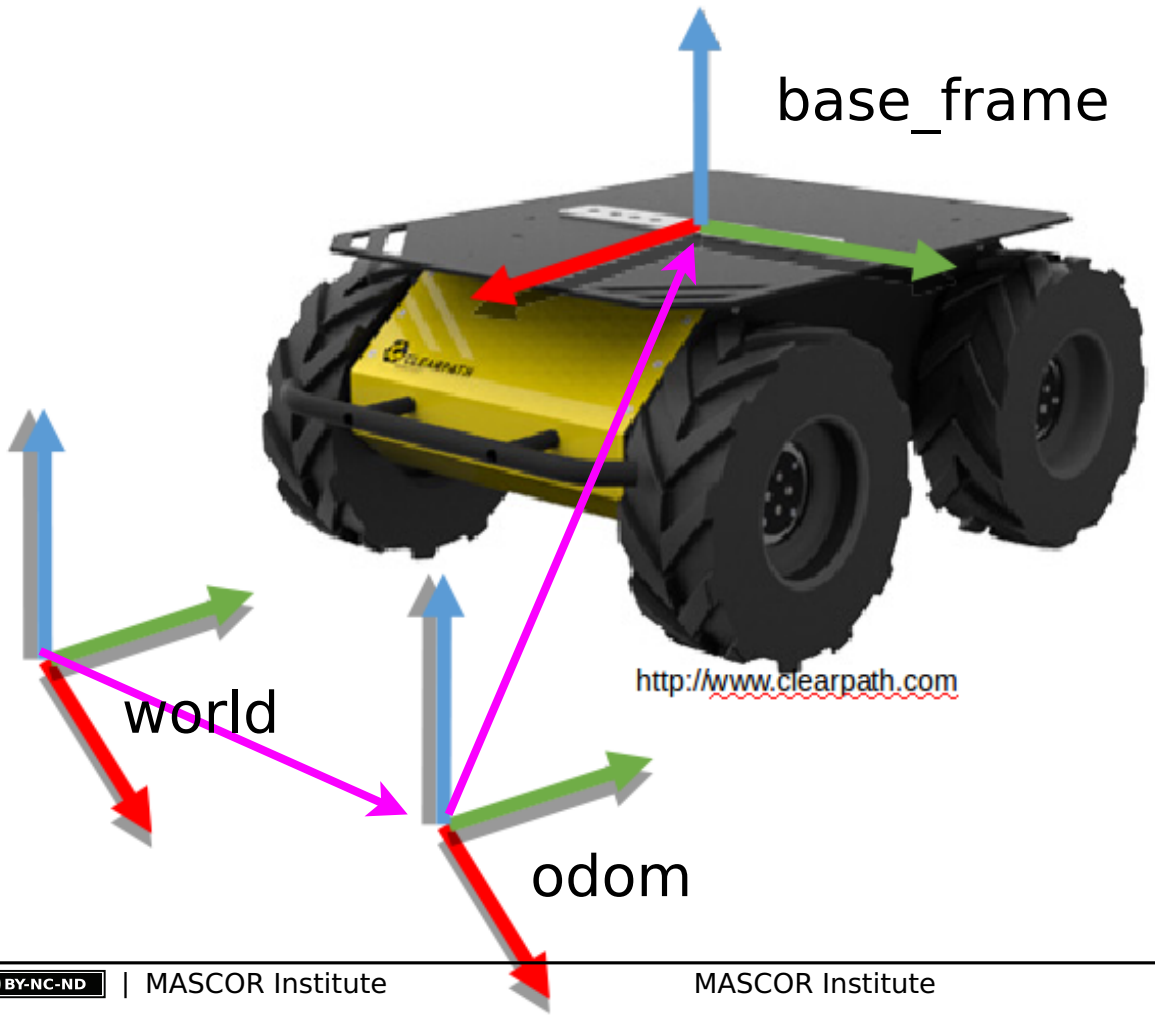
Sensor positioning

tf

Sensor positioning



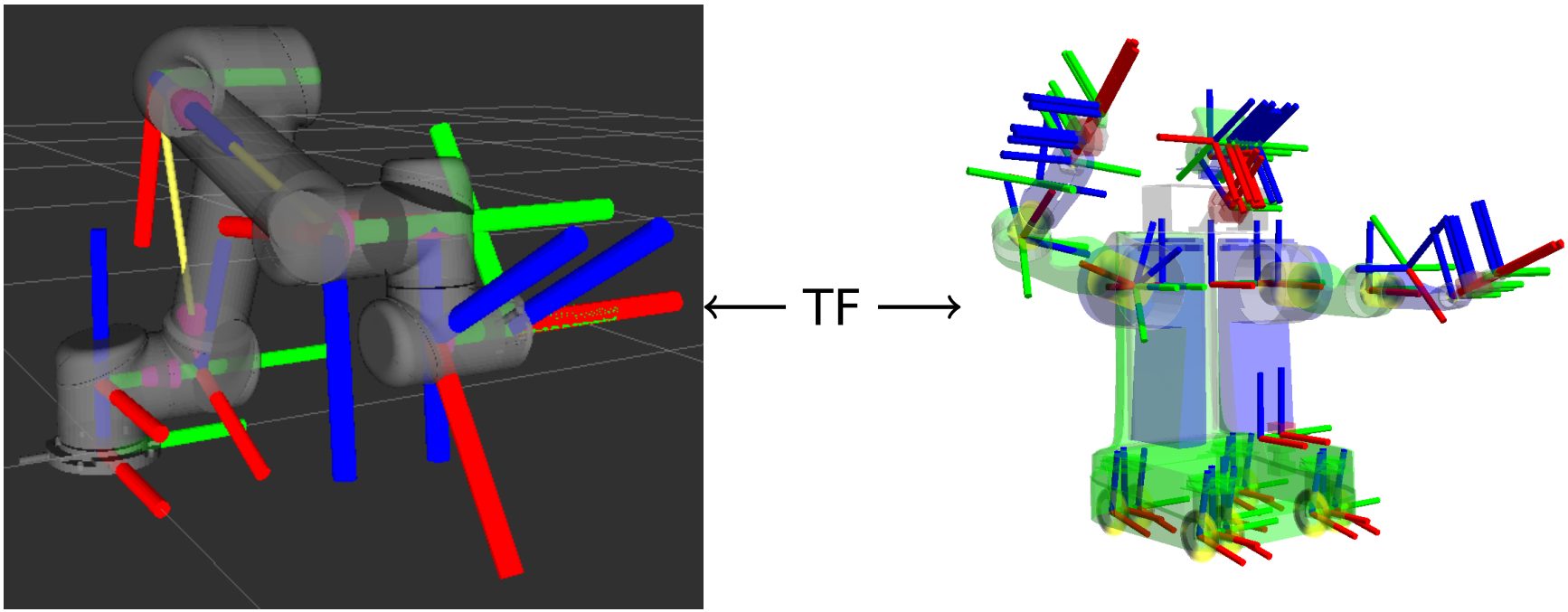
tf in navigation



tf in navigation

ROS_SS2016_Rover_teb_local_planner.mp4

tf



- Position and orientation of sensor devices
- Representation of complex tf structures

tf

features (http://wiki.ros.org/tf)

- The distributed ROS Tool TF keeps track of all frames over time
- Easily add new frames (static & dynamic)
- Transformation of points, vectors, etc. between any two frames at a desired point of time
- Allows to ask questions like:
  - Where was the head frame relative to the world frame, 5 seconds ago?
  - What is the pose of the object in my gripper relative to my base?
  - What is the current pose of the base frame in the map frame?

tf

static ⟷ dynamic

static

- constant transform (e.g. base_link → camera_link)
- Setup:
  - in launchfiles (`static_transform_publisher`
  - in urdf via joints of type `fixed` & `robot_state_publisher`
  - used to define the positions of actuators / sensors of robots

dynamic

- broadcast from custom nodes
- implementation by using a *broadcaster* in your ROS node

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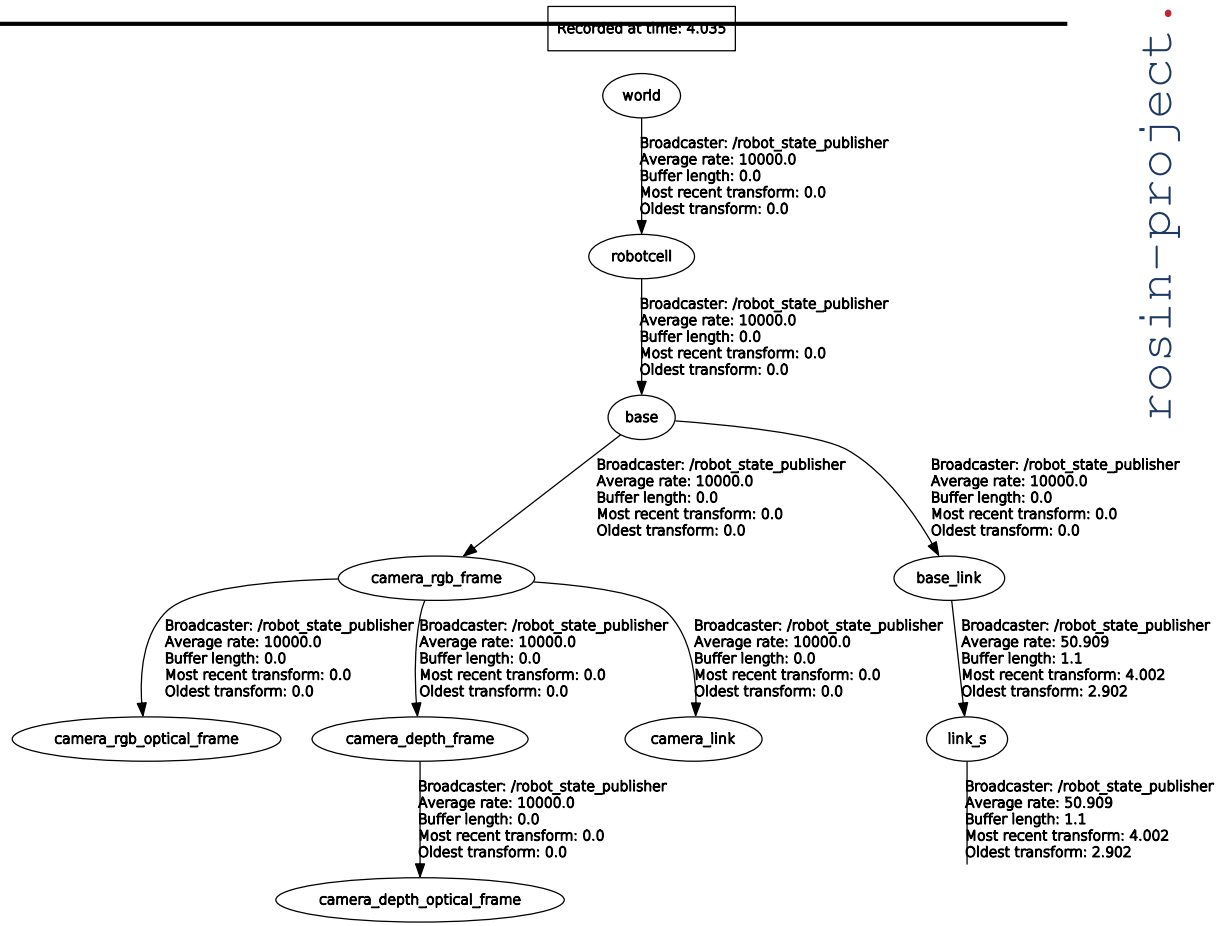
notations

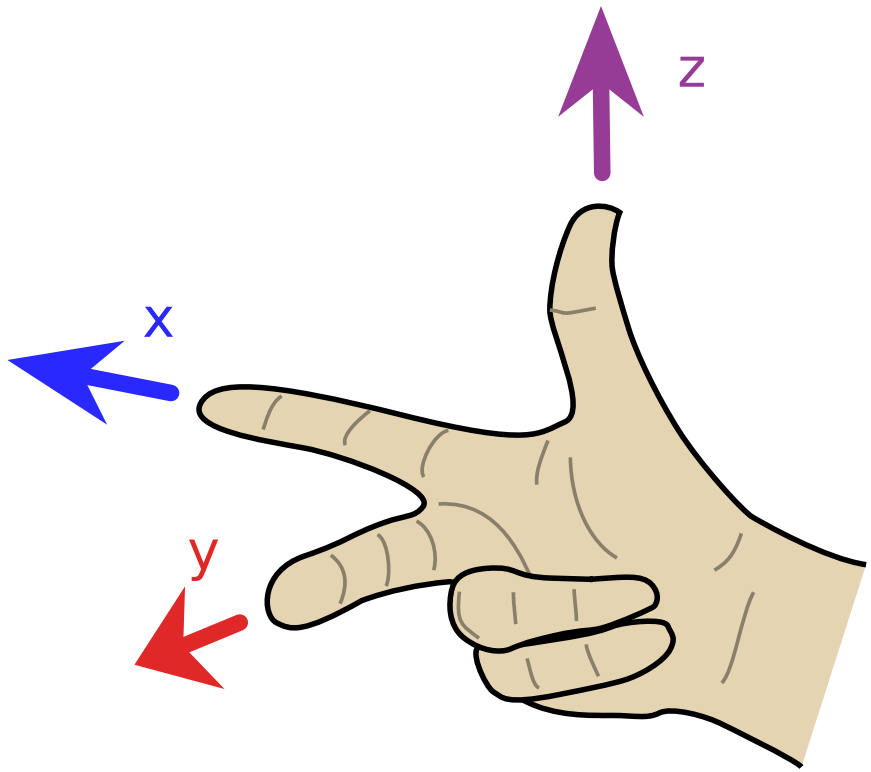
- TFs are implemented with a forward description from parent to child (from $\rightarrow$ to)
- One parent per frame
- Multiple childs per frame
- Orientations stored in Quaternions
  - Conversion to and from euler angles available



tf

"Standards" → REP-103

- SI units are used
- Right-hand rule
  - `x` forwards
  - `y` left
  - `z` upwards
  - `yaw` - component increases counter-clockwise
- Rotation representation
  - `roll` around `x`-axis
  - `pitch` around `y`-axis
  - `yaw` around `z`-axis
    - `0` when facing east on geographic poses



Source: en.wikipedia.org