Moving the Mechanism

ROS + PR2 Training Workshop   May 25, 2010

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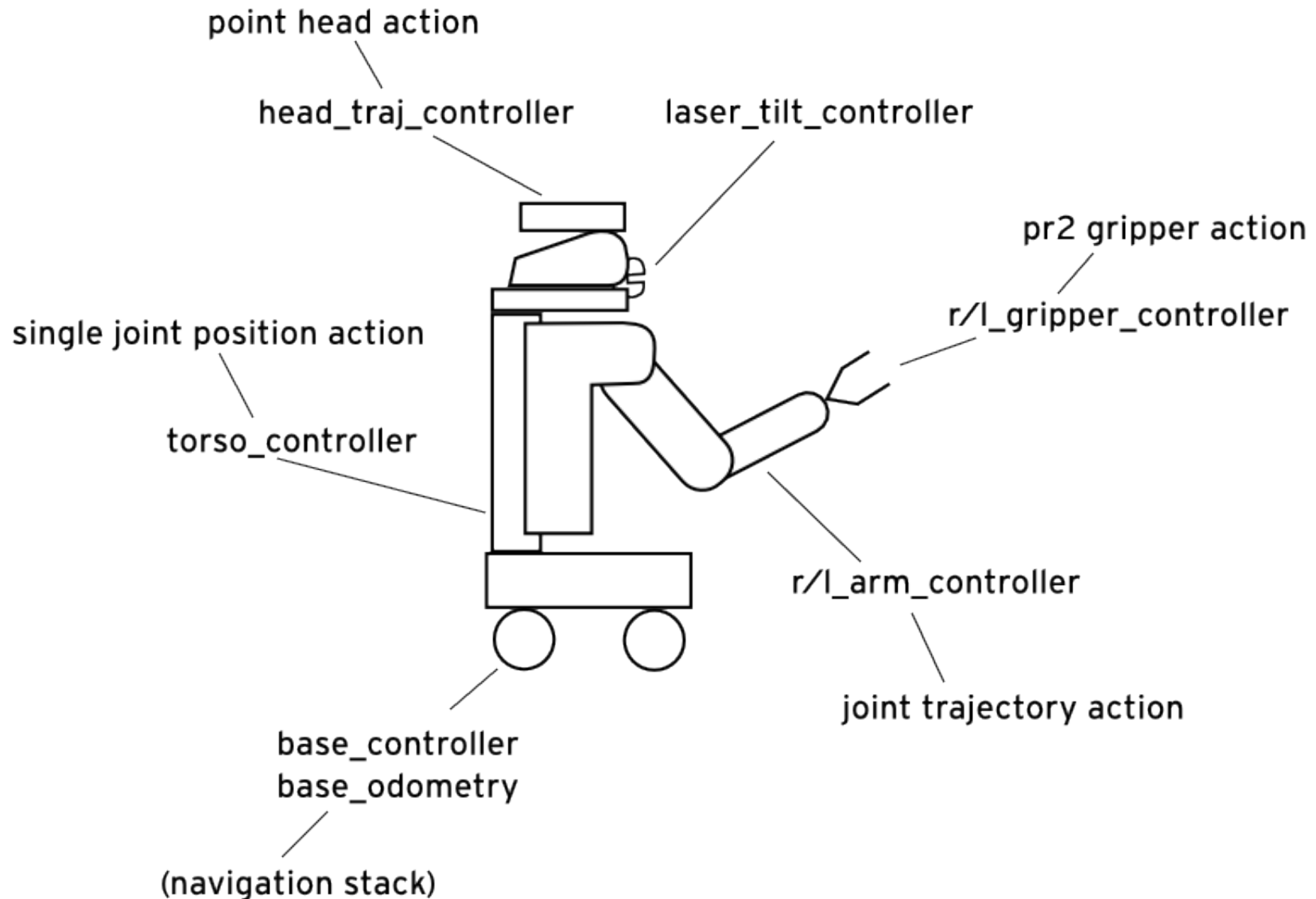
Moving the Mechanism

- The Controller Manager
- Control of the...
  - Base
  - Laser
  - Torso
  - Gripper
  - Head
- Trajectories and arm control
- IK and Cartesian movement
- Alternative controllers

PR2 Controller Manager

```
┌──────────────┐      ROS      ┌──────────────┐   etherCAT   ┌──────────────────┐
│   External   │ ───────────▶  │  Controller  │ ───────────▶ │  Robot hardware  │
│    Nodes     │ ◀───────────  │   Manager    │ ◀─────────── │     (MCBs)       │
└──────────────┘               └──────────────┘              └──────────────────┘
```

PR2 Controller Manager

point head action

head_traj_controller

laser_tilt_controller

pr2 gripper action

r/l_gripper_controller

single joint position action

torso_controller

r/l_arm_controller

base_controller
base_odometry

joint trajectory action

(navigation stack)

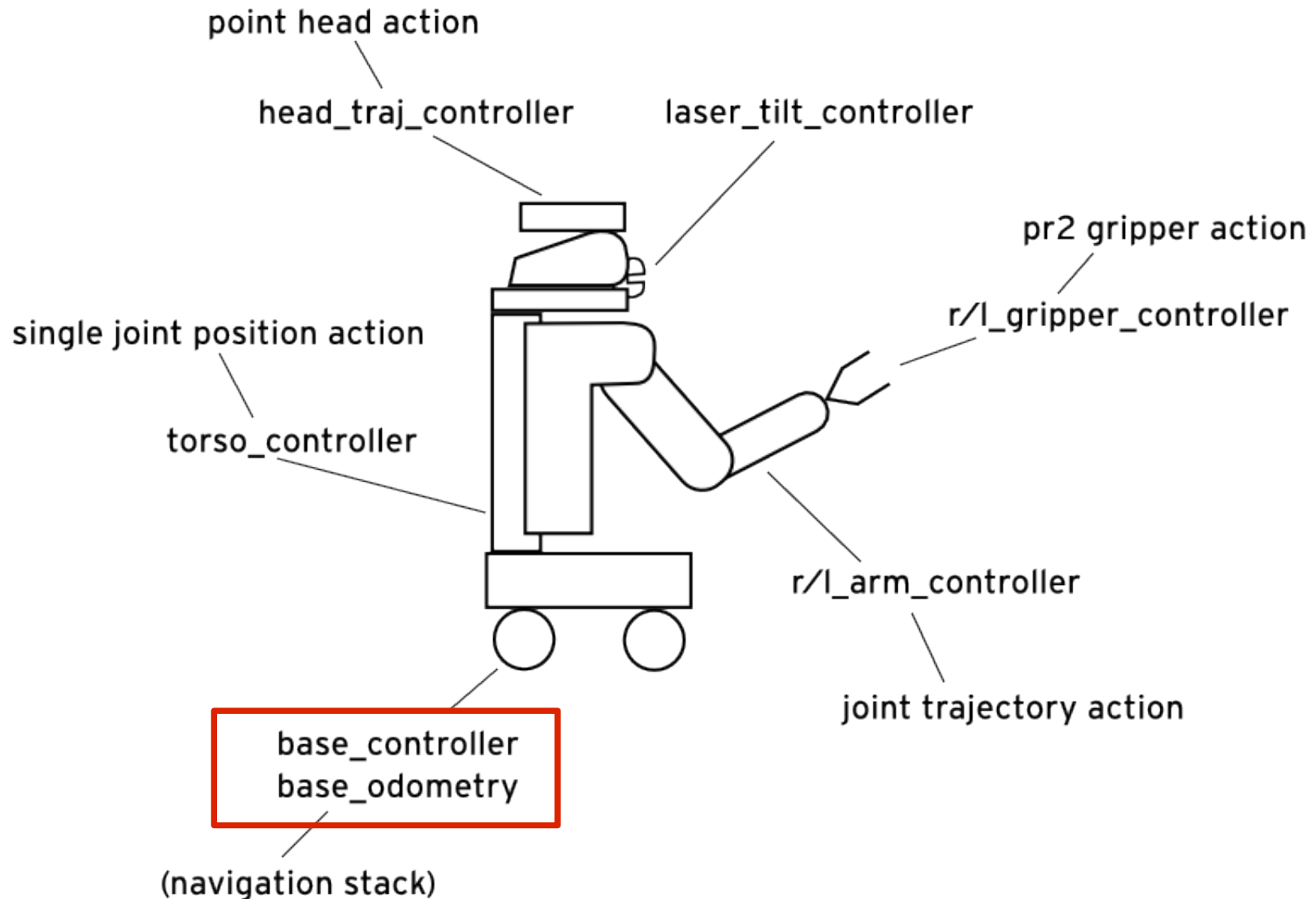# PR2 Controller Manager

```
$ rosrun pr2_controller_manager pr2_controller_manager list

base_controller ( running )
base_odometry ( running )
head_camera_trigger ( running )
head_traj_controller ( running )
l_arm_controller ( running )
l_forearm_cam_trigger ( running )
l_gripper_controller ( running )
laser_tilt_controller ( running )
projector_controller ( running )
projector_trigger ( running )
prosilica_inhibit_projector_controller ( running )
r_arm_controller ( running )
r_forearm_cam_trigger ( running )
r_gripper_controller ( running )
torso_controller ( running )
```

TODO: delete extra text. Just leave laundry list

```
$ roscreate-pkg mm_teleop rospy pr2_controllers_msgs actionlib geometry_msgs
```

Moving the Base

point head action

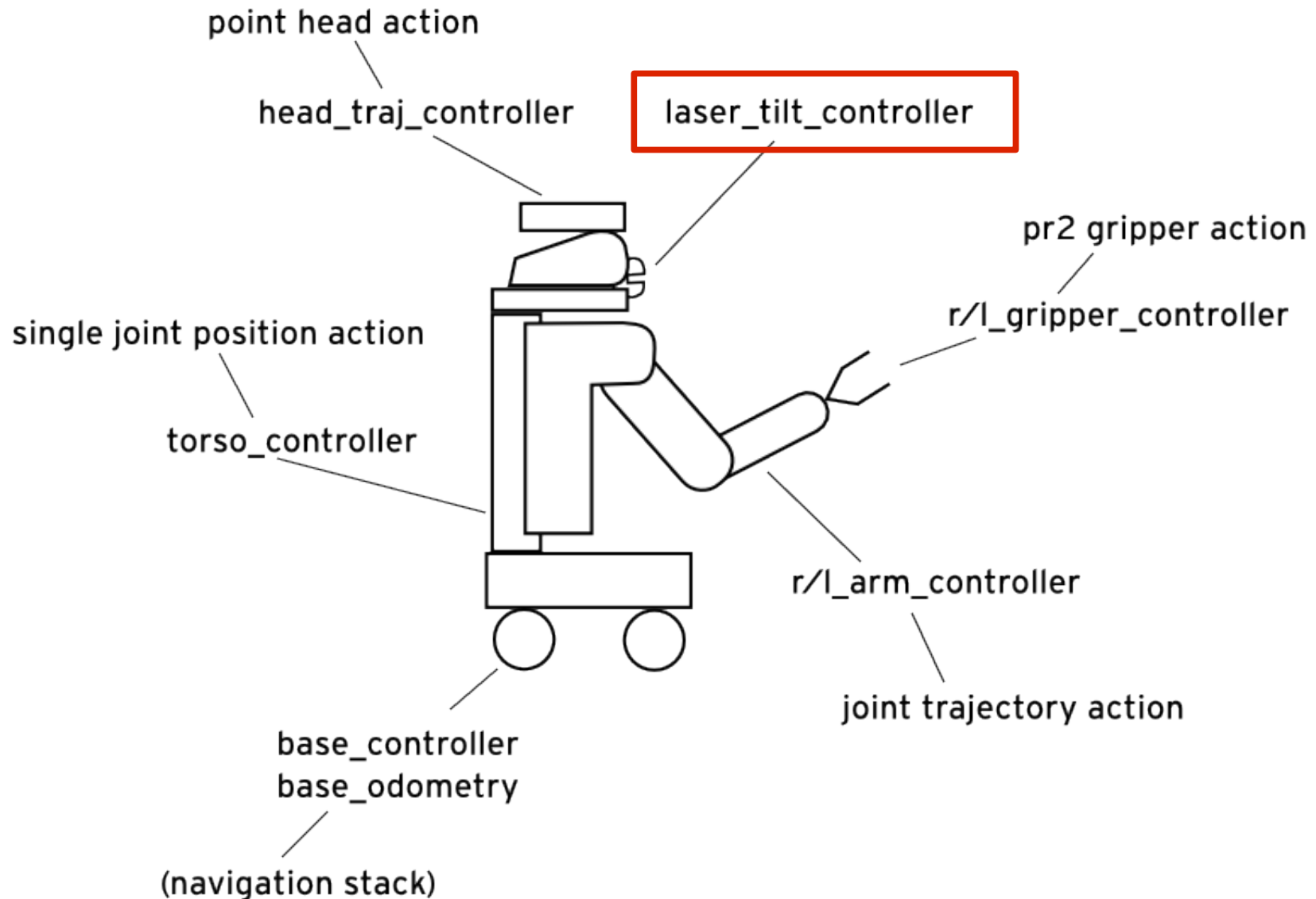head_traj_controller   laser_tilt_controller

pr2 gripper action

r/l_gripper_controller

single joint position action

torso_controller

r/l_arm_controller

joint trajectory action

base_controller
base_odometry

(navigation stack)

Moving the Base (Notes)

```
$ rostopic list base_controller
$ rostopic info base_controller/command
$ rosmsg show geometry_msgs/Twist

$ rostopic list base_odometry
$ rostopic echo /base_odometry/odom
$ rostopic info /base_odometry/odom
$ rosmsg show nav_msgs/Odometry
```

Moving the Laser

point head action

head_traj_controller

laser_tilt_controller

single joint position action

torso_controller

pr2 gripper action

r/l_gripper_controller

r/l_arm_controller

joint trajectory action

base_controller
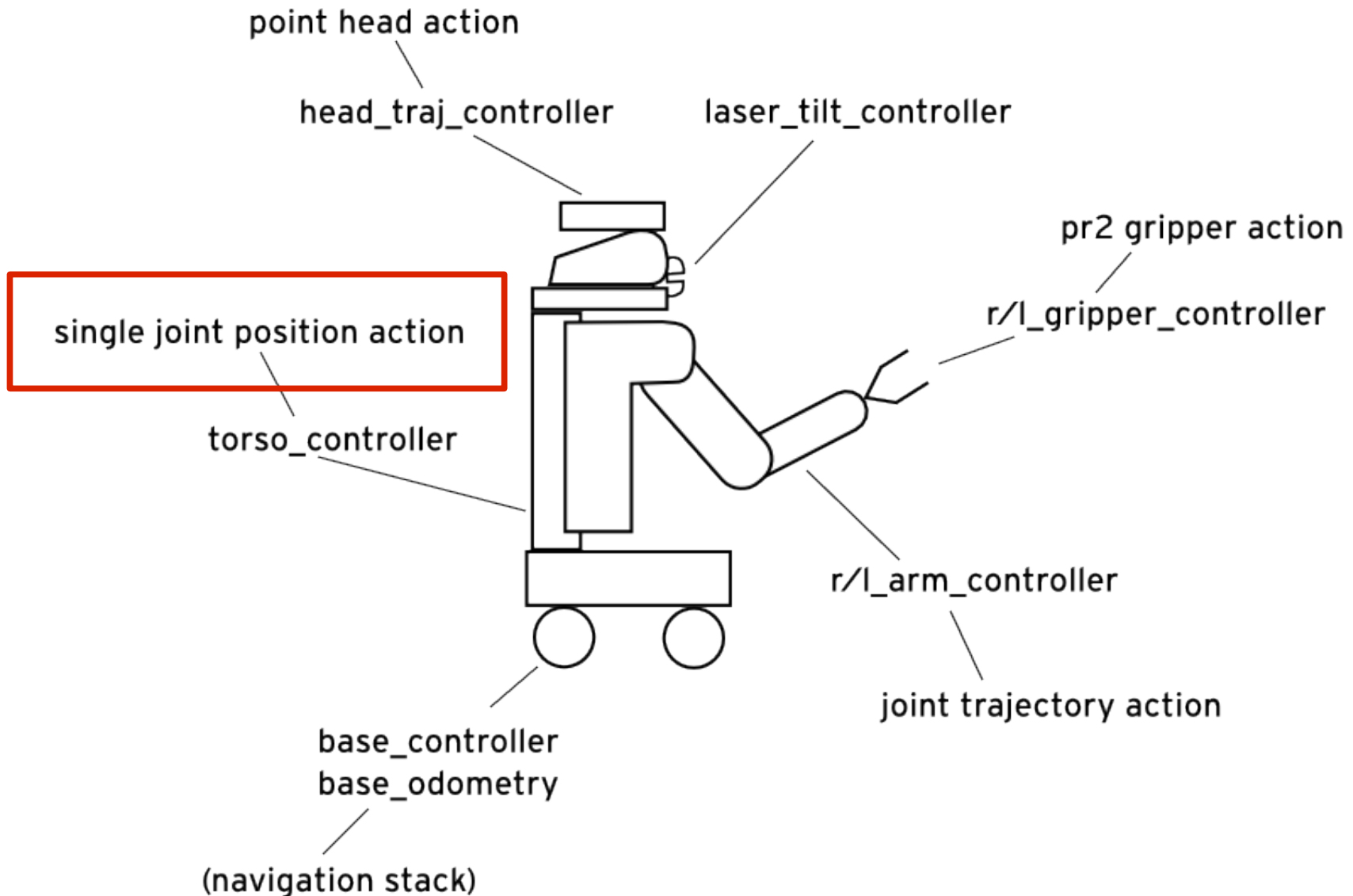base_odometry

(navigation stack)

Moving the Laser (Notes)

```
$ rostopic list laser_tilt_controller
$ rosservice list laser_tilt_controller
$ rosservice type /laser_tilt_controller/set_periodic_cmd
$ rossrv show pr2_msgs/SetPeriodicCmd

$ rosrun pr2_mechanism_controllers send_periodic_cmd_srv.py
$ rosrun pr2_mechanism_controllers send_periodic_cmd_srv.py \
laser_tilt_controller linear 3 0.4 0.0

$ rosrun pr2_controller_manager pr2_controller_manager list-joints
$ rostopic info joint_states
$ rosmsg show sensor_msgs/JointState
$ rxplot -b 60 /joint_states/position[15]
```

Moving the Torso

point head action

head_traj_controller

laser_tilt_controller

pr2 gripper action

r/l_gripper_controller

single joint position action

torso_controller

r/l_arm_controller

joint trajectory action

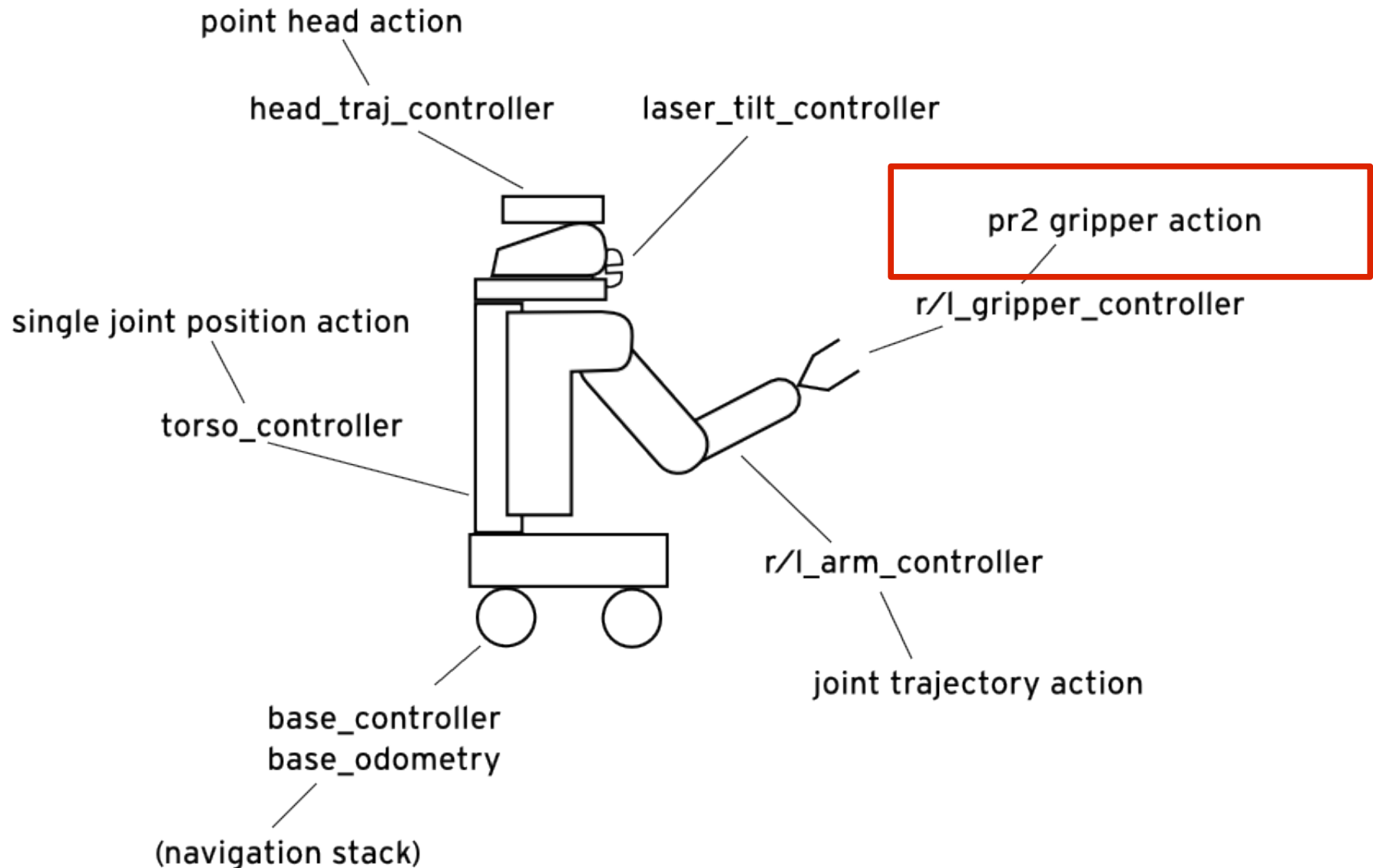base_controller
base_odometry

(navigation stack)

Moving the Torso (Notes)

```
$ rostopic list torso_controller

$ rostopic echo /torso_controller/position_joint_action/status

$ rostopic info /torso_controller/position_joint_action/goal
$ rosmsg show SingleJointPositionGoal
```

Moving the Gripper

point head action

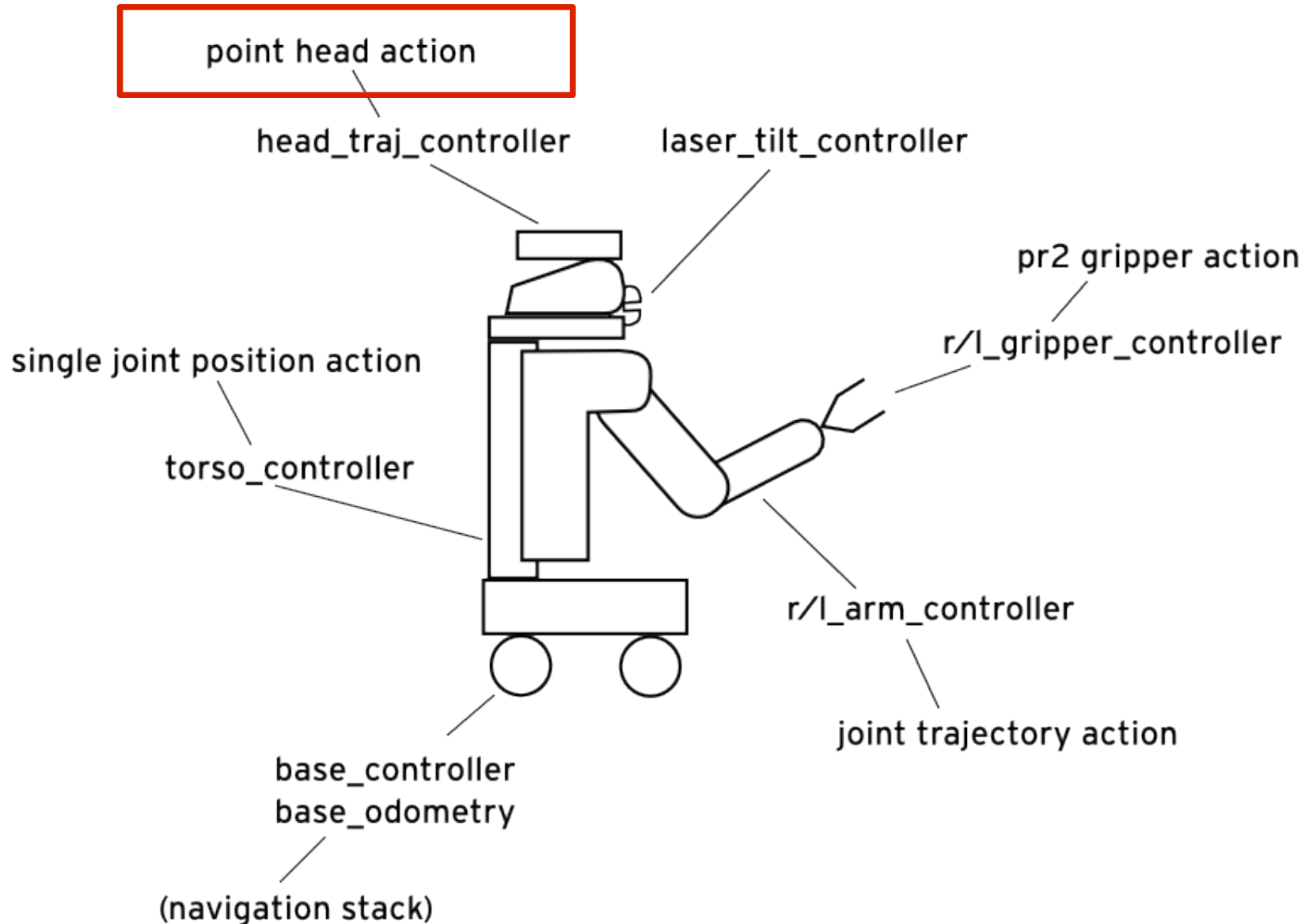head_traj_controller   laser_tilt_controller

pr2 gripper action

r/l_gripper_controller

single joint position action

torso_controller

r/l_arm_controller

joint trajectory action

base_controller
base_odometry

(navigation stack)

Moving the Gripper (Notes)

```
$ rostopic list r_gripper_controller

$ rosmsg show pr2_controllers_msgs/Pr2GripperCommandGoal

$ rosmsg show Pr2GripperCommandResult
```

Moving the Head

point head action

head_traj_controller

laser_tilt_controller

pr2 gripper action

r/l_gripper_controller

single joint position action

torso_controller

r/l_arm_controller

joint trajectory action

base_controller
base_odometry

(navigation stack)

Moving the Head (Notes)

```
$ rostopic list head_traj_controller

$ rosmsg show pr2_controllers_msgs/PointHeadGoal
```
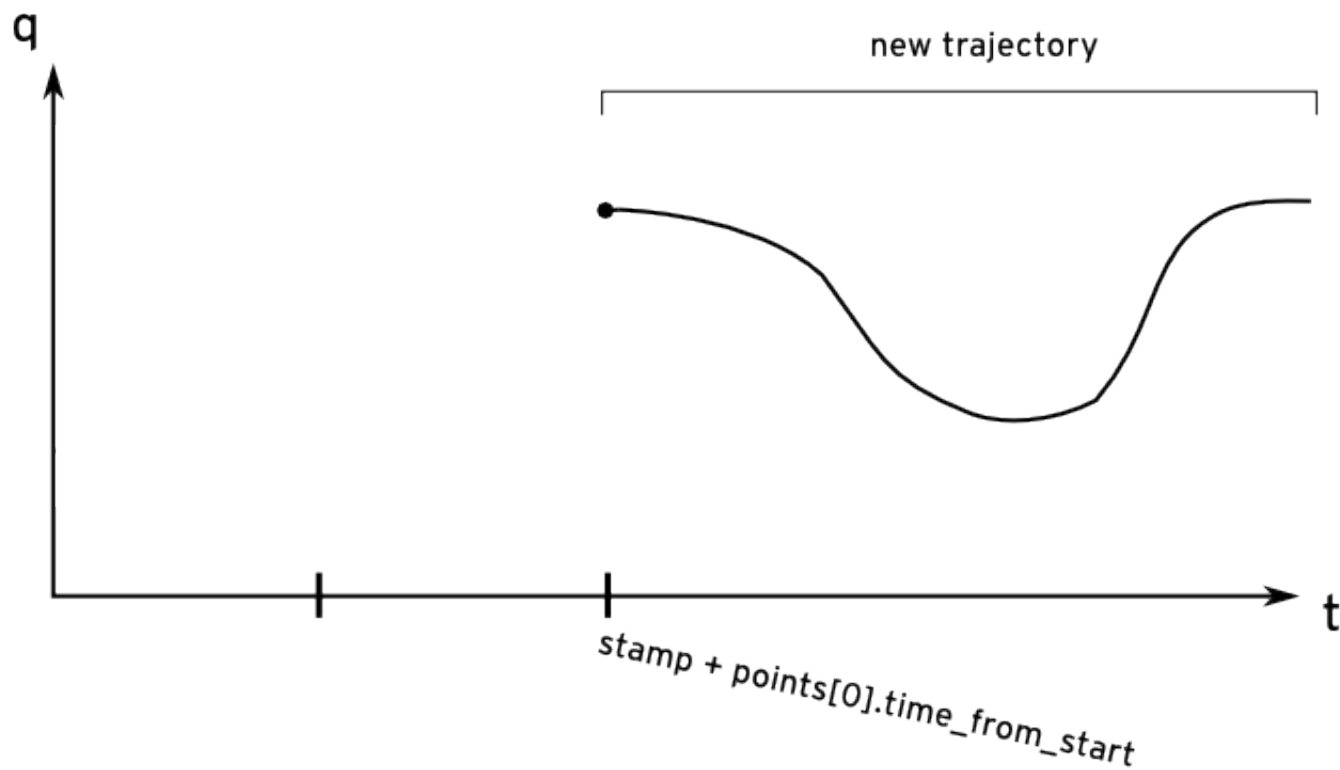
Joint trajectories and moving the arms

Moving the Arms

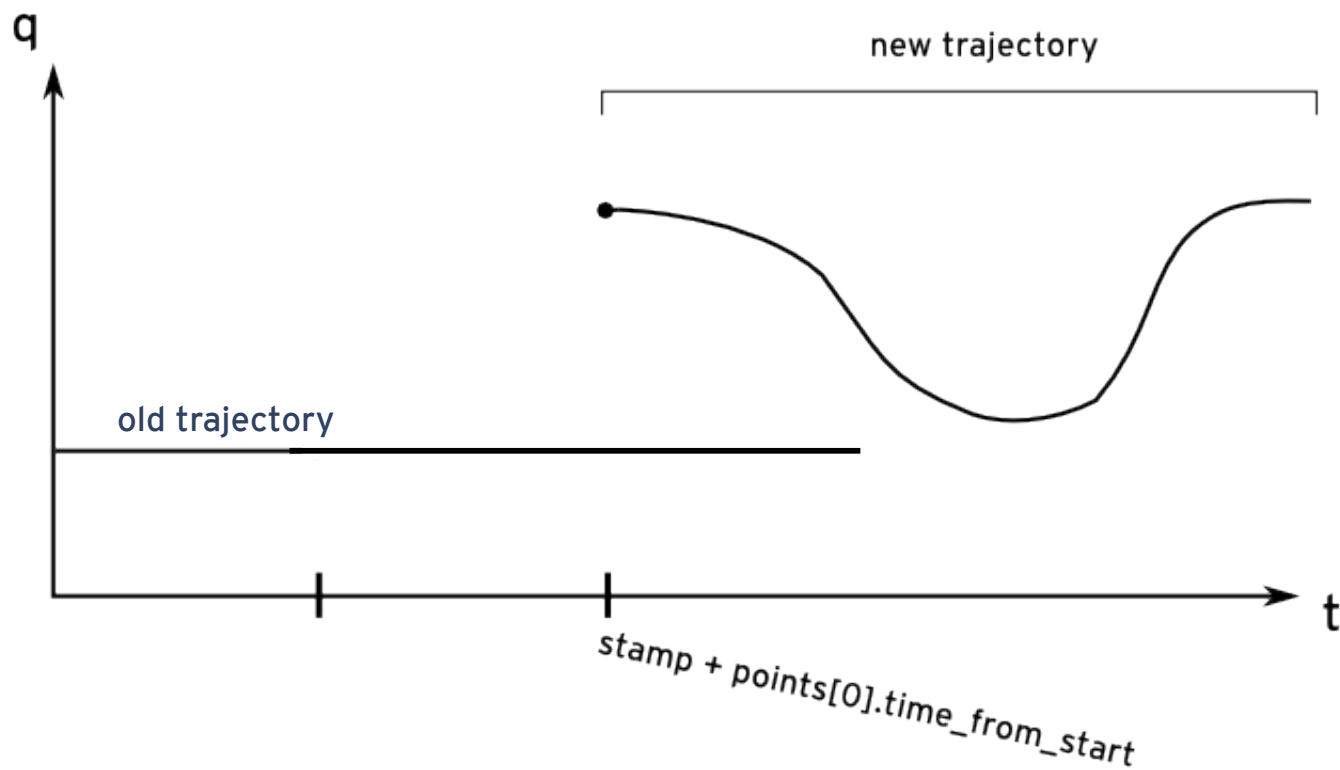point head action

head_traj_controller

laser_tilt_controller

pr2 gripper action

r/l_gripper_controller

single joint position action

torso_controller

r/l_arm_controller

joint trajectory action
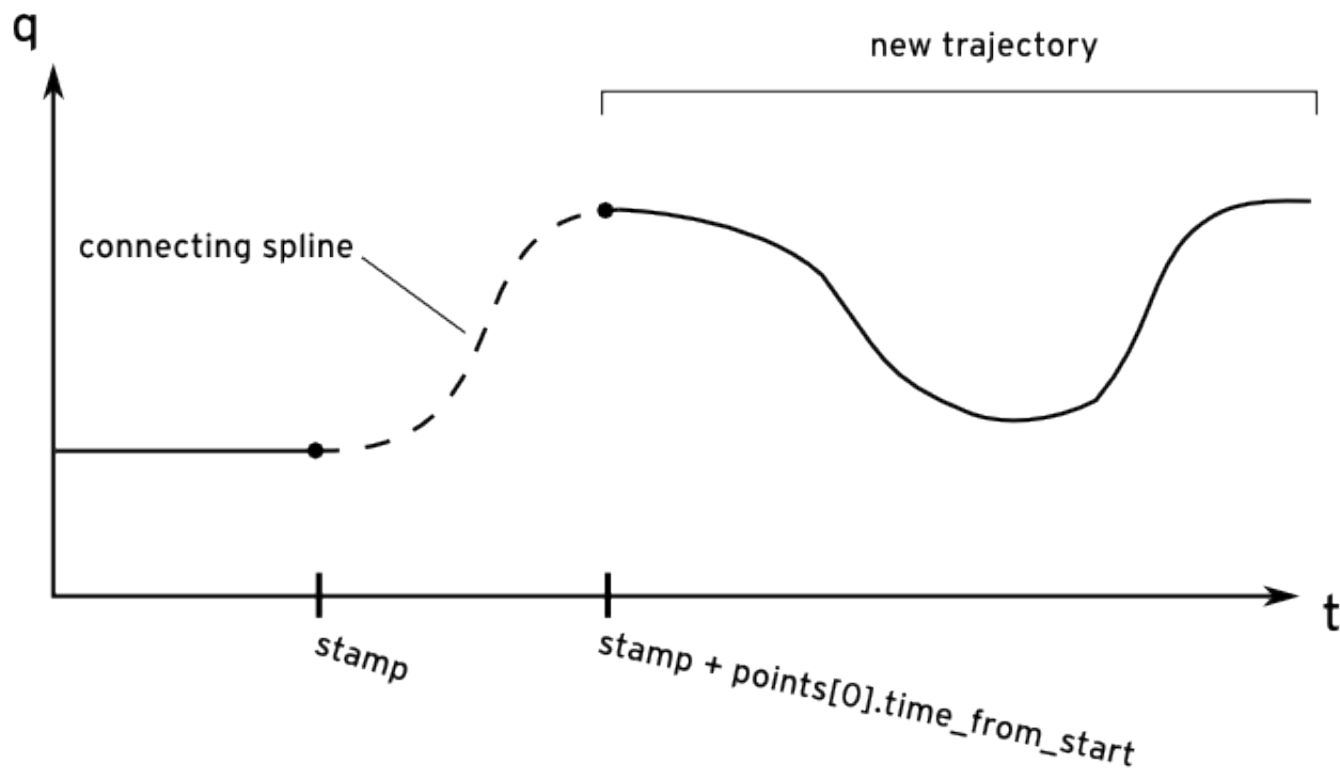
base_controller
base_odometry

(navigation stack)
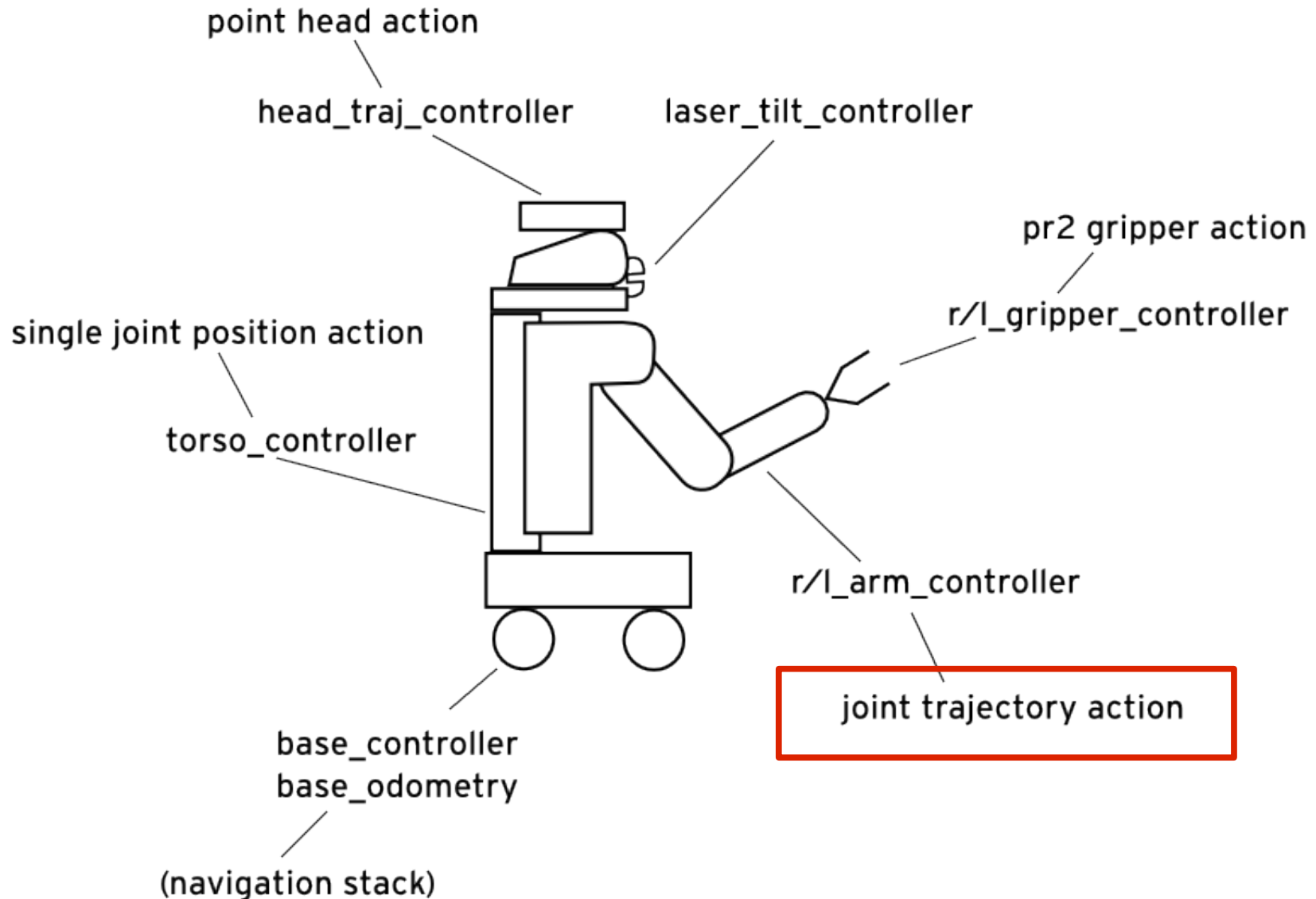
Joint Trajectory

Joint Trajectory

Joint Trajectory

Moving the Arms (Notes)

$ rostopic list r_arm_controller

$ rosmsg show pr2_controllers_msgs/JointTrajectoryGoal

Useful resources

ROS interfaces to the controllers:
* http://www.ros.org/wiki/robot_mechanism_controllers
* http://www.ros.org/wiki/pr2_mechanism_controllers

Tutorials on moving the PR2:
 * http://www.ros.org/wiki/pr2/Tutorials