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iDynTree :
Free Floating Dynamics Library

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Slides taken from VVV18 International Winter School on Humanoid Robot Programming
Credits Silvio Traversaro

Loading model

Models can be built programmatically but typically are loaded from **URDF** files (the same robot description format used in **ROS**).

As sometimes we are not interested in all joints contained in a robot, we can explicitly specify the **joints** that we want to load, and their order, using the **iDynTree::ModelLoader** class.

From this class, you obtain a **iDynTree::Model** that contain the structure and the parameters of the model, that you can pass to **iDynTree::KinDynComputations** that

```
ModelLoader mdlLoader;

std::vector<std::string> joints; // specify the used joints
joints.push_back("torso_pitch");
...
joints.push_back("r_wrist_pitch");

mdlLoader.loadReducedModelFromFile("./model.urdf", joints);

Model model = mdlLoader.model();

KinDynComputations kinDynComp;
kinDynComp.loadRobotModel(mdlLoader.model());

// You can now use the kinDynComp object to compute terms
// of the dynamics equations, transformation between
// frames, jacobians
```

Caveat on iDynTree <--> YARP integration

- Conversion utilities between **YARP** and **iDynTree** are available in the `<iDynTree/yarp/YARPConversions.h>` header.

- **iDynTree** uses *radians* for all its interfaces, **YARP** typically uses *degrees*.

- **iDynTree** assume in input and in output always *floating base quantities*, you will need to do to the appropriate conversions if you want to use them for **fixed base robots** control.

- See the **impedance_control-tutorial** for more on this!

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Joint Level Motor Control

(for whole-body dynamic control)

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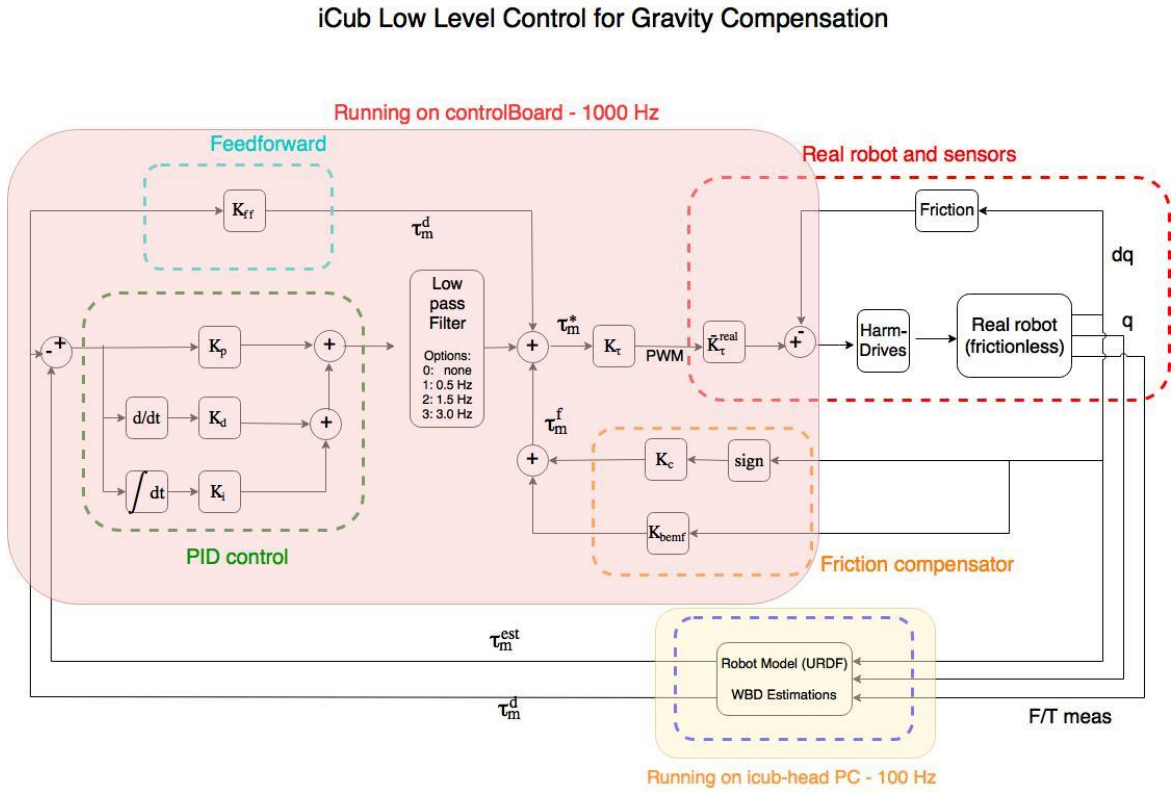
Torque Control (iCub, Feb 2018)

τ_d

Command
from YARP

τ_m

Feedback to YARP

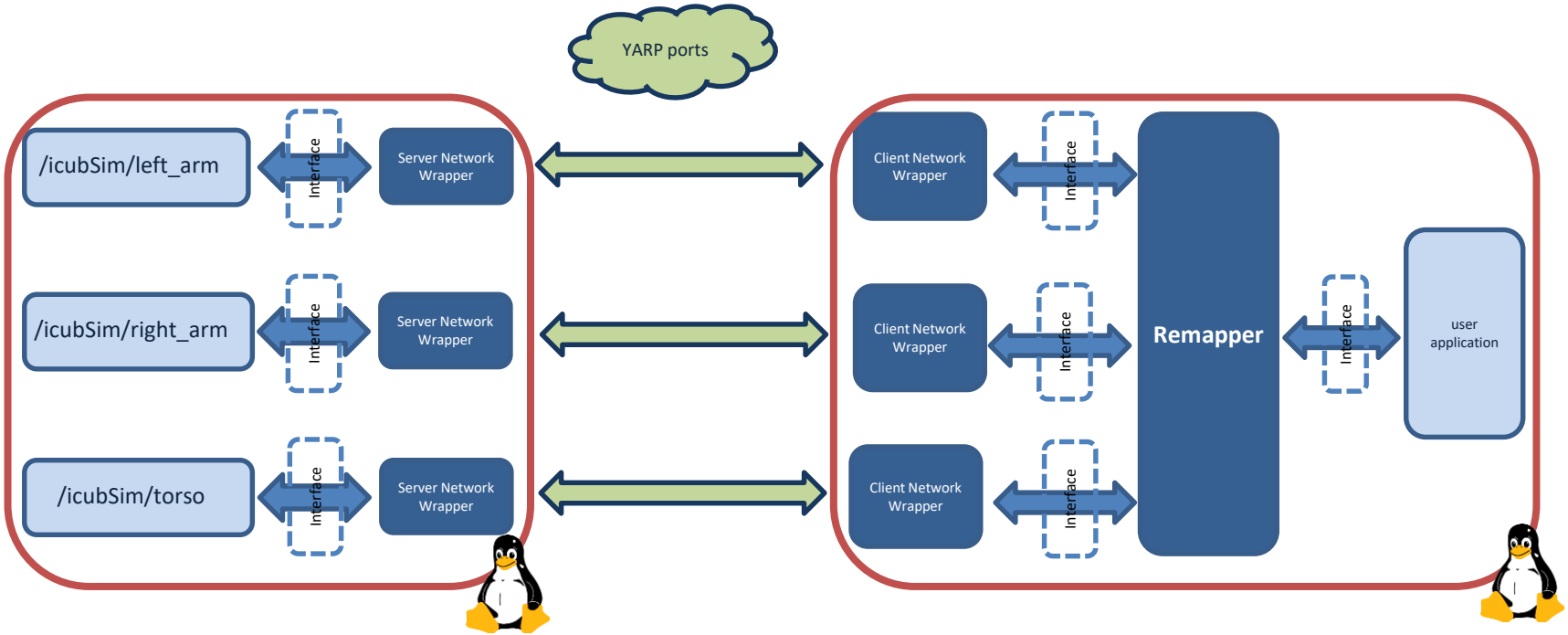


Interface: ITorqueControl

Like IPositionControl2 and IVelocityControl2, but for torque control

```
ITorqueControl::getAxes() = 0;
ITorqueControl::setRefTorque(…) = 0;
ITorqueControl::getTorque(…) = 0;
```

Whole-body hardware abstraction



The remapper only exposes the joint required by the user application.
Similar concept in `ros_control` : **CombinedRobotHW**

Getting Interfaces only for the desired joints

The device that combines multiple "remote_controlboard" devices by specifying the desired joints is "remotecontrolboardremapper"

Required parameter to configure it are:

- List of remote port prefixes: remoteControlBoards
- Local port name: localPortPrefix
- Ordered list of desired joints: axesNames

```
PolyDriver poly;
Property config;

config.put("device", "remotecontrolboardremapper");
config.put("localPortPrefix", "/<myApplication>");

Bottle boards;
Bottle & boardsList = boards.addList();
boards.addString("/icubSim/torso");
boards.addString("/icubSim/left_arm");
boards.addString("/icubSim/right_arm");
options.put("remoteControlBoards", boards.get(0));

Bottle joints;
Bottle & jointsList = joints.addList();
joints.addString("torso_pitch");
...
joints.addString("r_wrist_yaw");
options.put("axesNames", joints.get(0));

...

poly.open(config);
```

```
ITorqueControl *trqControl = NULL;
poly.view(trqControl);                  // Get the interface


int joints;
trqControl->getAxes(&joints);           // Get number of joints

yarp::sig::vector desTorques(joints, 0.0);
trqControl->setRefTorques(desTorques.data()); // Set a desired torques setpoint

yarp::sig::vector measTorques(joints, 0.0);
trqControl->getTorques(measTorques.data());   // Get the measured (or estimated) torques
```