ISTITUTO ITALIANO DI TECNOLOGIA
HUMANOIDS AND HUMAN CENTERED MECHATRONICS

Università di Genova

IN SUPREMÆ DIGNITATIS 1343
UNIVERSITÀ DI PISA

ROSin

Exploiting ROS2 to facilitate end-effectors integration and control

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RATIONALE

- High Number of different End-Effectors
- Large variety of structures (kinematic, actuators, interfaces)
- Complex integration

RATIONALE

- High Number of different End-Effectors

Develop a framework aimed to abstract each end-effector from its mechanical instructions and plan at higher level

- Complex integration

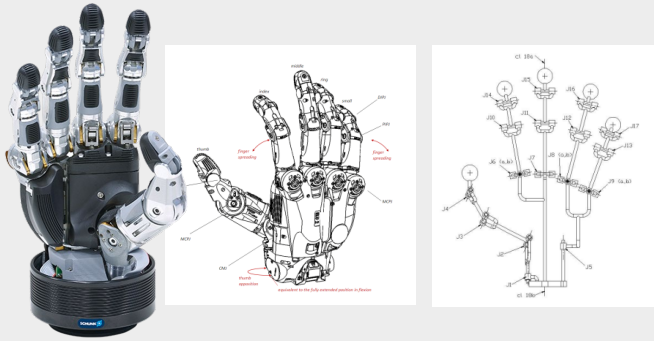
ROS END-EFFECTOR

- ROS-based hardware-agnostic control framework

ROS ROS 2

- Simplify integration of new End-Effectors
(few model description information required)

URDF
SRDF



- Automatic extraction of End-Effector capabilities
(Primitive Grasping Actions)

FRAMEWORK

EXTRACTION PHASE

OFFLINE

EXECUTION PHASE

ONLINE

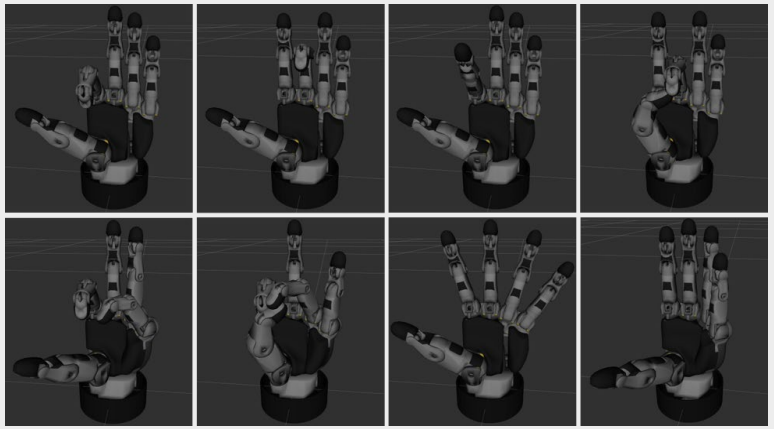
FRAMEWORK

URDF
SRDF

OFFLINE

FRAMEWORK

URDF
SRDF

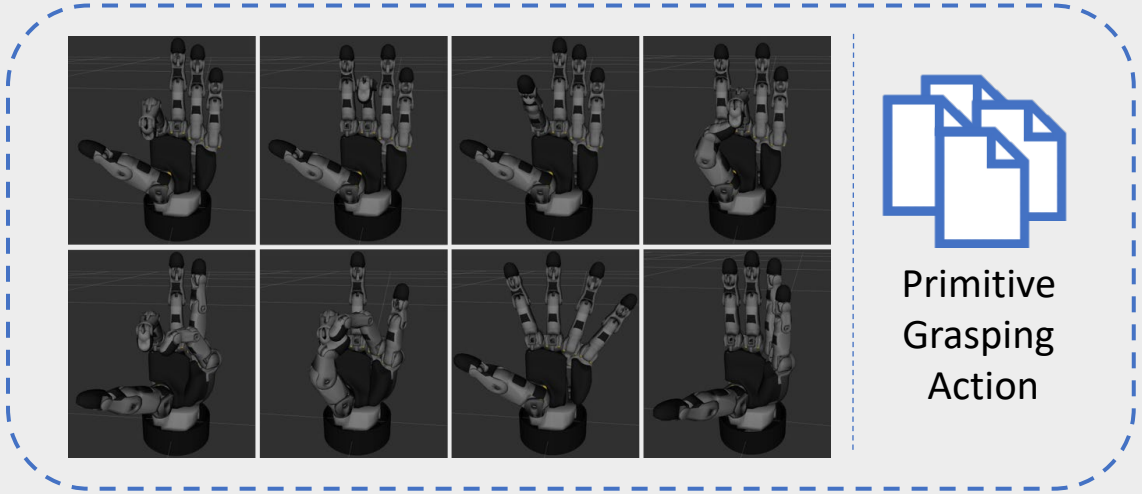


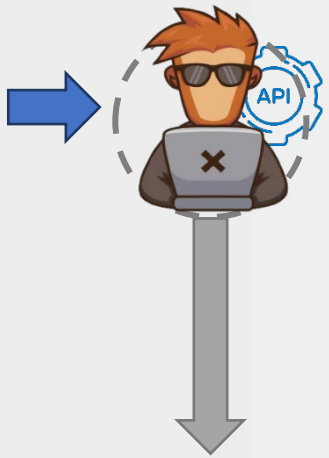
Primitive
Grasping
Action

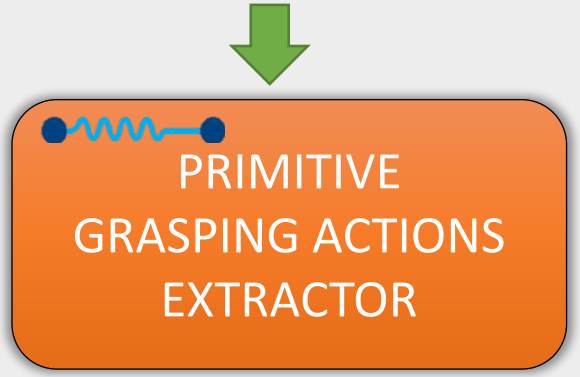
PRIMITIVE
GRASPING ACTIONS
EXTRACTOR

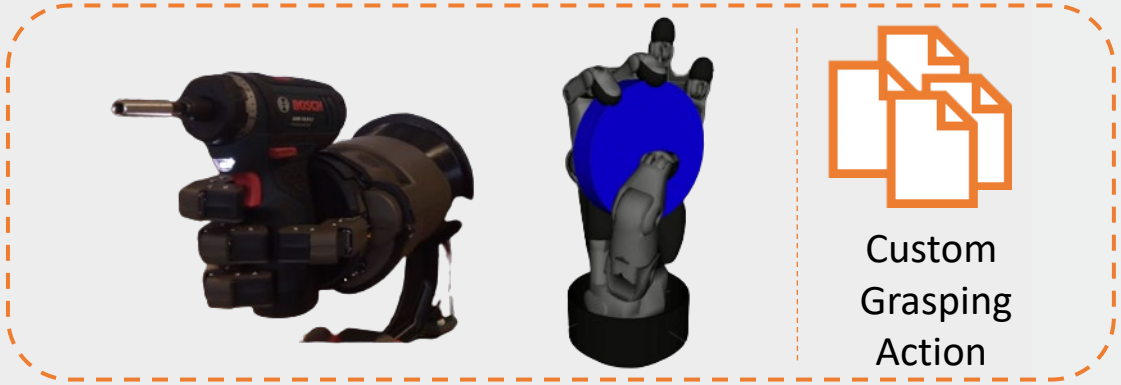
OFFLINE

FRAMEWORK



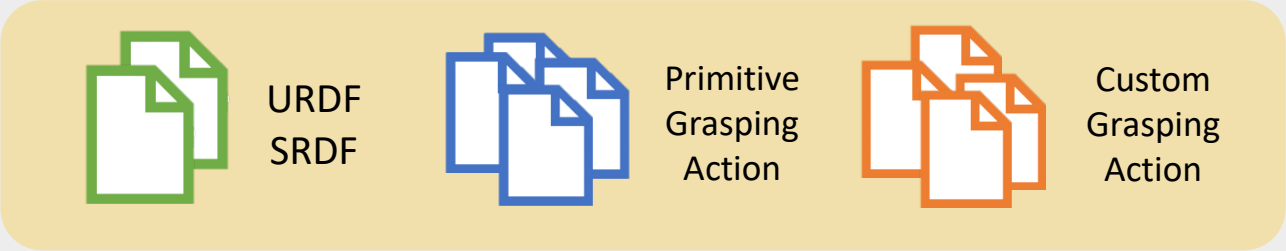




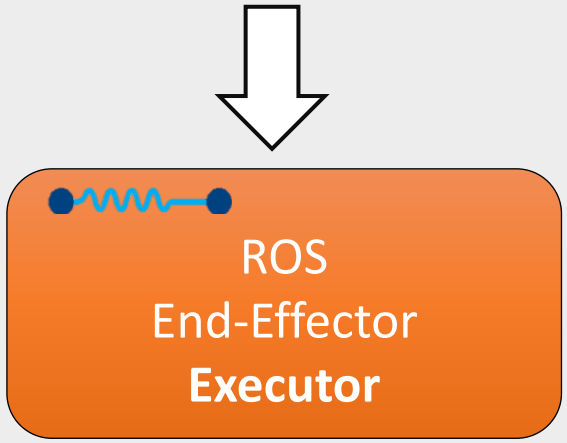


OFFLINE

FRAMEWORK

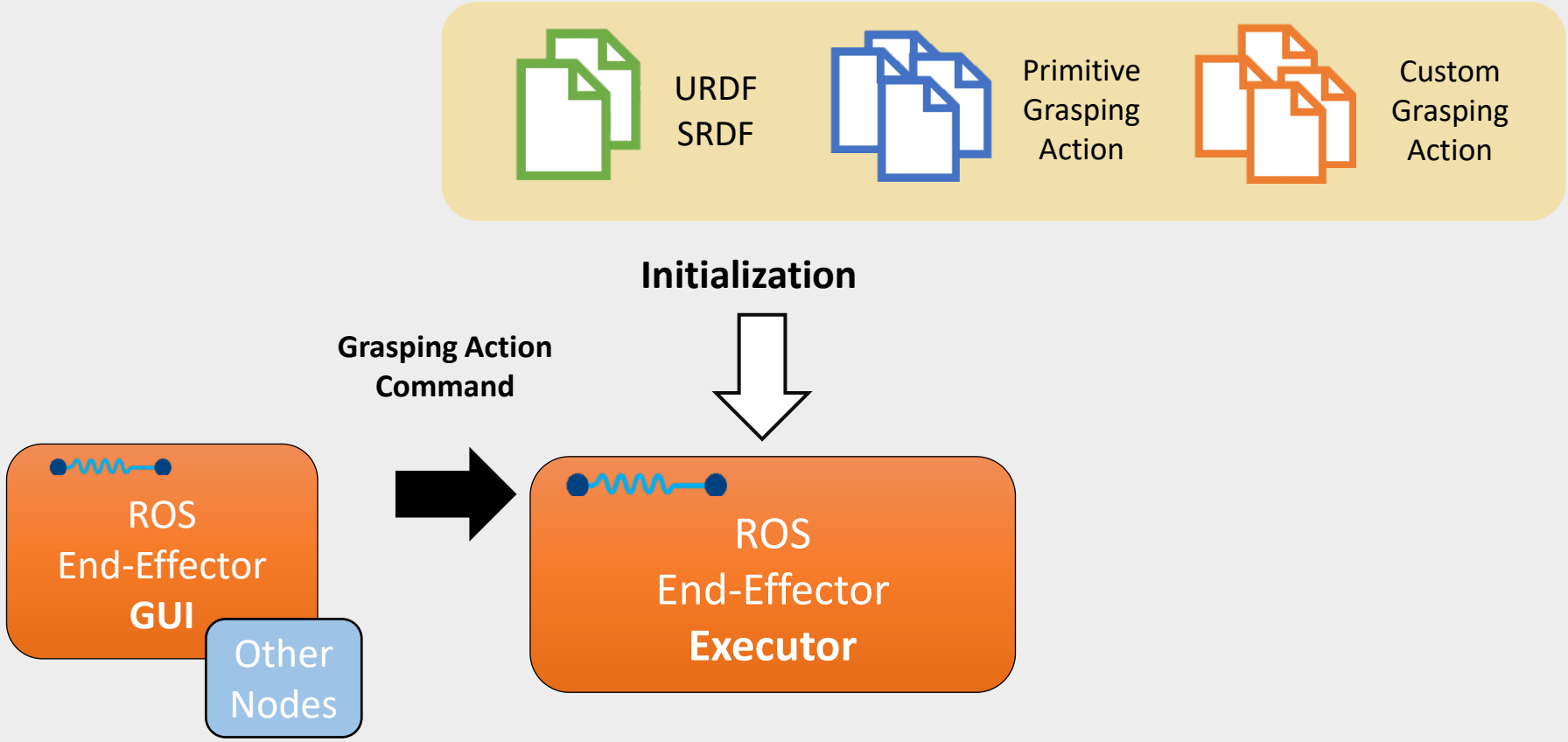


Initialization



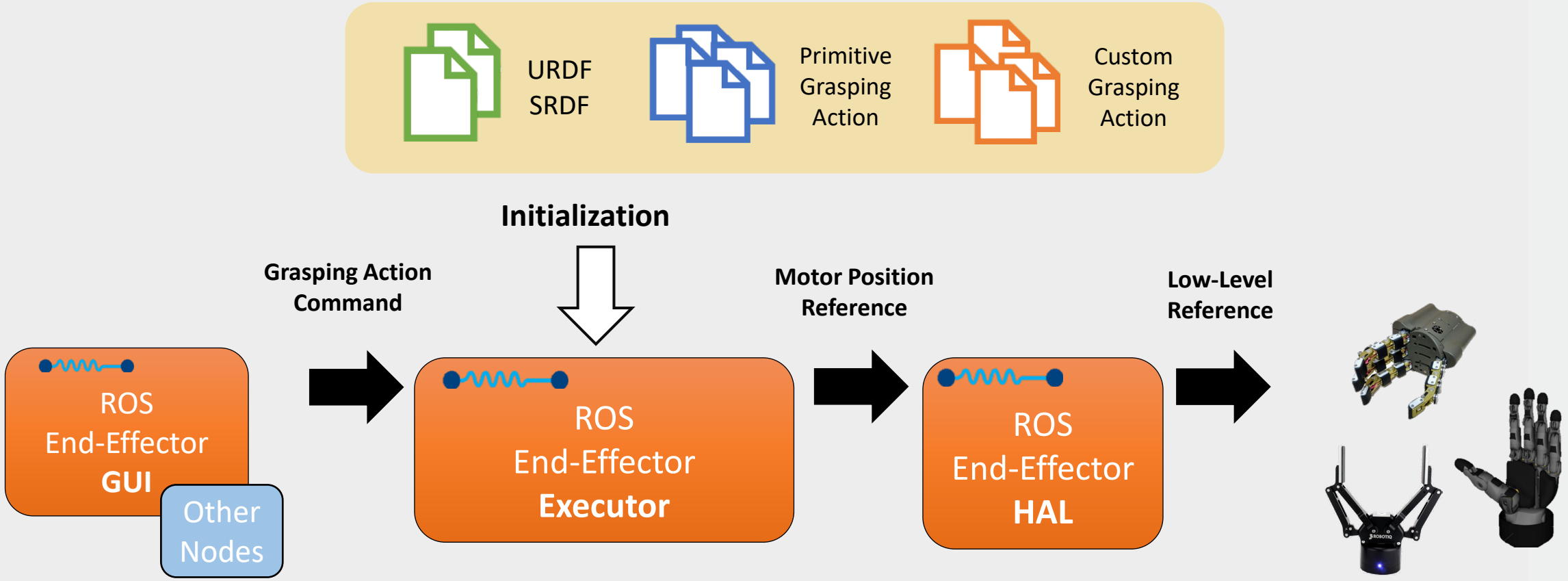
ONLINE

FRAMEWORK



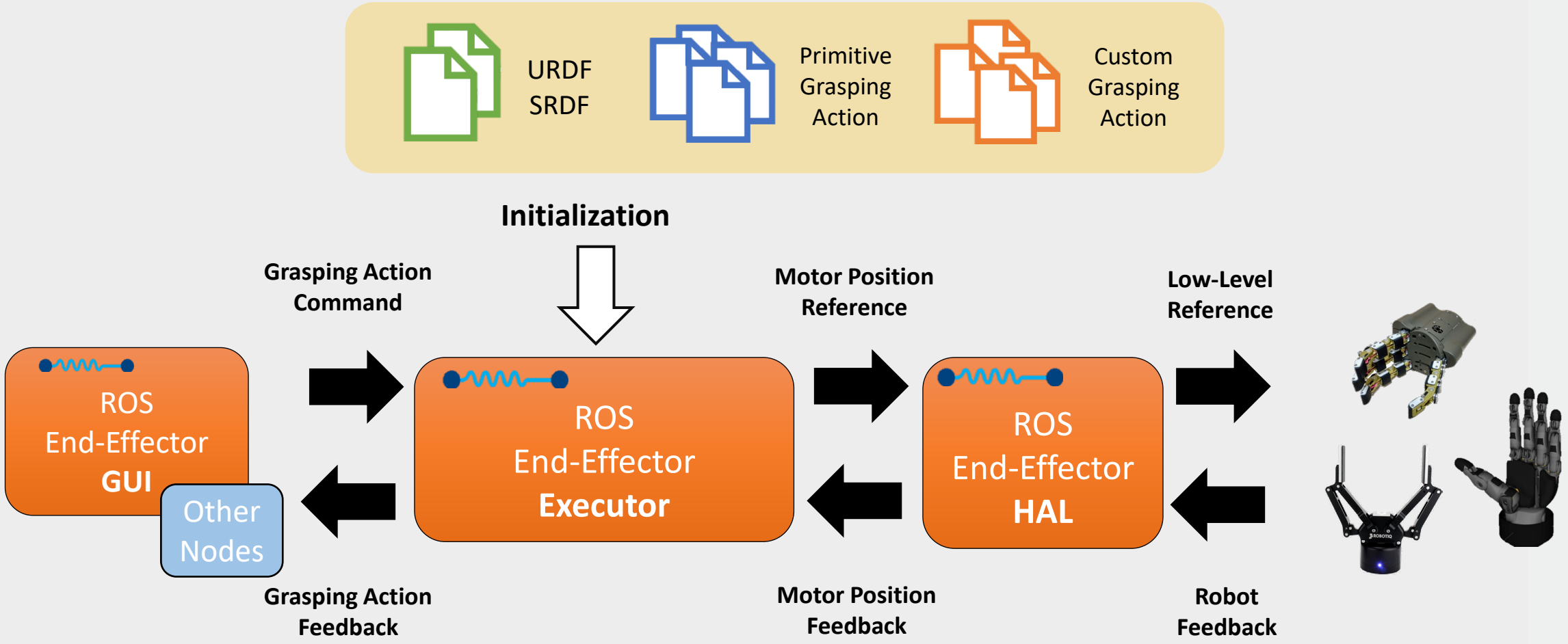
ONLINE

FRAMEWORK



ONLINE

FRAMEWORK



ONLINE

ROS 2 INTEGRATION

ROS → ROS 2

ROS 2 INTEGRATION

ROS → ROS 2

Topics, Services, Actions

<xml /> Launch Files <xml />

catkin → colcon ament

ROS 2 INTEGRATION

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Parameter Server → ✗

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Topics, Services, Actions

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Parameter Server →

MoveIt Collisions (FCL) → MoveIt2 Collisions (FCL)

ROS 2 INTEGRATION

ROS → ROS 2

Topics, Services, Actions

<xml /> Launch Files <xml />

catkin → colcon ament

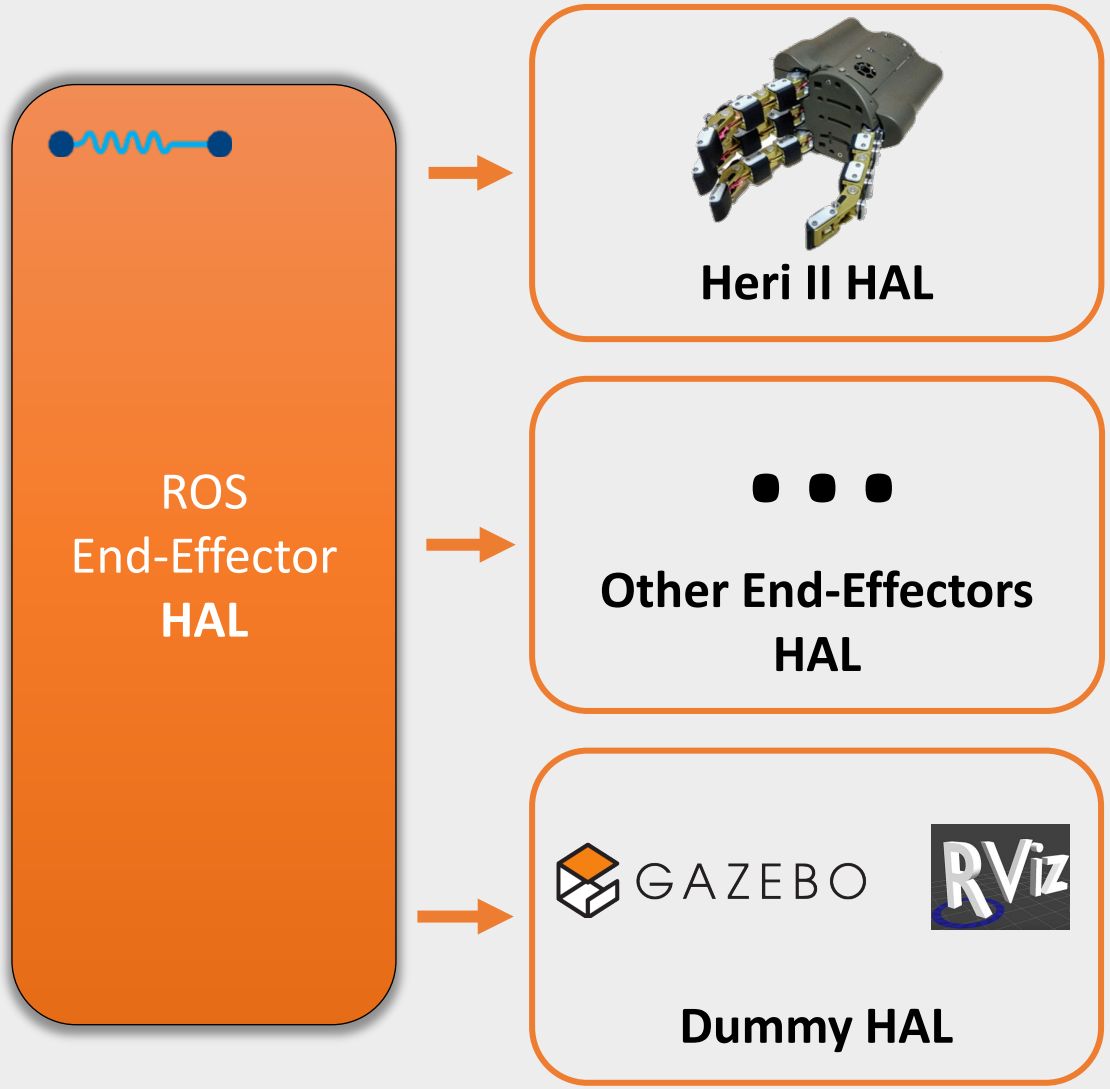
Parameter Server → ✗

MoveIt
Collisions (FCL) → MoveIt2
Collisions (FCL)

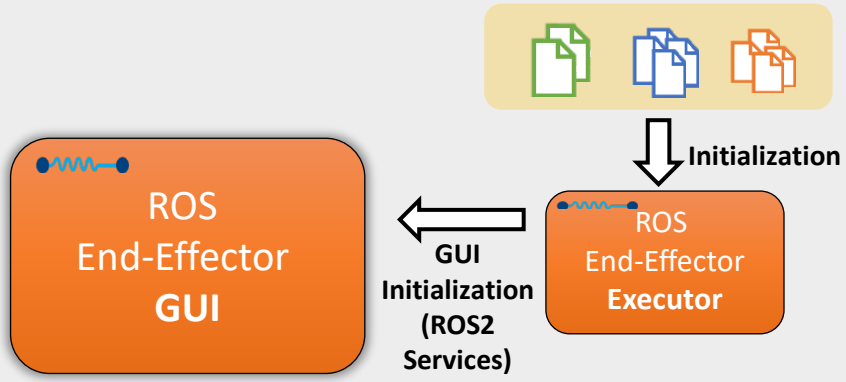
Standard C methods (dlopen)
For HAL dynamic loading → ROS2 PluginLib
For HAL dynamic loading

HAL

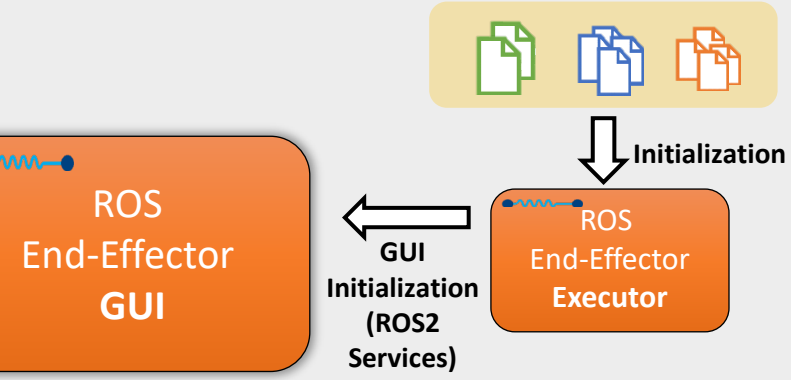
The ROS End-Effector HAL abstracts the low-level details of the end-effector



GUI


Initialization
ROS
End-Effector
Executor
GUI
Initialization
(ROS2
Services)
ROS
End-Effector
GUI

GUI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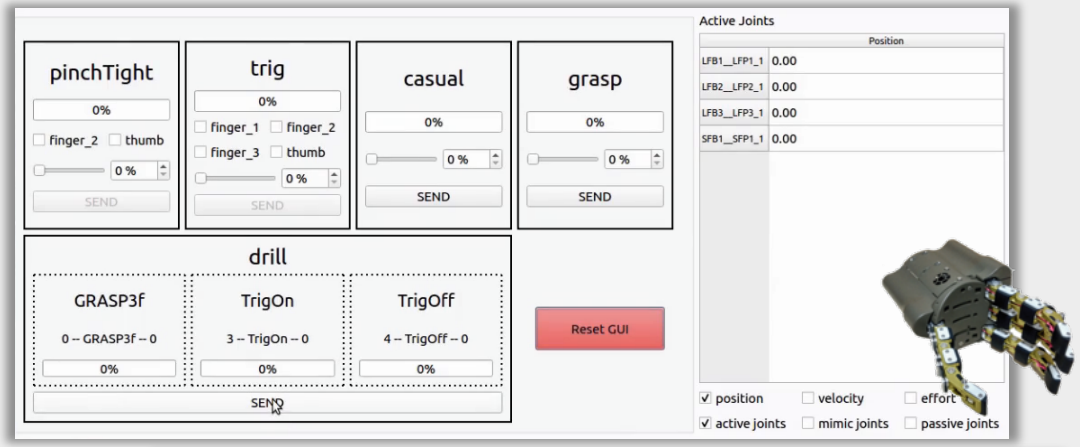
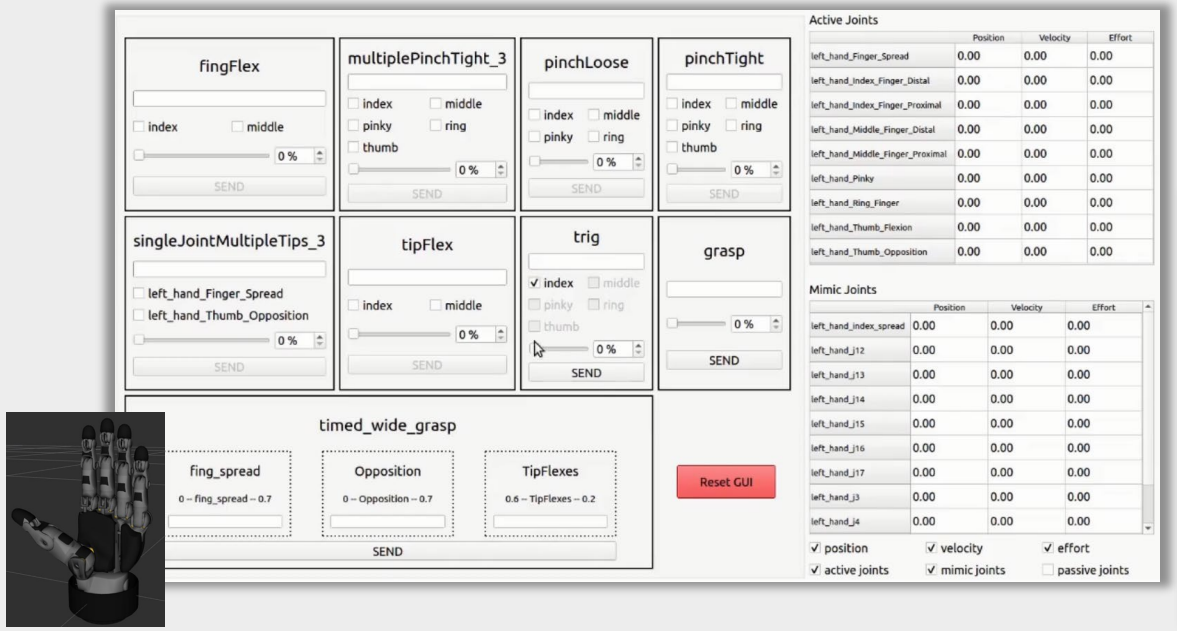
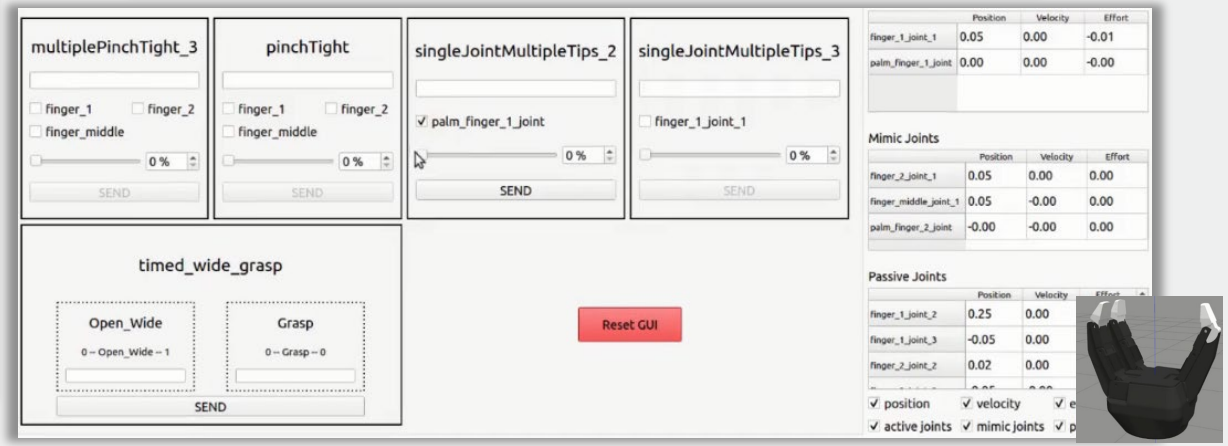

pinchTight
trig
casual
grasp
drill
GRASP3f
TrigOn
TrigOff
Reset GUI
Active Joints
position
velocity
effort
active joints
mimic joints
passive joints


pinchTight
singleJointMultipleTips_2
Reset GUI
Active Joints
Mimic Joints
position
velocity
effort
active joints
mimic joints
passive joints


fingFlex
multiplePinchTight_3
pinchLoose
pinchTight
singleJointMultipleTips_3
tipFlex
trig
grasp
timed_wide_grasp
fing_spread
Opposition
TipFlexes
Reset GUI
Active Joints
Mimic Joints
position
velocity
effort
active joints
mimic joints
passive joints


multiplePinchTight_3
pinchTight
singleJointMultipleTips_2
singleJointMultipleTips_3
timed_wide_grasp
Open_Wide
Grasp
Reset GUI
Mimic Joints
Passive Joints
position
velocity
active joints
mimic joints

DOCS & CODE

- ROS-Industrial Focused Technical Project (ROSIN-FTP)
  https://www.rosin-project.eu/ftp/ros-end-effector

- ROS End-Effector source code
  https://github.com/ADVRHumanoids/ROSEndEffector
  https://github.com/ADVRHumanoids/ROSEndEffector2

- ROS End-Effector documentation
  https://advrhumanoids.github.io/ROSEndEffectorDocs/

  Read the Docs

- Available in the ROS official repository :
  `ros-melodic-end-effector` `ros-noetic-end-effector` (ROS)
  `ros-foxy-end-effector` (ROS2)

PUBLICATIONS

- **D. Torielli**, **L. Bertoni**, N. Tsagarakis, and L. Muratore, "Towards an Open-Source Hardware Agnostic Framework for Robotic End-Effectors Control", *2021 20th International Conference on Advanced Robotics (ICAR)*, 2021, pp. 688-694, doi: 10.1109/ICAR53236.2021.9659331

- **L. Bertoni**, **D. Torielli**, Y. Zhang, N. Tsagarakis, and L. Muratore, "Towards a Generic Grasp Planning Pipeline using End-Effector Specific Primitive Grasping Actions", *2021 20th International Conference on Advanced Robotics (ICAR)*, 2021, pp. 722-729, doi: 10.1109/ICAR53236.2021.9659402

- **D. Torielli**, **L. Bertoni**, N. Tsagarakis, and L. Muratore, "ROS End-Effector: A Hardware-Agnostic Software and Control Framework for Robotic End-Effectors", *submitted for publication*

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THANK YOU FOR YOUR ATTENTION !

ANY QUESTIONS?

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