



# Pro and Cons of using ROS from laboratory to industry

ROS Industrial Conference 2019

10<sup>th</sup> December 2019, Stuttgart, Germany

ROBots 4 the Future  
of Aircraft Manufacturing

O. Stasse,

GEPETTO, LAAS/CNRS, Toulouse France



Costly, heavy, "car-factory"  
robots is not satisfying

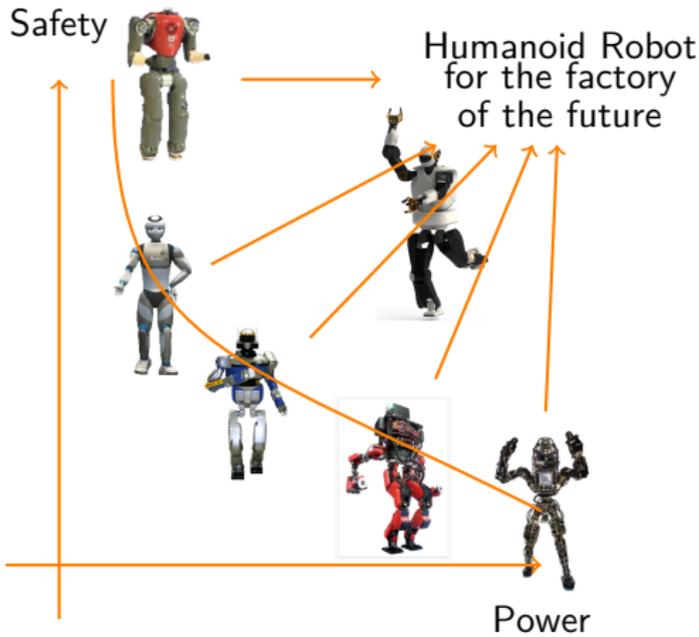
Competitiveness/versatility/avoid  
"Dull Dirty Dangerous Tasks"

Partial automation is desirable





125 millions of holes drilled by year  
75 % are done *manually*



Goal : Safety and Power

*Reactivity through planning and control*

125 millions of holes drilled by year

75 % are done *manually*

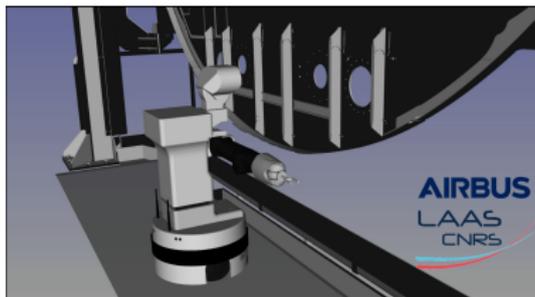
Provide lightweight, safe, mobile, versatile manufacturing cells

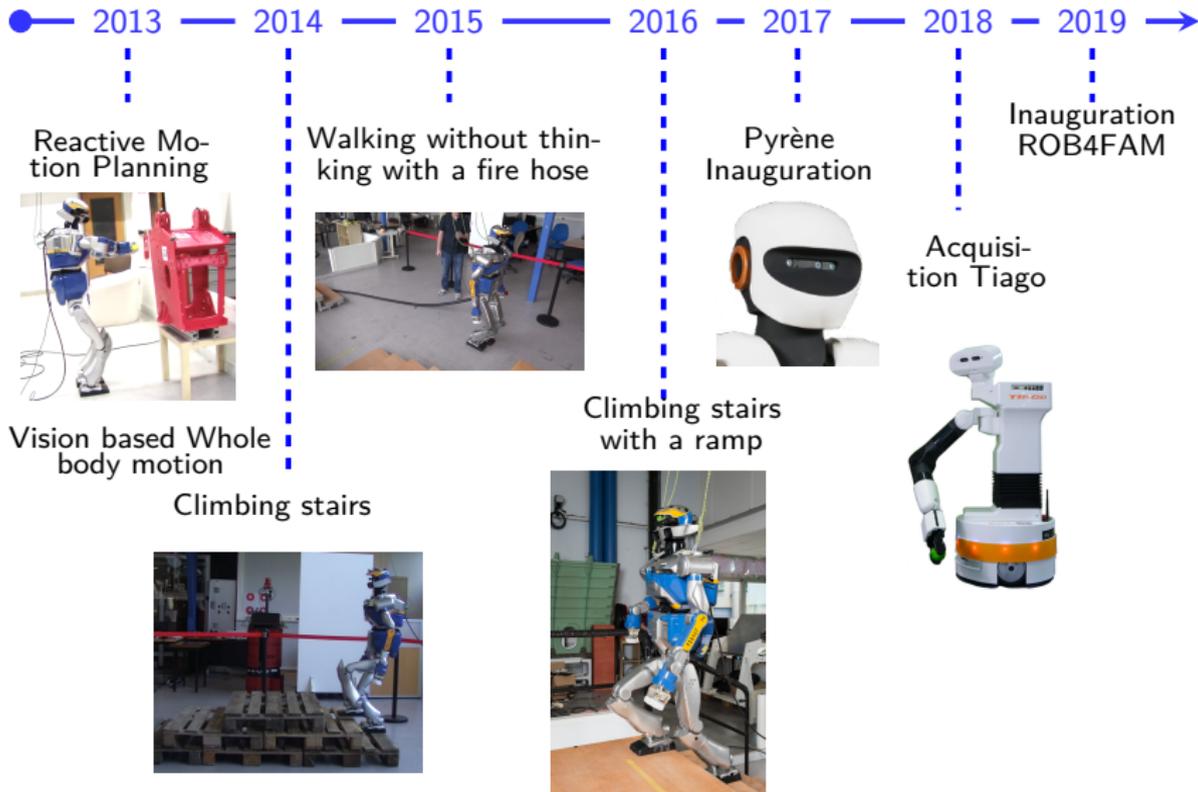


Humanoid robot as a scientific flagship



Applicative transfers through pragmatic proof of concepts





**Problem 1** : Variability according to the customers

**Problem 2** : Variability in the realization (humans)

**Problem 3** : Variability in the delivery

**Problem 4** : Collaboration with humans

**Problem 5** : Certification

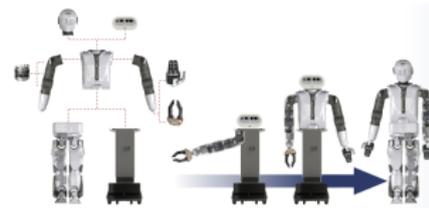


**Flexibility** : Not being trapped in a software architecture

**Open – Source** : All code-source BSDv2

**Composability** : Variability in the delivery

**Mechanical Modularity** : Decreasing the cost







**WP1** : Real-time/Interactive Planning

**WP2** : Torque control

**WP3** : SLAM

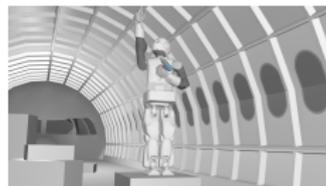
**WP4** : Balance

**Challenge 1** : Climbing stairs

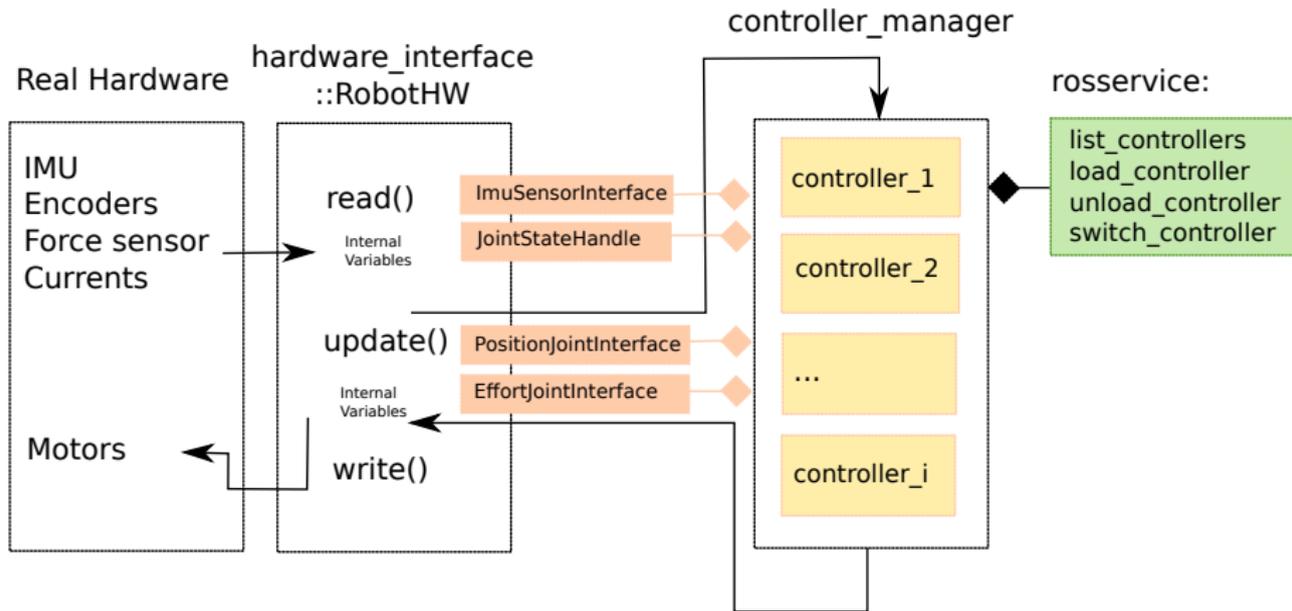
**Challenge 2** : Screwing

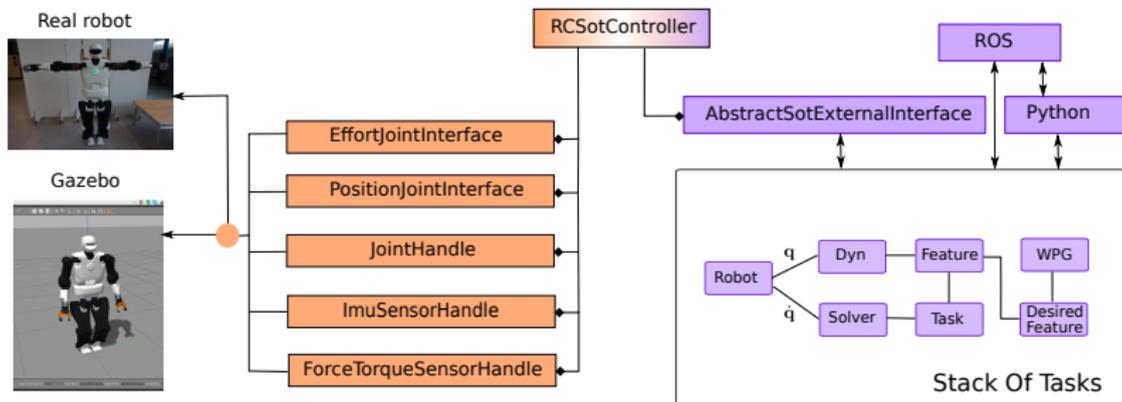
**Challenge 3** : Drilling

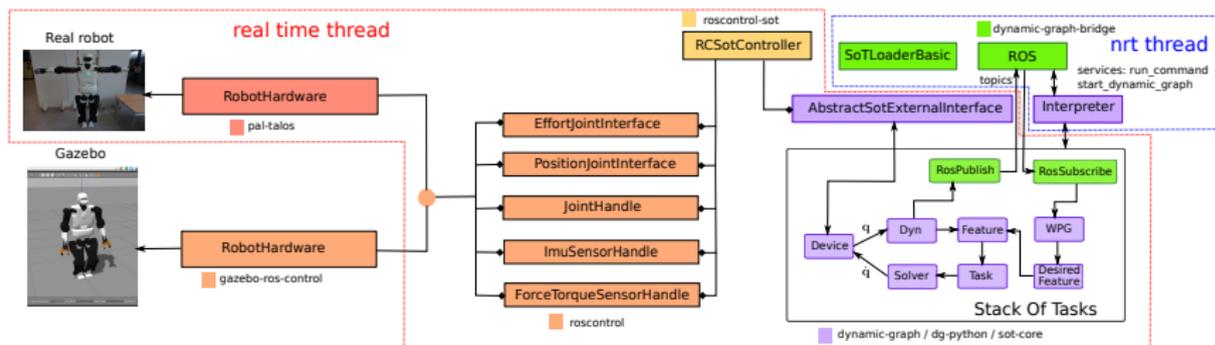
**Challenge 4** : Multicontacts



- roscontrol : A \*must\* have
- ROS-2 :
  - Not enough real-time : field bus from field bus jitter too important
  - Connection with industry standard :
    - Not favorable comparison with OPC UA [Profanter, ICIT, 2018]
    - Not favorable comparison with PLCOpen [Fischer, ITASE, 2019]
  - Yes but with ROS-2 we can use such middleware if needed.







- WP1 Path planning Coupling planning and control
  - sot-core
  - hpp
  - Agimus

Embedded in the robot : planning and control

- WP2 Torque control
  - Low level access checked
  - sot-torque-control
  - talos-torque-control
  - PAL torque control software layer

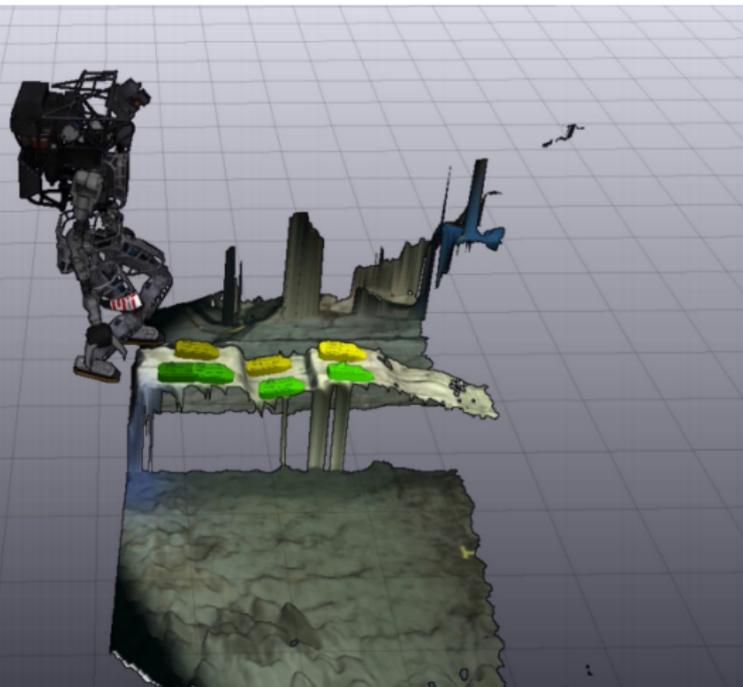


[ T. Flayols and al. ICHR, 2017]

[PAL Robotics - IROS 2018]

DDP on one actuator [Ramuzat, ECC2020 (Submitted)]

- WP3 SLAM Visp (IRISA)  
Auto-Tune ICP (Oxford)



[Fallon, ICHR, 2016]



- ROS control is nice !
- Tight integration between lab and industry is much easier with ROS
- ROS-2 and real time capabilities are very important.

Questions ?