

## ICAPS18 Tutorial

# Integrating Classical Planning and Mobile Service Robots using ROSPlan

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# About us

## Institute for Systems and Robotics (ISR-Lisbon)

<http://isr.tecnico.ulisboa.pt/>



- RD&I institution, affiliated to **Instituto Superior Técnico (IST)**, the engineering school of **University of Lisbon**
- Multidisciplinary advanced research on the areas of **Robotic Systems** and **Information Processing**
- **Research domains:** Systems and Control Theory, Robotics, Signal Processing, Computer Vision, Optimisation, AI and Intelligent Systems, Biomedical Engineering.



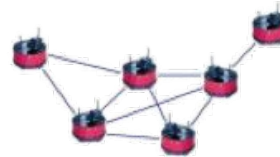


# About us

Institute for Systems and Robotics (ISR-Lisbon)  
<http://isr.tecnico.ulisboa.pt/>



**Intelligent Robots and Systems group**  
<https://irsgroup.isr.tecnico.ulisboa.pt/>



Holistic view of complex systems control and coordination,  
 following approaches that fuse  
 Systems, Control, and Decision Theories with  
 Artificial Intelligence.

# Part 1 - Introduction



# Big picture

```
(define (domain gpsr)

  (:requirements :typing :action-costs)

  (:types
   location ; service areas, points of interest, navigation goals
   object  ; objects to be manipulated by the robot
   person  ; a human being who needs to be conquered
   sentence ; a sentence to express world domination joy
  )

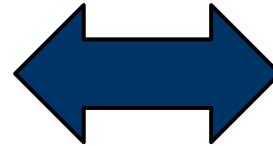
  (:predicates
   ; the robot is at location ?l
   (at_r ?l - location)

   ; person ?p is at location ?l
   (at_p ?p - person ?l - location)

   ; object ?obj is on location ?l
   (on ?obj - object ?l - location)

   ; the robot is holding object ?obj
   (holding ?obj - object)

  [ . . . ]
```





# Classical Planning

**Planning:** finding a sequence of actions to achieve the agent's goal

**Assumptions:**

- deterministic,
- fully observable, and
- static environment

**PDDL:** Planning Domain and Definition Language, defining

- initial and goal states as conjunctions of literals and
- actions in terms of their preconditions and effects



# Robotics

**Robot:** a physical agent situated in the physical world

- Sensors translate physical quantities into information
- Actuators translate information into physical effects

However, the **physical world** is (mostly)

- NOT deterministic
- NOT fully observable
- NOT static

**Problem statement: how to apply Classical Planning to Robotics?**



# Program

1. Introduction (15mins)
2. ROS essentials (30mins)
3. ROSPlan and PDDL planners (45mins)
4. Introduction to the robot skills (30 mins)
5. Hands-on session (1 hour)
6. Q&A and discussion (30 mins)