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DIPARTIMENTO DI

INGEGNERIA E SCIENZA DELL'INFORMAZIONE

Trustable autonomy for efficient and safe deliberation

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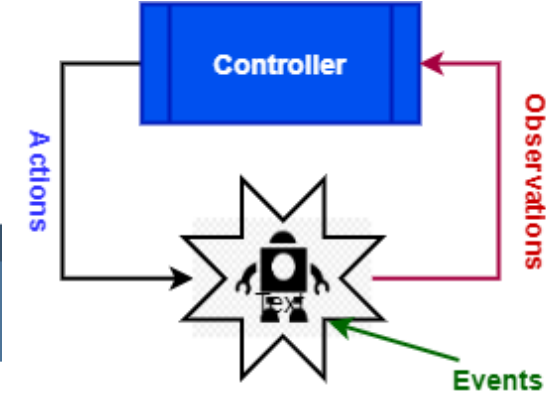
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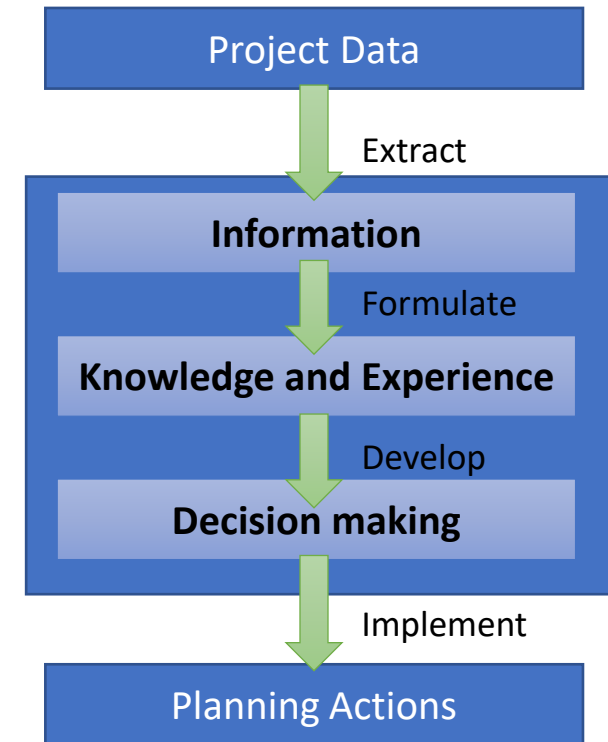


AI Planning and Scheduling

- At the core of **autonomous behavior** there is the "**decision-making and control**" problem i.e., the **selection of the next course of actions** or the **planning/automatic synthesis** of a course of actions to **achieve objectives**.
 - Specify a controller that will select the next action to execute
- Traditional solutions (hard-coded or rule-based) specify the controller in a pre-scripted form leveraging high-level programming languages.
 - The burden and hard work is in the programmer.
 - They are limited to the only pre-programmed solutions.
 - Cannot handle unforeseen cases.
- The objective of automated planning and scheduling is:
 - Find the best way to "constraint" in an intelligent way the search of the next actions to execute to achieve given goals.



Transform input in output



Transform data into actions to orchestrate over time

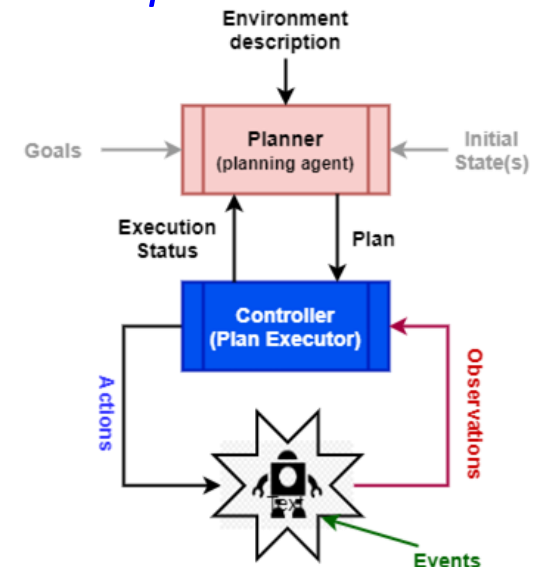
AI Planning and Scheduling in a nutshell



- “AI Planning (and Scheduling) is **the reasoning side** of acting (and executing). It is an explicit **deliberation process** that **chooses and organises** actions, on the basis of their **expected outcomes**, in order to **achieve some objective** as best as possible.”
- “...planning (and scheduling) is the **model-based** approach to **action selection...**” Geffner and Bonet
- “AI Planning (and scheduling) is **general problem solving**” Sievers et al., Newell et al.

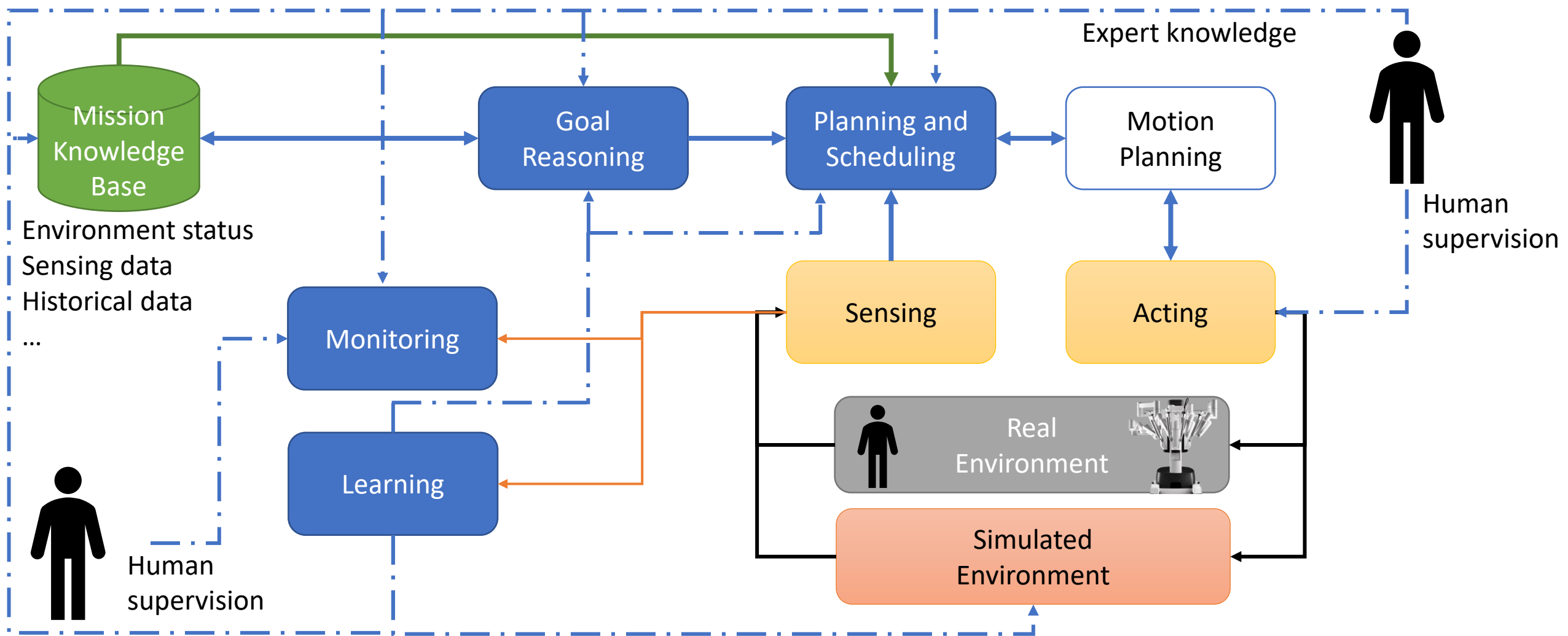
- In AI Planning and Scheduling for deliberations the agents have **access to world dynamic**
 - **actions** describe how the world changes
 - **sensor-model** describe how to update the knowledge of the world
 - **goals** denote what the agents wants
 - **states** capture evolving relevant conditions of the world the agents are operating in.

- A **Planner & Scheduler** is a *domain independent* program that can solve (find a *plan* for) **all** the planning problems starting from
 - an *environment* description (including action capabilities)
 - a *problem* description (initial state(s) and goal(s))





The Role of AI Planning and Scheduling in Autonomy for Robotics





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The ARI robot from PAL at MUSE in Trento

- We instantiated the architecture within the ARI robot (and others)
- We experimented it at our Department
- We also experimented at the MUSE in Trento

- Currently we are also integrating GenAI techniques for different purposes

- Can be deployed into different robotic platforms (ROS/ROS2 based)



**Robot ARI al
MUSE fuori orario**

