PLATINUm
A New Framework for Planning and Acting
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Context & Motivations
- Planning in real-world is challenging
  - Time, concurrency and uncertainty
  - Limited expressivity of classical planning
  - Timeline-based approach successfully applied in real-world scenarios
  - EUROPA [Barreiro et al. 2012], lxTeT [Laborie and Ghallab 1995], APSI-TRF [Cesta and Fratini 2008]
  - A recent uniform formalisms for planning with timelines under uncertainty [Cialdea et al. 2016]

Flexible Plan-based Control Architecture

The PLATINUm Framework
- Leverage a well-defined theoretical framework of planning with timelines under uncertainty
  - [Cialdea et al. 2016]
- Realize a uniform framework for planning and execution with timelines under uncertainty
  - Integrate search capabilities grounded on a hierarchical modeling approach
  - Synthesize pseudo-controllable plans for temporal uncertainty and controllability issues

A realistic Human-Robot Collaboration scenario
- A collaborative assembly process from a real-world application scenario
- A human operator and a robotic arm collaborate in order to execute collaborative production tasks
- Model the human operator as a completely uncontrollable element of the scenario
- Dynamically adapt the behavior of the robotic arm according to the behavior of the human operator

Pseudo-controllability Aware Planning
- Iteratively refines a plan by detecting and solving flaws
- Select flaws to solve by means of a hierarchy-based heuristics [Umbrico et al. Al*IA 2015]
- Generate pseudo-controllable plans by analyzing flexible durations of uncontrollable tasks
- Pseudo-controllable plans do not make hypothesis on the actual duration of uncontrollable tasks
- Pseudo-controllability is a necessary but not sufficient condition for dynamic controllability

Executing Timelines under Uncertainty
- Execute plans by dynamically adapting the behaviors of the timelines according to the observations received from the environment
  - Closed-loop control
  - Extract execution dependencies according to the relations of a plan
  - Manage execution transitions according to controllability properties

Future works
- Introduce flexible resource management and more informed heuristics
- Comparison with state of the art hybrid temporal planning systems
  - CHIMP [Stock et al. 2015], FAPE [Dvorak et al. 2014], MetaCSP [Mansouri et al. 2014]