# Multi-Tier Planning with $LTL_f$/$PLTL_f$ Goals

**Ramon Fraga Pereira**

Reasoning Agents – Final Project Proposal

Sapienza University of Rome
DIAG

April, 2021

# Introduction

- Main idea:
  - Extend recent work on *Multi-Tier Planning*[1] to cope with *temporally extended goals*[2] ($LTL_f$ and $PLTL_f$) goals;
  - Existing *Multi-Tier Planning* framework has only been tested with *conjunctive* goals;

---

[1] Ciolek et al., Multi-tier Automated Planning for Adaptive Behavior, ICAPS, 2020

[2] Fuggitti, FOND Planning for LTLf and PLTLf Goals, MSc Thesis, 2018.
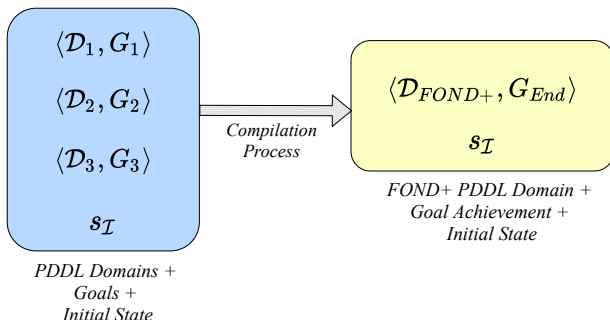
# LTL$_f$ and PLTL$_f$ Goals

- I will skip the explanation in this presentation.

# Multi-Tier Planning

- *Multi-Tier Planning* is a framework that allows the specification of different sets of domain models with different corresponding goals.

**Multi-Tier Planning Problem**                    **Dual FOND Planning Problem**



$\langle \mathcal{D}_1, G_1 \rangle$

$\langle \mathcal{D}_2, G_2 \rangle$

$\langle \mathcal{D}_3, G_3 \rangle$

$s_{\mathcal{I}}$

*PDDL Domains +*
*Goals +*
*Initial State*

*Compilation*
*Process*

$\langle \mathcal{D}_{FOND+}, G_{End} \rangle$

$s_{\mathcal{I}}$

*FOND+ PDDL Domain +*
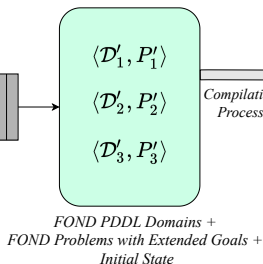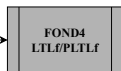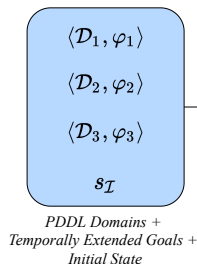*Goal Achievement +*
*Initial State*

- FOND-SAT[3] is the only planner that extracts Dual-FOND solutions.

[3] Geffner and Geffner, Compact Policies for Fully Observable Non-Deterministic Planning as SAT, ICAPS, 2018.
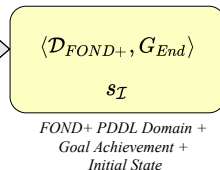
# Project Proposal Overview



**Multi-Tier Planning Problem**

**Dual FOND Planning Problem**

$\langle \mathcal{D}_1, \varphi_1 \rangle$

$\langle \mathcal{D}_2, \varphi_2 \rangle$

$\langle \mathcal{D}_3, \varphi_3 \rangle$

$s_{\mathcal{I}}$

*PDDL Domains +*
*Temporally Extended Goals +*
*Initial State*

**FOND4**
**LTLf/PLTLf**

$\langle \mathcal{D}'_1, P'_1 \rangle$

$\langle \mathcal{D}'_2, P'_2 \rangle$

$\langle \mathcal{D}'_3, P'_3 \rangle$

*FOND PDDL Domains +*
*FOND Problems with Extended Goals +*
*Initial State*

*Compilation*
*Process*

$\langle \mathcal{D}_{FOND+}, G_{End} \rangle$

$s_{\mathcal{I}}$

*FOND+ PDDL Domain +*
*Goal Achievement +*
*Initial State*

- **Use** FOND4LTL$_f$/PLTL$_f$[4] as part of the Multi-Tier *compilation process*;

- **Test the scalability** of FOND-SAT[5] with LTL$_f$ and PLTL$_f$ goals.

---

[4] http://fond4ltlfpltl.diag.uniroma1.it

[5] https://github.com/tomsons22/FOND-SAT

## References and Available Tools

- Ciolek et al., Multi-tier Automated Planning for Adaptive Behavior, ICAPS, 2020;

- Fuggitti, FOND Planning for LTLf and PLTLf Goals, MSc Thesis, 2018;

- FOND4LTL$_f$/PLTL$_f$:
    - http://fond4ltlfpltl.diag.uniroma1.it

- Multi-Tier Planning framework:
    - https://github.com/ssardina-planning/pypddl-translator

- FOND-SAT planner:
    - https://github.com/tomsons22/FOND-SAT

Thank you!