

PDSIM

Planning Domain Simulation



Sumário

- ✓ Quem é Emanuelle?
- ✓ Outros projetos de planejamento
- ✓ Projetos correlatos
- ✓ Funcionamento do PDSim
- ✓ Apresentação do PDSim

Emanuele De Pellegrin

Bacharel em Química pela Universidade La Sapienza de Roma

Mestrado em Inteligência Artificial pela Universidade Heriot-Watt

Doutorado em Robótica e Sistemas Autônomos do ECR



PhD Candidate in Robotics and Autonomous Systems at Edinburgh Centre for Robotics



De Pellegrin, Emanuele

para mim

qui., 27 de jun., 11:12 (há 4 días)



Hi Marjorie,

Thanks for the interest! 😊

Sure I can share with you a video about the workflow from defining a problem to animating a planning problem.

You can find the video here: https://drive.google.com/drive/folders/1_IMVPJe5Dy89hJeD5qLsMA3YOWw68atX

If you check the github for PDSim there is a wiki and explanation for all the animation nodes that have been implemented

The main project github: <https://github.com/Cryoscopic-E/PDSim>

The wiki: <https://github.com/Cryoscopic-E/PDSim/wiki>

Also bare in mind if you want to use external pddl files of using Unified Planning to develop your domain you need the PDSim backend: <https://github.com/Cryoscopic-E/PDSim-Backend>

I can share an example of the floor-tile domain (I presented this in the talk at ICAPS): <https://drive.google.com/file/d/1-Ef3WLR-gtrJqmceAOamw5sOM7kuoQLx/view?usp=sharing>

You just need to:

- Clone PDSim from github and open it as a project in Unity
- Unzip the file I shared and drag the folder in unity

If you open the floor tile scene you can see how all the components are set-up (mainly the objects and the fluents animations)

If you have any problem we can always have a chat on teams if you wish, but I'll be on holiday until end of July.



De Pellegrin, Emanuele

para mim

05:59 (há 13 horas)



Hi Marjorie,

Absolutely, I will produce a video for your class! 😊

I'll probably do it after I'm back from holiday at the end of July.

Just out of curiosity how many of you guys are interested in PDSim? I'm plan to run a user study with students that know planning and Unity if you have a group that is interested participating can you please let me know? 😊

All the Best,

Emanuele.

From: Marjorie Rodrigues <miamitzi12092004@gmail.com>

Sent: Friday, June 28, 2024 17:49

To: De Pellegrin, Emanuele <ed50@hw.ac.uk>

Subject: Re: I'm interested in your work about PDSim

Destaque do Ano



- **Prêmio de Menção Honrosa no ICAPS 2024**

Recentemente, anunciou que a demonstração de sistema, intitulada "Simulando o domínio de planejamento de robótica com PDSim e ROS (Robot Operating System)".

Conferência Internacional sobre Planejamento e Programação Automatizados (ICAPS), é o principal fórum para pesquisadores e profissionais em planejamento e programação. A demonstração mostrou a integração do PDSim com o ROS e como usá-lo como um gêmeo digital para problemas de planejamento de domínio de robótica do mundo real.

Prêmio de Menção Honrosa no ICAPS 2024

ICAPS 2024
Banff, Canada | icaps2024.com

34th International Conference on Automated Planning and Scheduling

**Best System Demonstration Award
Honorable Mention**

Presented to

Emanuele De Pellegrin, Ron Petrick

For their demonstration

Simulating Robotics Planning Domains with PDSim and ROS

June, 2024 — Banff, Alberta, Canada

Jiaoyang Li
Jiaoyang Li & Sarath Sreedharan, System Demonstrations Chairs

Emanuele De Pe... • 3º e +
PhD Candidate in Robotics an... ✓ Seguindo
2 d • 🌐

🌟 Exciting News! 🌟

I'm happy to announce that our system demonstration, titled "Simulating Robotics Planning Domain with PDSim and ROS," received an Honorable Mention Award at ICAPS 2024! 🎉

Our demonstration showcased the integration of PDSim with ROS, and how to use it as a digital twin for real-world robotics domain planning problems.

A huge thank you to the ICAPS community and the people voting for us!

[#ICAPS2024](#) [#Award](#) [#Innovation](#) [#Robotics](#)
[#AutomatedPlanning](#) [#Scheduling](#) [#TechAwards](#)

[Visualizar tradução](#)

👍❤️ 29 2 comentários

👍 Gostei 💬 Comentar ↻ Compartilhar 📧 Enviar

Projetos Correlatos



● ItSimple

● Jedai

● VIZ

● LPS

● GIPO

ItSimple



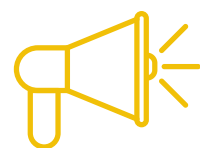
O que é?

É um projeto de pesquisa dedicado ao estudo de um processo de projeto para apoiar as fases de concepção de modelos de planejamento da vida real.



Por que?

PDDL é uma linguagem de entrada amplamente utilizada na comunidade de pesquisa de planejamento de IA. Entretanto, não é intuitivo para especialistas que não são de planejamento ou especialistas de domínio formular problemas



Como?

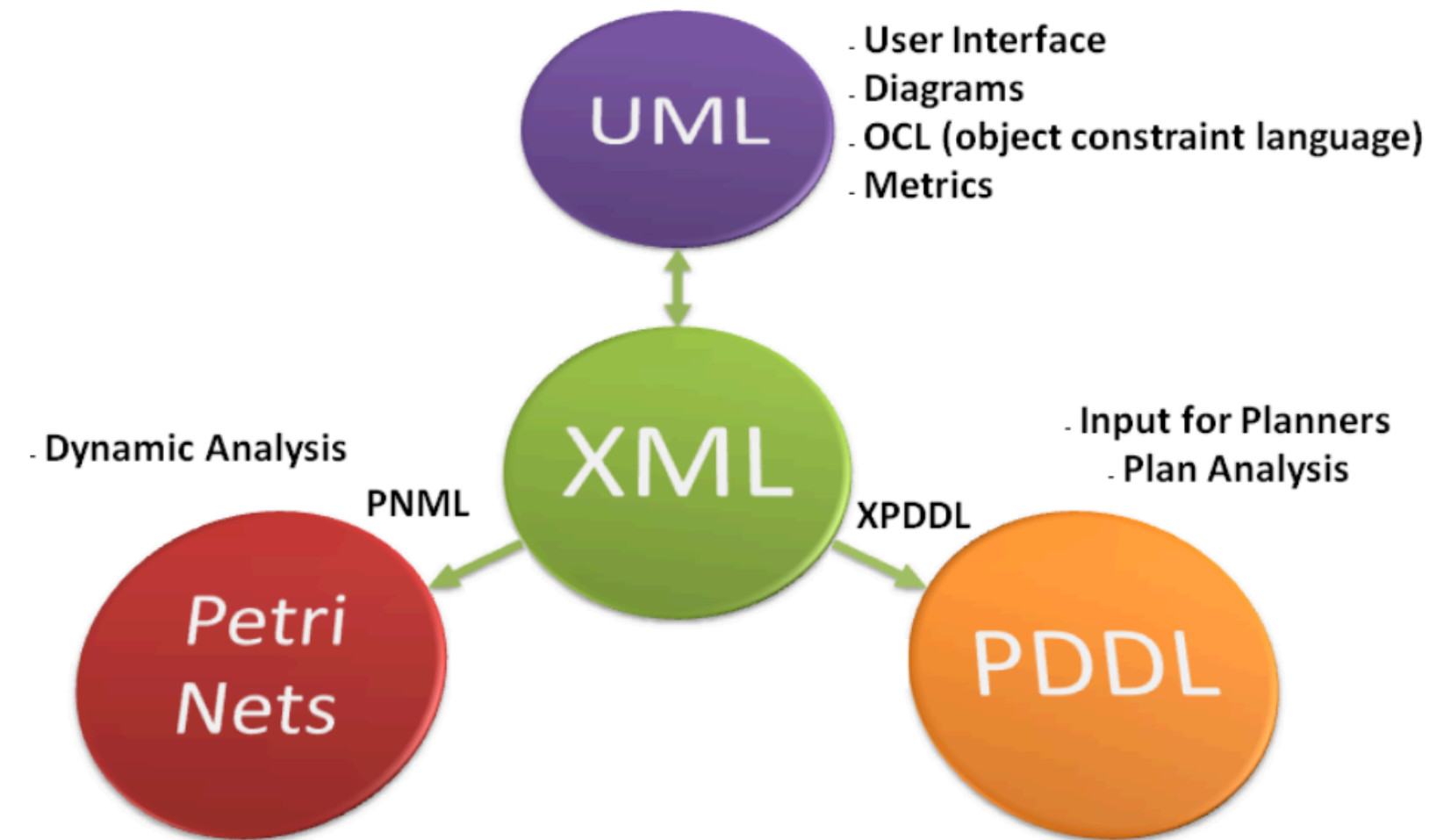
traduz todo o modelo descrito em UML para uma representação PDDL pronta para o solucionador. Os planos de diferentes planejadores podem então ser simulados e avaliados usando ferramentas de validação. A estrutura e os tradutores do itSIMPLE reduzem a lacuna entre os aplicativos de planejamento reais, que raramente são representados diretamente no PDDL, e os planejadores de IA de última geração



ItSimple

UML	PDDL
1)	(:types MyClass - object ...)
2)	(:types Class0 - MyClass Class1 - MyClass MyClass - object ...)
3)	(:predicates (attr ?cla - Class0))
4)	(:functions (attr ?cla - Class0))
5)	(:predicates (attr ?cla0 - Class0 ?cla1 - Class1)) OR (:functions (attr ?cla0 - Class0 - Class1))
6)	(:predicates (attr ?p0 - ClassP0 ... ?pn - ClassPN))
7)	(:predicates (role ?cla0 - Class0 ?cla1 - Class1))
8)	(:predicates (role1 ?cla0 - Class0 ?cla1 - Class1) (role0 ?cla1 - Class1 ?cla0 - Class0))
9)	(:action act (:parameters ?p0 - Class0 ?p1 - Class1 ... ?pn - ClassN) (:precondition ...) (:effect ...)

OCL Expression	PDDL
p0 = p1 where: p0 and p1 are parameters of the operator. The case $p0 \triangleleft p1$ is identical to $\text{not}(p0 = p1)$.	(= ?p0 ?p1)
p0.attr = true where: p0 is a parameter of the operator and attr is an attribute of p0 that has a Boolean type.	(attr ?p0) A false value would be represented as: (not(attr ?p0))
p0.attr(ol,...,on) = true where: p0 is a parameter of the operator; attr is a parameterized attribute of p0 that is a Boolean type.	(attr ?p0 ?o1 ... ?on)
p0.role = p1 where: p0 and p1 are parameters of the operator; and role is a <i>rolename</i> , with multiplicity "1" or "0..1", for any association between two classes of p0 and p1. If " \triangleleft " is used instead of "=", the mapping is $\text{not}([\text{expression}])$.	(role ?p0 ?p1)
p0.role->exists(p p = p1) where: p0 and p1 are parameters of the operator; and role is a <i>rolename</i> , with multiplicity greater than 2 or "*", of any association between classes of p0 and p1. If " \triangleleft " is used instead of "=", the mapping is $\text{not}([\text{expression}])$.	(role ?p0 ?p1)
attr(ol,...,on) = true where: attr is a global Boolean parameterized attribute. If " \triangleleft " is used instead of "=", the mapping is $\text{not}([\text{expression}])$.	(attr ?o1 ... ?on)



Sistema para Planejamento de Robôs - Jedai



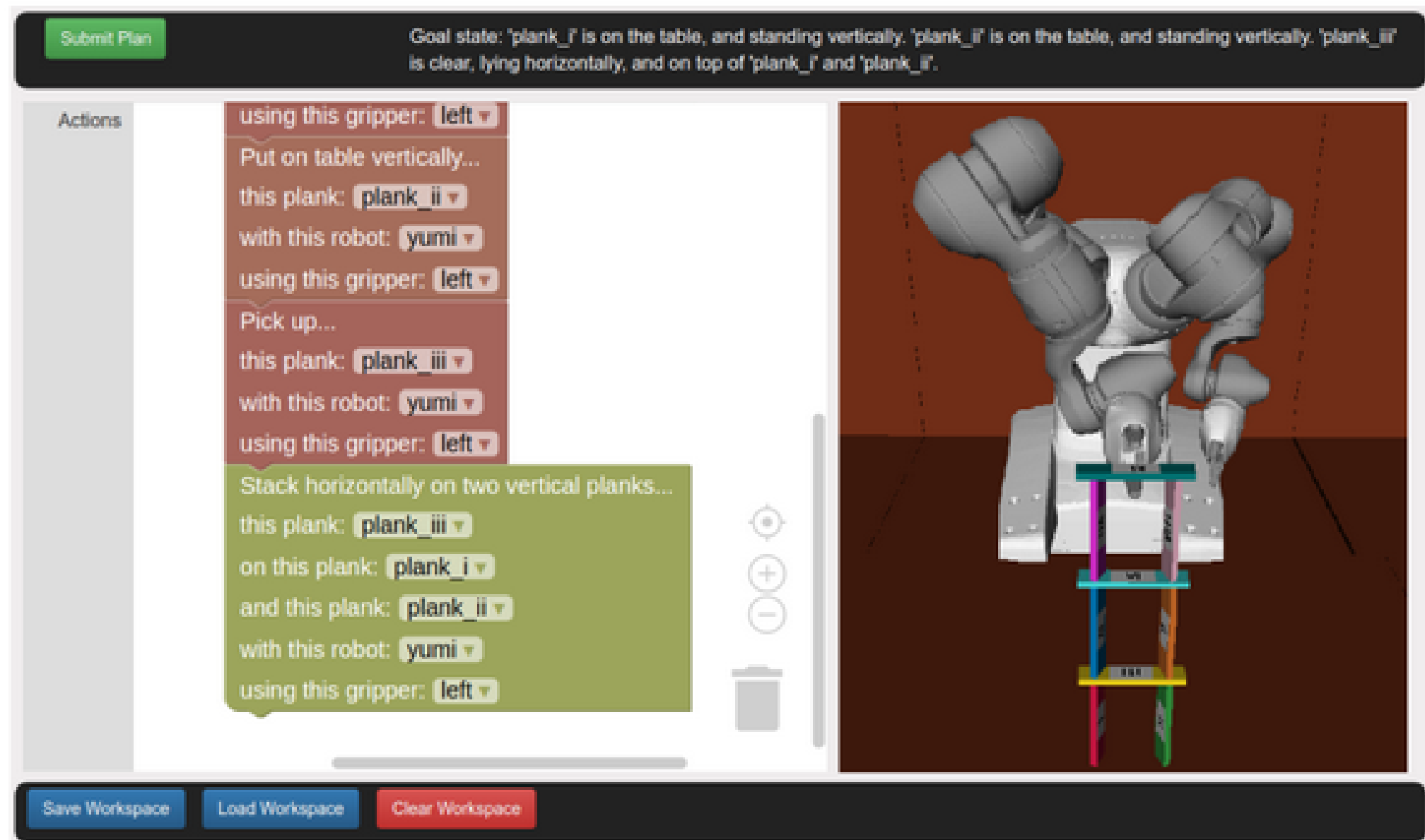
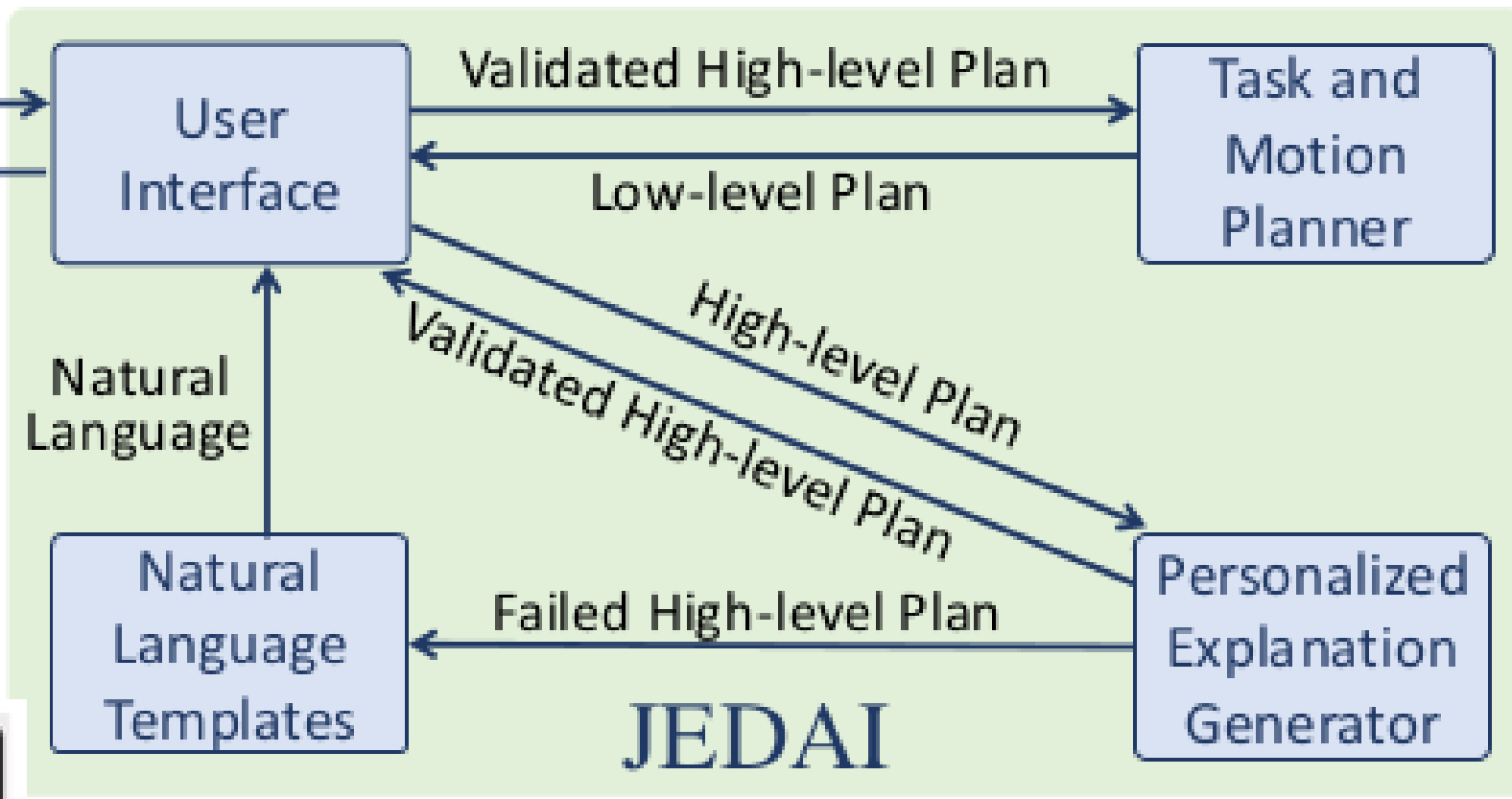
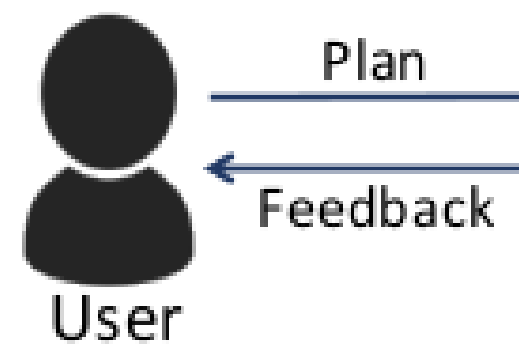
Fácil Uso por Conta
da Interface
Simples



Algoritmo de Erros
e Linguagem
Natural



- 1- Selecionar um domínio e uma tarefa associados
- 2- O usuário monta um plano a partir da programação em blocos.
- 3- O jedai valida esse plano, e se tiver algum erro o algoritmo identifica e o Jedai tradução a explicação para linguagem natural
- 4-Executar

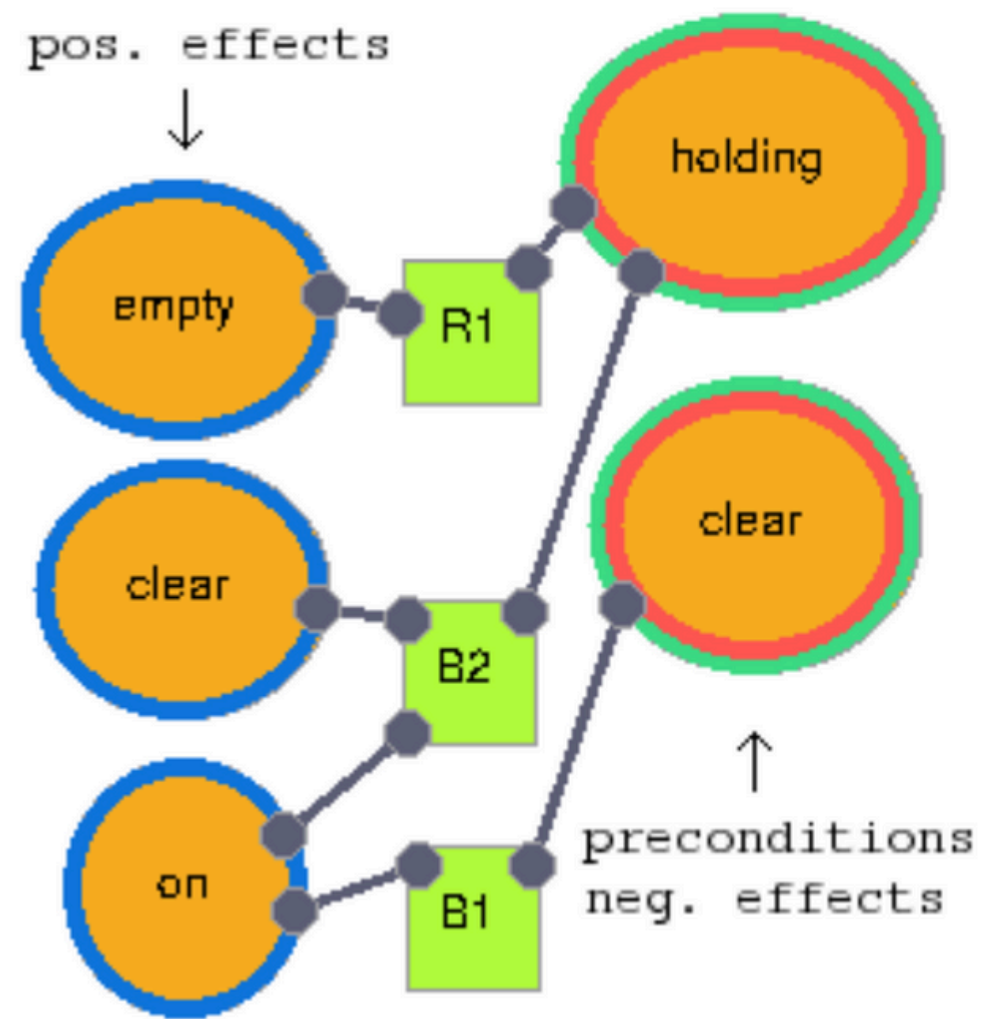


**Automated Task
Motion Planning
Markov Decision Processes**

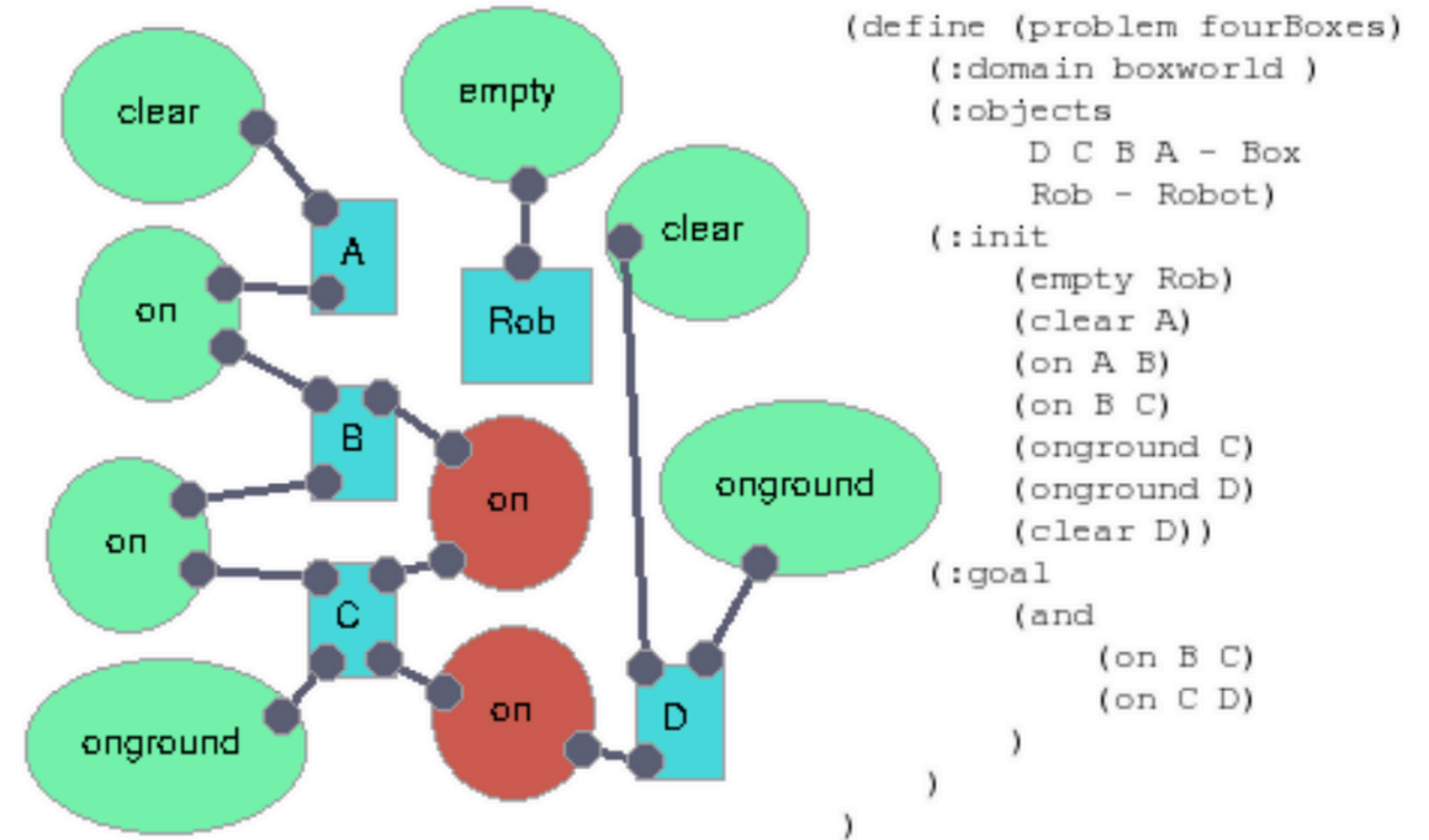
Visual Design of Planning Domains

- 📍 Um sistema leve que usa uma abordagem direta para modelar um domínio de planejamento.
- 📍 Fornece uma interface gráfica de usuário para descrição de domínios e problemas de planejamento.
- 📍 Os usuários não precisam estar familiarizados com a sintaxe PDDL.

Visual Design of Planning Domains



```
(:action stack
:parameters (
    ?B1 - Box
    ?B2 - Box
    ?R1 - Robot )
:precondition (and
    (holding ?R1 ?B2)
    (clear ?B1)
)
:effect (and
    (on ?B2 ?B1)
    (empty ?R1)
    (clear ?B2)
    (not (holding ?R1
        ?B2))
    (not (clear ?B1)))
)
```



Interface gráfica para planejamento com objetos - GIPO



O G.I.P.O incorpora a visão centrada em objetos, resultando em uma série de benefícios geralmente associados aos métodos orientados a objetos em outros campos da engenharia de software, como métodos de desenvolvimento altamente visuais, reutilização de código, e desenvolvimento eficiente e confiável



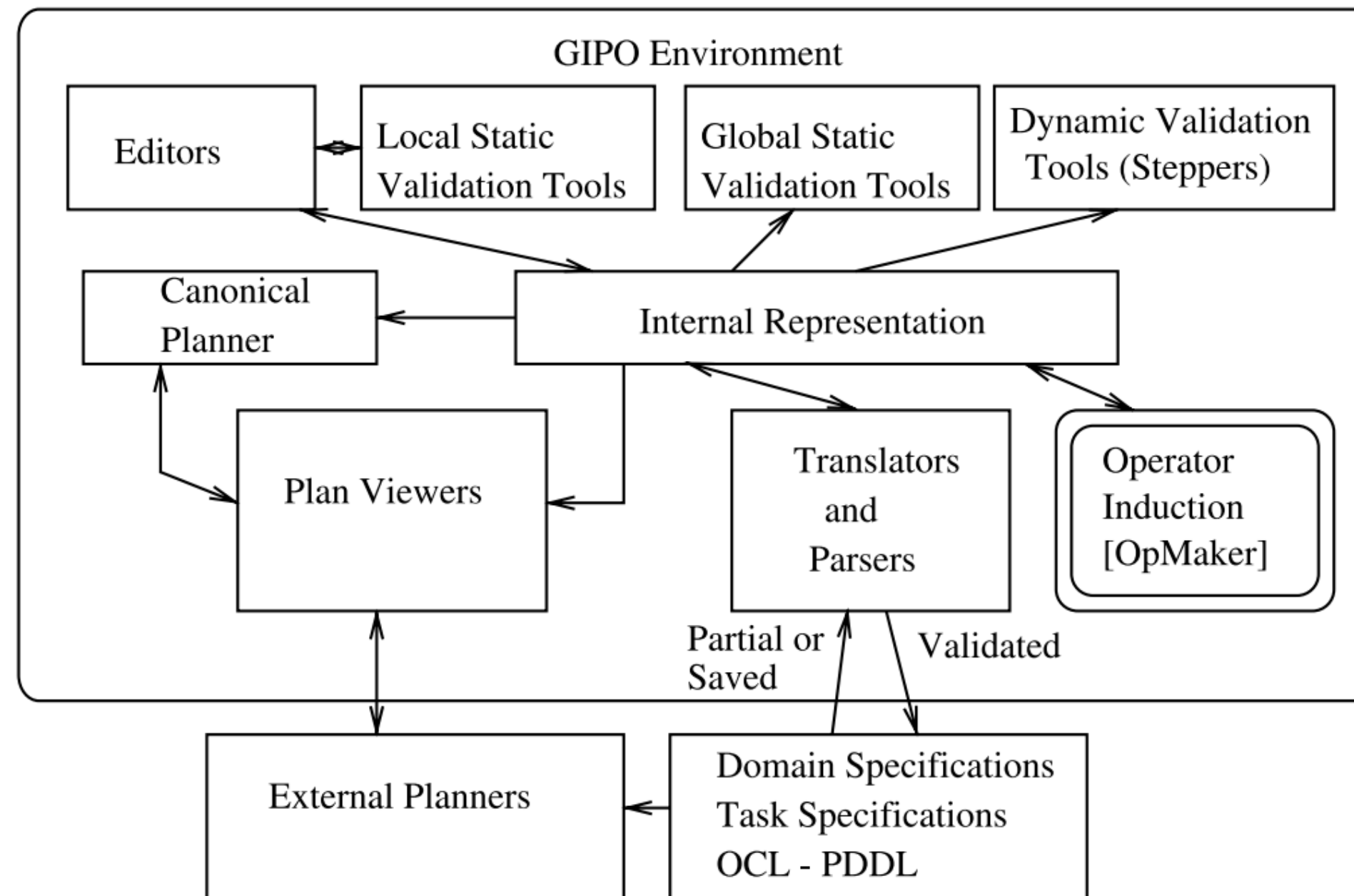
A experiência com o uso do GIPO no ensino indica que ele simplifica a tarefa de compreender a estrutura de domínios de planejamento existentes e a tarefa de criar e validar novas definições de domínio



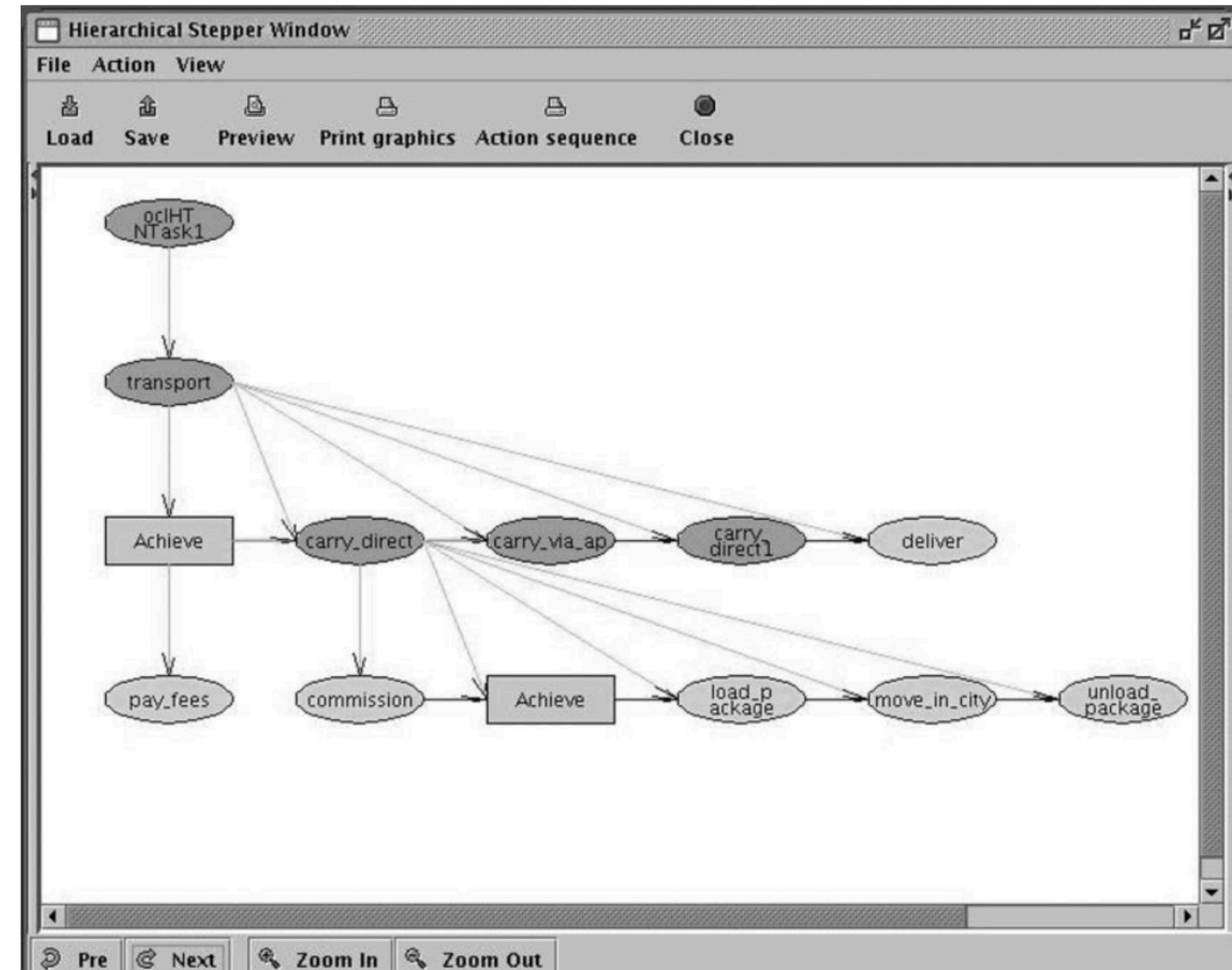
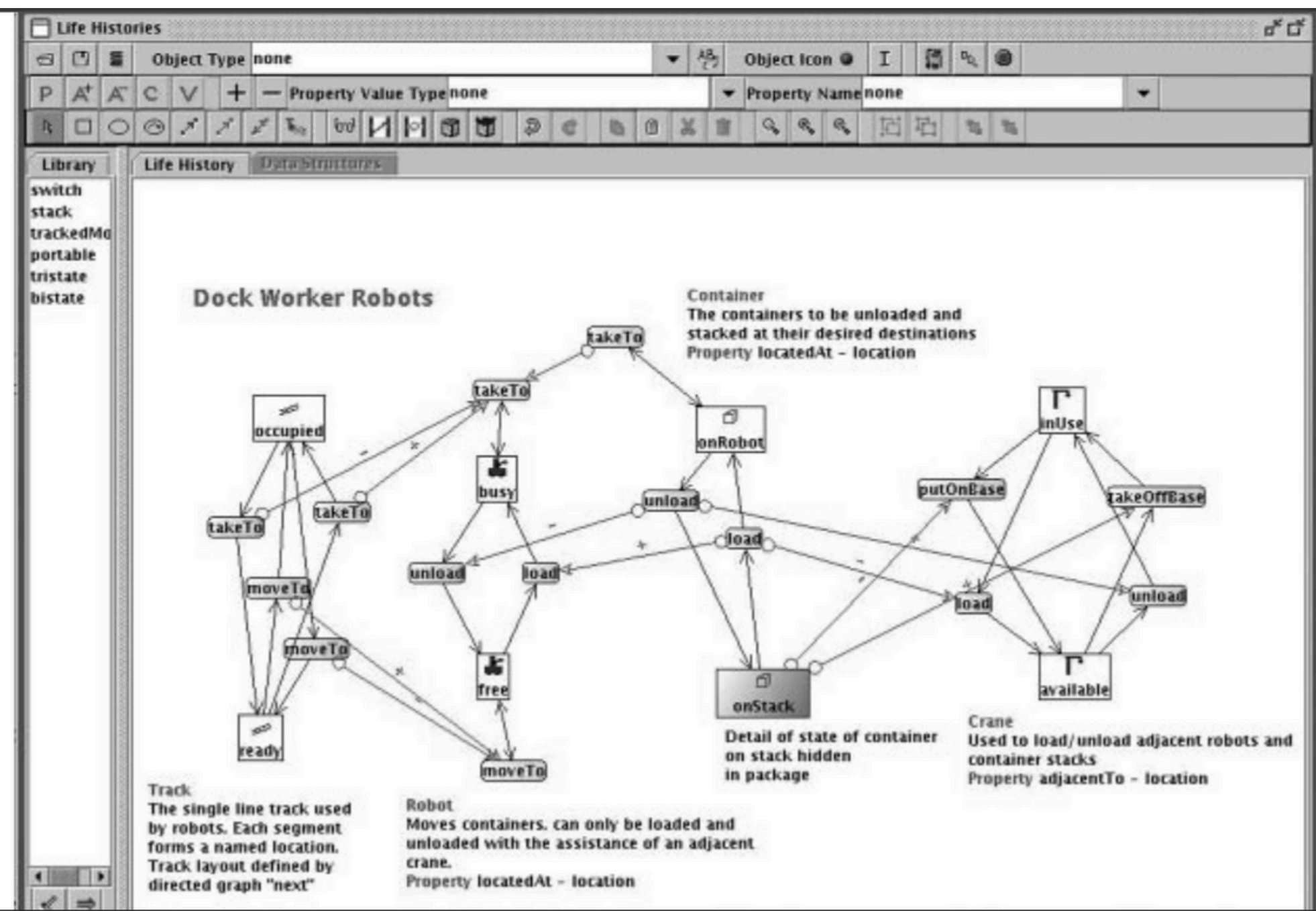
Em resumo, a interface G.I.P.O. torna o processo de planejamento e modelagem de objetos mais visual e intuitivo, possibilitando uma interação mais eficaz e produtiva com os dados e informações do sistema.

Interface gráfica para planejamento com objetos - GIPO

Planning with GIPO



Interface gráfica para planejamento com objetos - GIPO



Logic Planning System



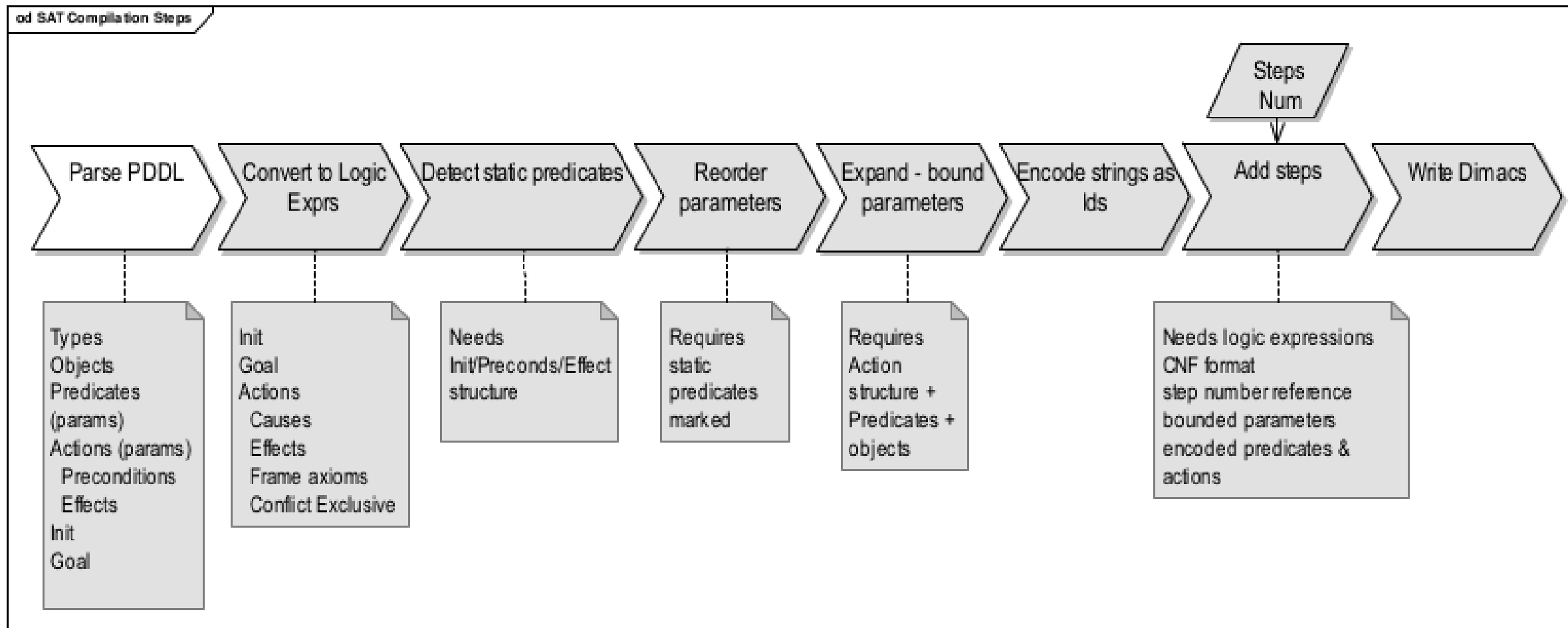
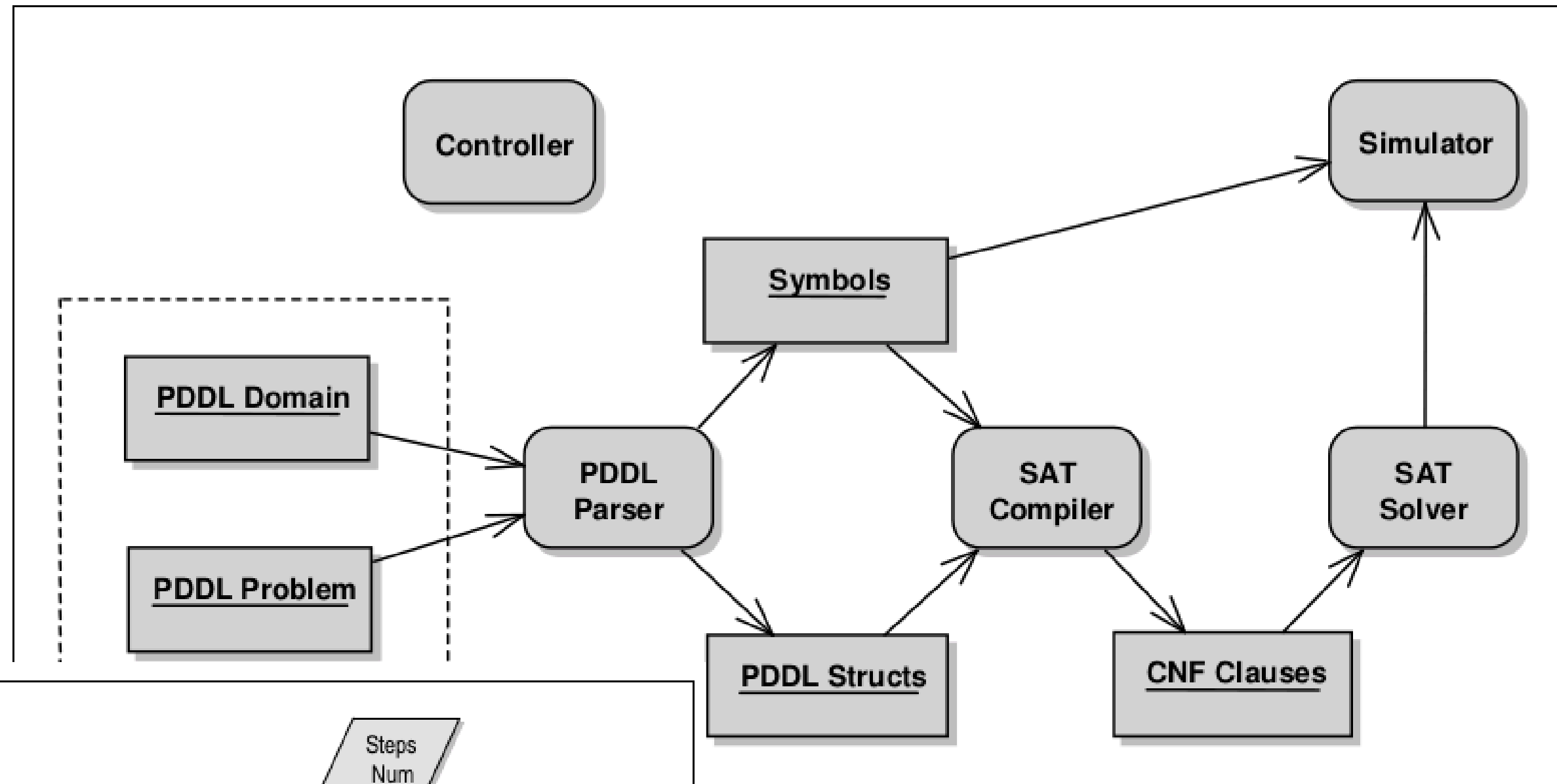
**Iniciantes, Pesquisadores e
Profissionais**

Função e Sistema

Cenas e Objetos em 3D

Parser em PDDL, Planejador,
compilador, solucionador SAT

**Constantes pesquisas para
melhoria da usabilidade**






Planification Simulation x

← → ↻ /jenkins/job/parser/ws/simulator/core/html/index.html

Aplicaciones <Utilidades> Otros marcadores



The simulation environment displays a 3D scene with several objects: two large trucks, a smaller truck, and two airplanes. The objects are rendered in a simple, greyish style.

- obj_package2
- obj_package3
- airplane_airplane1
- airplane_airplane2
- city_pgh
- city_bos

```
flyairplane("airplane1","pgh_airport","la_airport");loadtrucks  
flyairplane("airplane1","la_airport","pgh_airport");drivetruck  
flyairplane("airplane2","pgh_airport","bos_airport");flyairp  
flyairplane("airplane2","bos_airport","pgh_airport");flyairp  
drivetruck1("la_truck","la_central","la_po","la");drivetruck  
flyairplane("airplane2","pgh_airport","la_airport");flyairpla
```

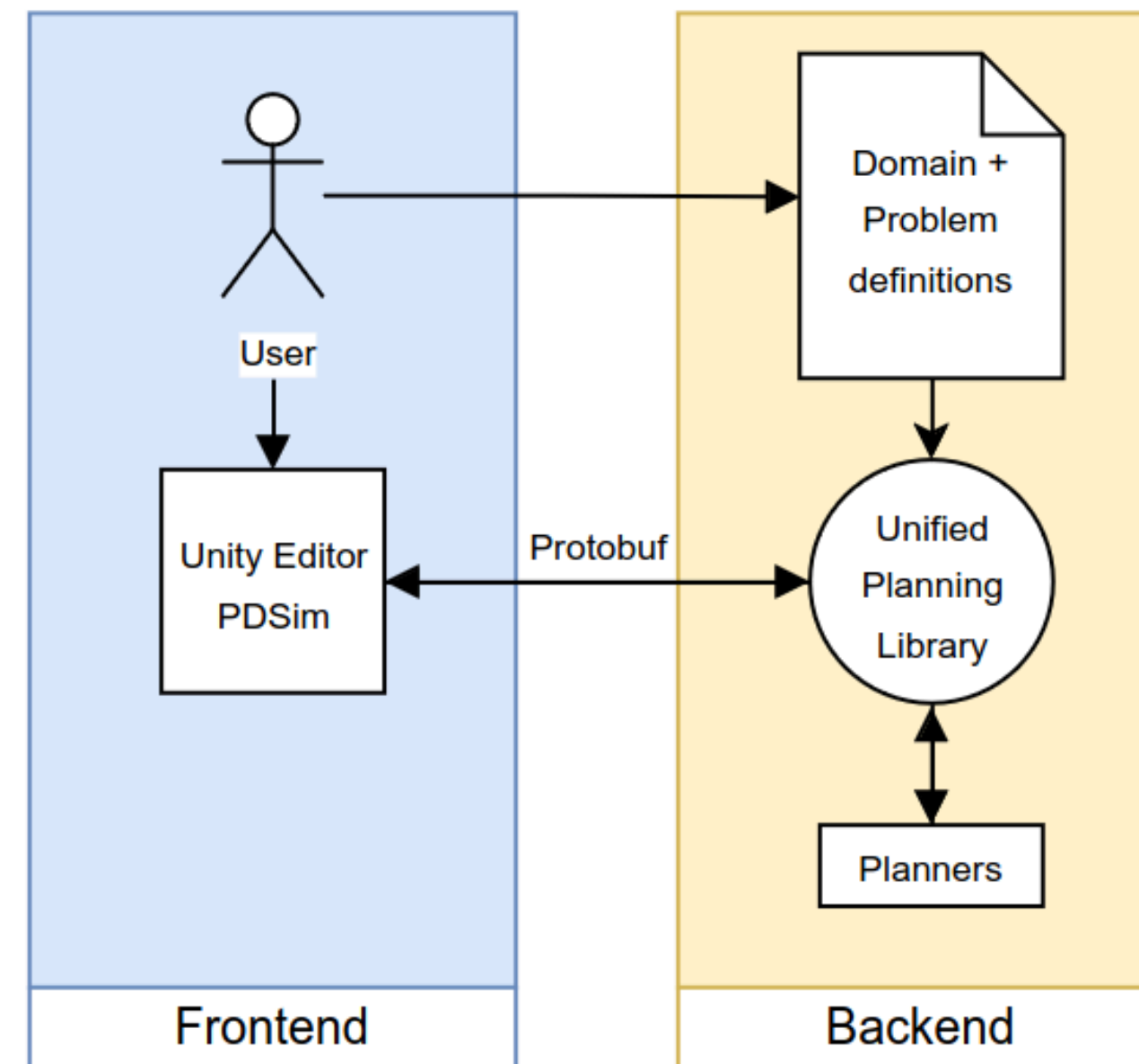
Run

Step

Funcionamento do PDSim



Arquitetura do Sistema Frontend e Backend



Representação de Conhecimento e Conversão de Modelos de Planejamento

Funcionamento do PDSim



Listing 1. Representação da ação push-to-goal no domínio do Sokoban

```
(:action push-to-goal
:parameters (
  ?p - player
  ?s - stone
  ?ppos ?from ?to - location
  ?dir - direction
)
:precondition (and
  (at ?p ?ppos)
  (at ?s ?from)
  (clear ?to)
  (MOVE-DIR ?ppos ?from ?dir)
  (MOVE-DIR ?from ?to ?dir)
  (IS-GOAL ?to)
)
:effect (and
  (not (at ?p ?ppos))
  (not (at ?s ?from))
  (not (clear ?to))
  (at ?p ?from)
  (at ?s ?to)
  (clear ?ppos)
  (at-goal ?s)
)
)
```

Listing 2. Representação da ação push-to-goal no domínio do Sokoban usando a formatação da biblioteca UPL do Python

```
ptg = InstantaneousAction("pushToGoal",
  p=player, s=stone,
  ↪ ppos=location,
  ↪ from=location,
  ↪ to=location, dir=direction)

ptg.add_precondition(at(ptg.p, ptg.ppos)
  &
  at(ptg.s, ptg.from)
  &
  clear(ptg.to)
  &
  moveDir(ptg.ppos,
    ↪ ptg.from,
    ↪ ptg.dir)
  &
  moveDir(ptg.from,
    ↪ ptg.to,
    ↪ ptg.dir)
  &
  isGoal(ptg.to))

ptg.add_effect(at(ptg.p, ptg.ppos),
  ↪ False)
ptg.add_effect(at(ptg.s, ptg.from),
  ↪ False)
ptg.add_effect(clear(ptg.to), False)
ptg.add_effect(at(ptg.p, ptg.from), True)
ptg.add_effect(at(ptg.s, ptg.to), True)
ptg.add_effect(clear(ptg.ppos), True)
ptg.add_effect(atGoal(ptg.s), True)
```

Funcionamento do PDSim



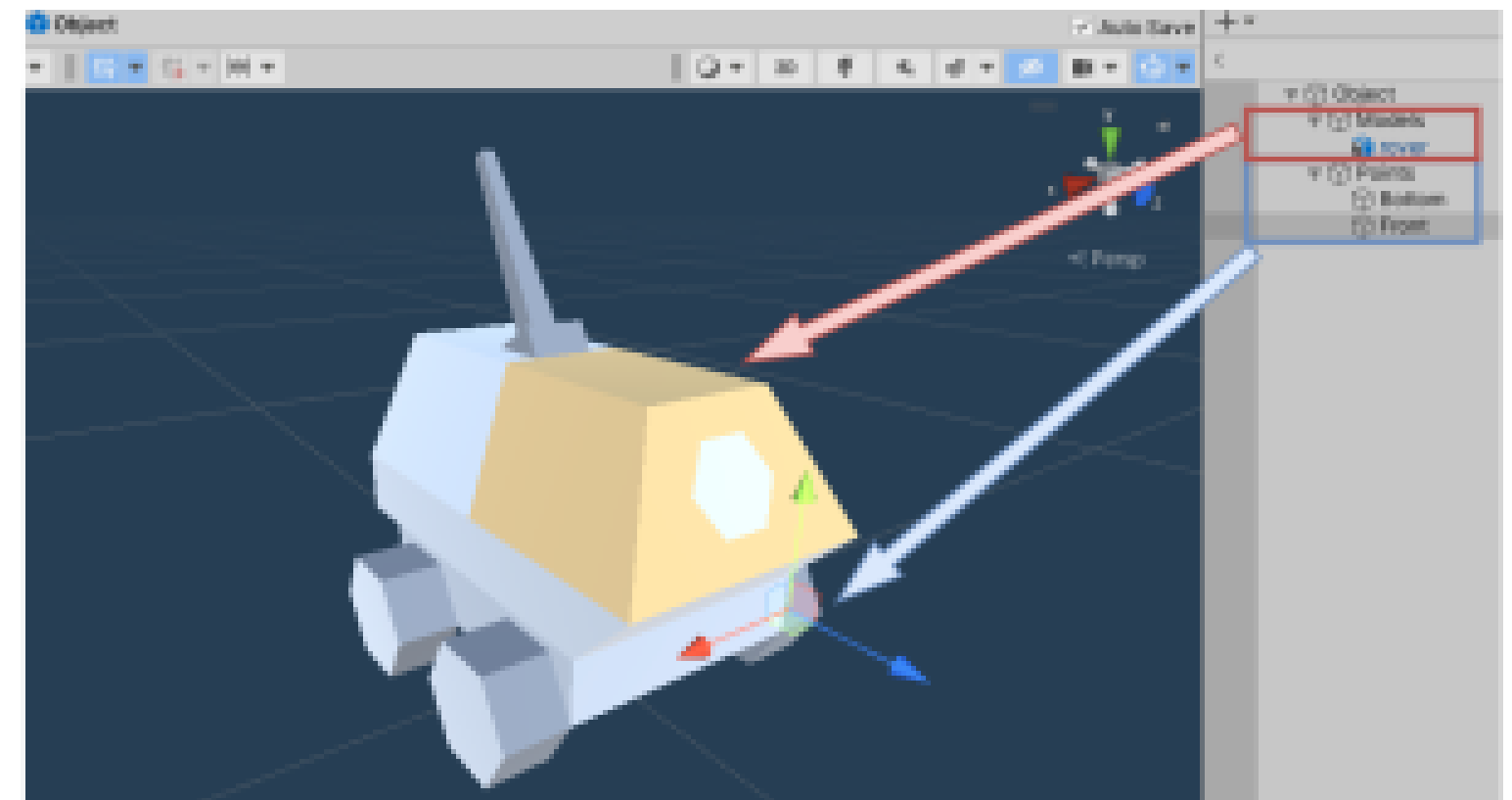
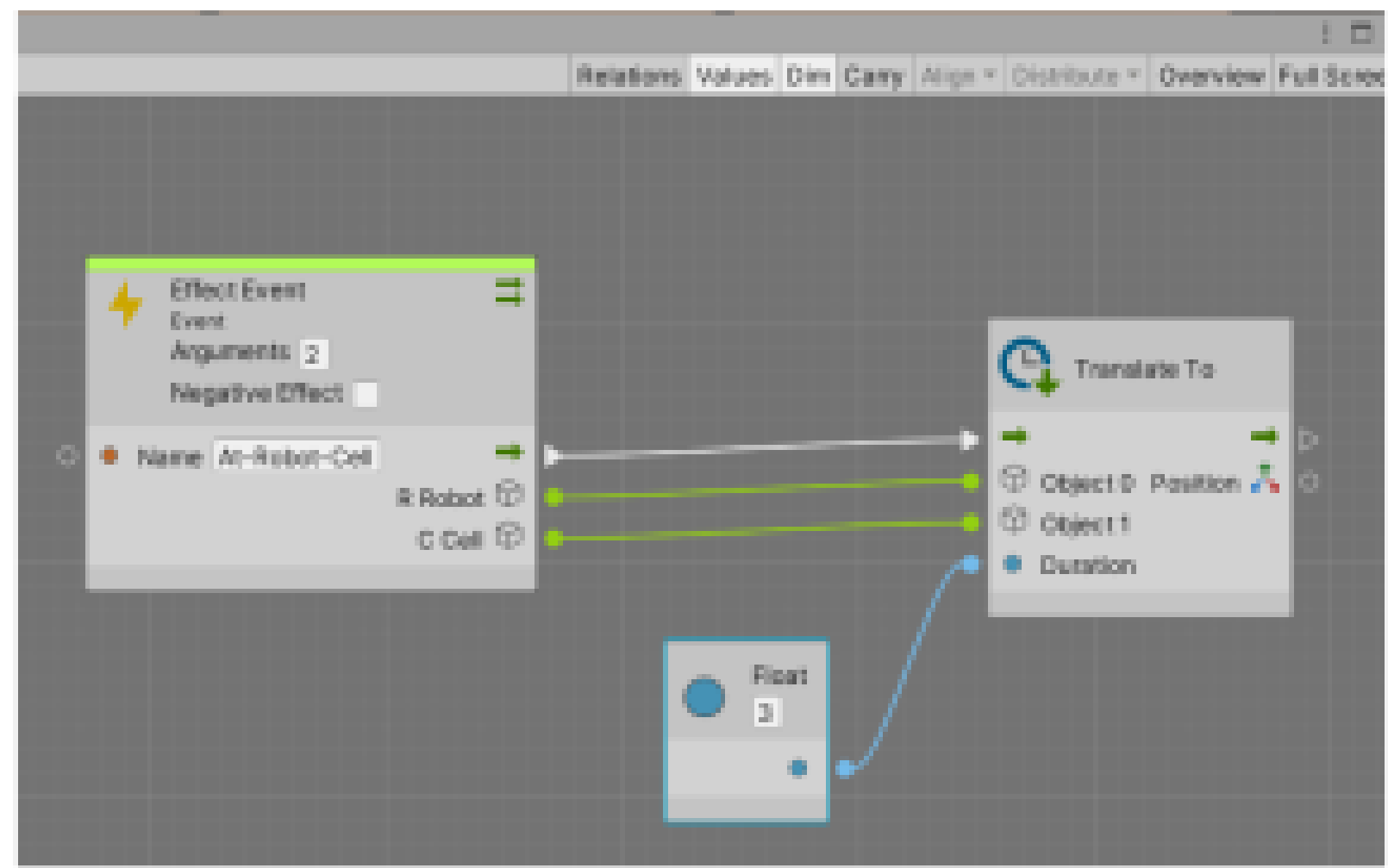
Integração entre C# e Animação

Table 1
PDDL to Unity conversion table

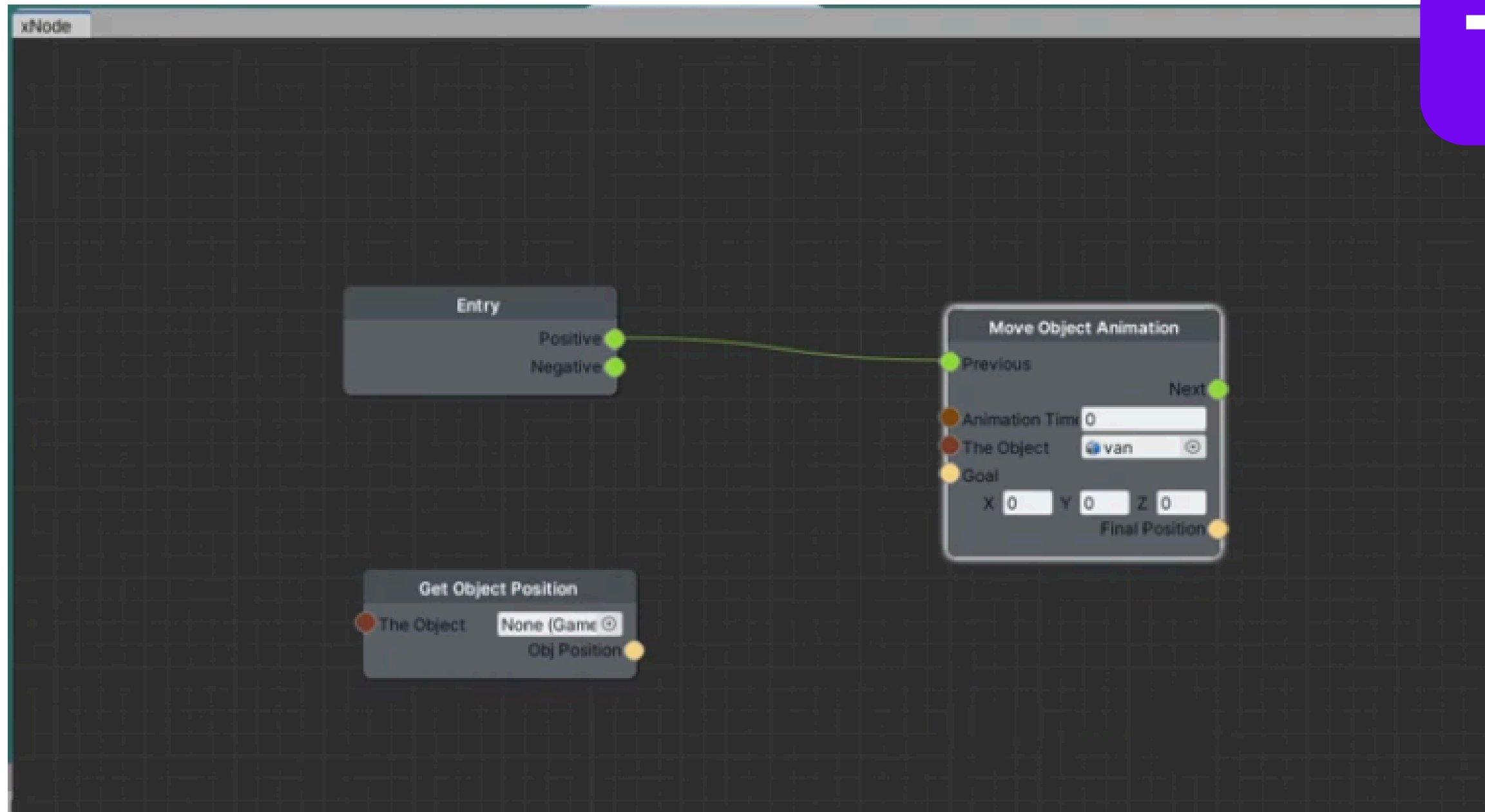
PDDL Element	Unity Representation
predicate	Animation graphs define object behaviour in Unity (translation, path planning, audio emission, particle effects, etc.)
action	Action effects are the animated components, using the object attributes
objects	General 2D/3D model representation with custom sprites/meshes
init	Pre-simulation using the predicate's defined animations

```
{'objects':  
  [{'name': 'apn1', 'type': 'airplane'},  
   {'name': 'apt1', 'type': 'airport'},  
   ...],  
 'predicates':  
  [{'name': 'in-city', 'attributes': ['place', 'city']},  
   {'name': 'at', 'attributes': ['physobj', 'place']},  
   {'name': 'in', 'attributes': ['package', 'vehicle']}],  
 'init':  
  [{'predicate': 'at', 'attributes': ['obj13', 'pos1']},  
   {'predicate': 'at', 'attributes': ['obj23', 'pos2']},  
   ..]  
  ..  
}
```

PD Sim



Teste do PDSim



```
Windows PowerShell
(pdsim) PS D:\Programming\Python\PDSim-Backend> python .\server_upf.py
#####
#### PDSim SERVER ####
#####
Server running on port 5556..
Server initialized with domain at: D:/Programming/Python/PDSim-Backend/pddl/blocks-domain.pddl
Server initialized with problem at: D:/Programming/Python/PDSim-Backend/pddl/blocks-instance.pddl
```


Obrigado pela Atenção!

