# EKUMEN

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# Accelerating robotics development through simulation

FOSDEM 2025, Robotics and Simulation Devroom
2025/02/02

# A little bit about Ekumen

- HQed in Buenos Aires, Argentina.
- Distributed team across Americas and Europe.
- Robotics, XR, DevOps and Web based services.
- OSRA members.
- ROS, Gazebo, Open-RMF and Infrastructure contributors.

# Some Ekumen owned projects

# A little about Ignacio Davila

- Roboticist at Ekumen
- Simulations Operations head @ Ekumen
- Electronics Engineering graduate
- Based in Buenos Aires, Argentina 🧉
- Hobbies: 🎸💻⚽

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IDavGal

# A little about myself

- Regional Director for EMEA @ Ekumen
- Based in Munich, Germany.
- EE background.
- Statistics and Theory of Circuits undergrad teaching assistant.
- Working on robotic and AV simulation and validation since 2016.
- Hobbies: 🚴 ⚽ 🧉🍳💻

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# Our journey today

- Robots and Simulators
  - What is a *robotic* system?
  - What is a *robotic* simulator?
  - What can I *do* with a robotic simulator?
- Picking the right tool for the job
  - How to pick a robotic simulator?
  - One robot, many simulators
    - Gazebo
    - Webots
    - O3DE
    - MuJoCo
    - Flatland
- Discussion and questions

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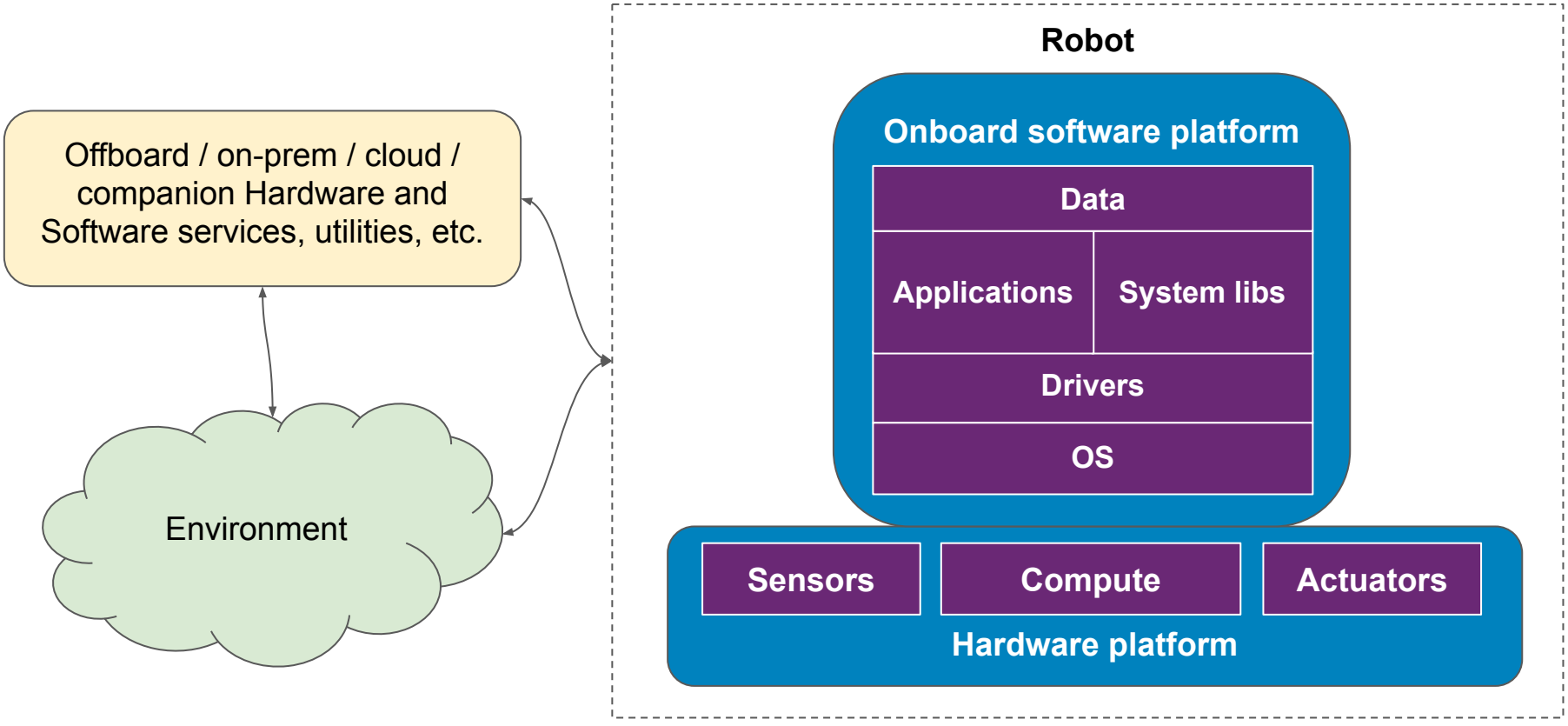
# Robots and Simulators

# What is a *robotic* system?



# What is a *simulator*?

A **simulator** is an application that **models** a **scenario** with a given **model**.

A **scenario** is a **representation** of a **collection of systems** and their **environment** which **evolves** throughout **time**.

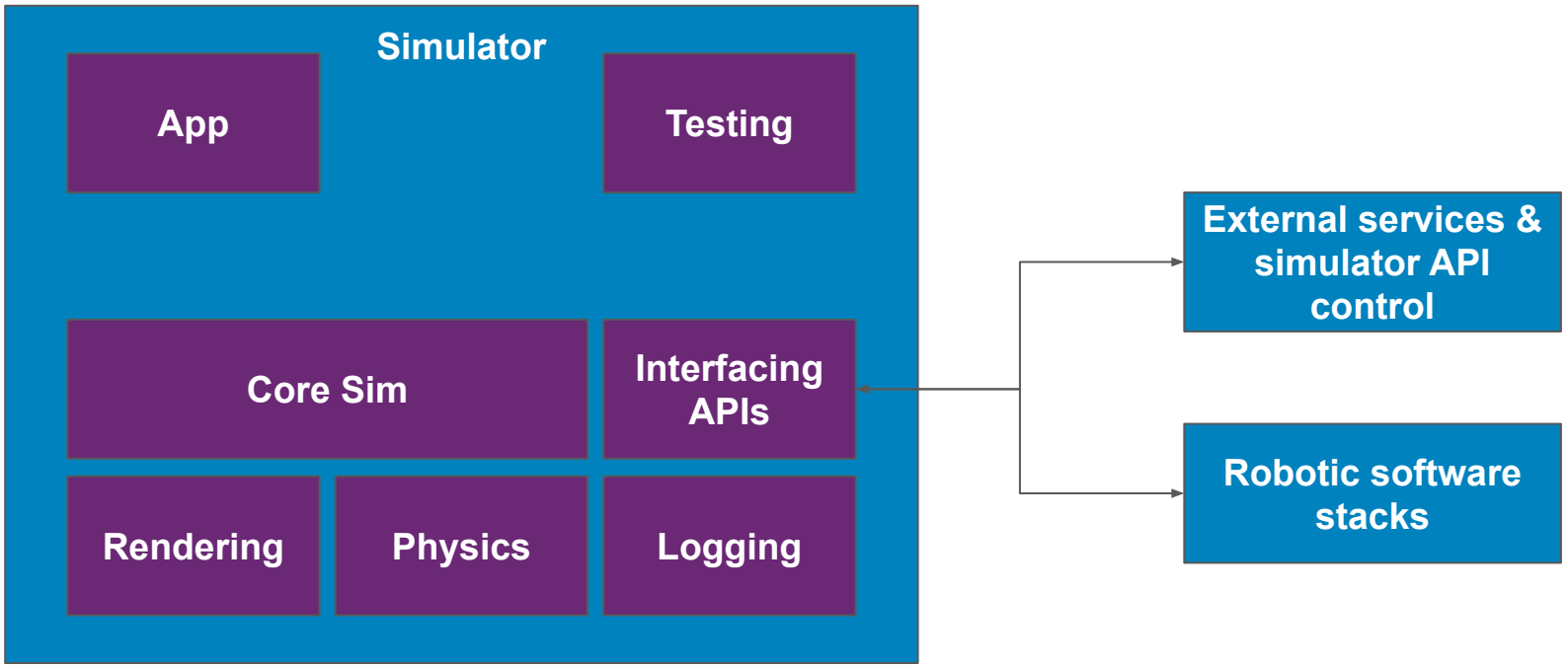
A **model** is a **representation** of the underlying rules of the **process** under evaluation.

# What is a *robotic* simulator?

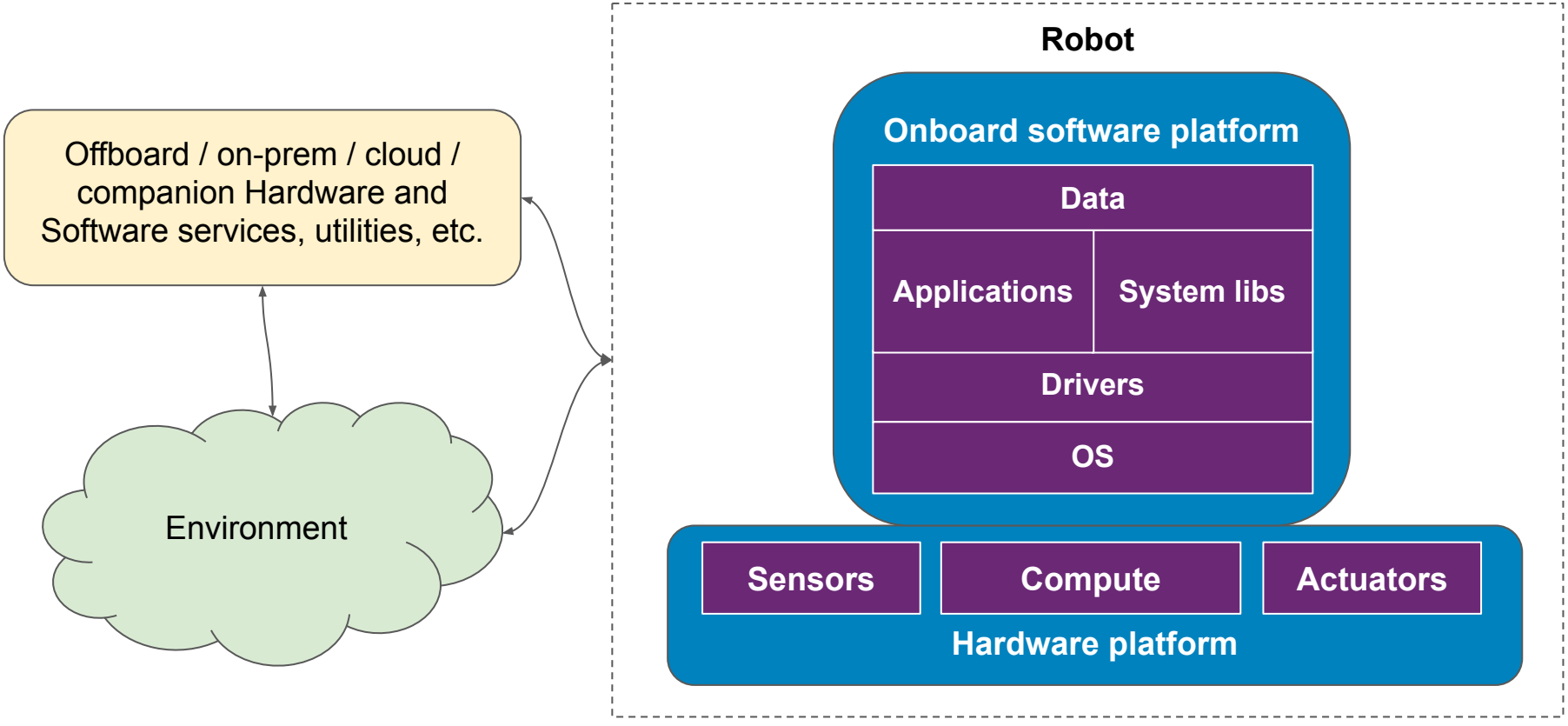
*A robotic simulator is an application which allows to model scenarios with robotic systems.*

# What is a *robotic* simulator?

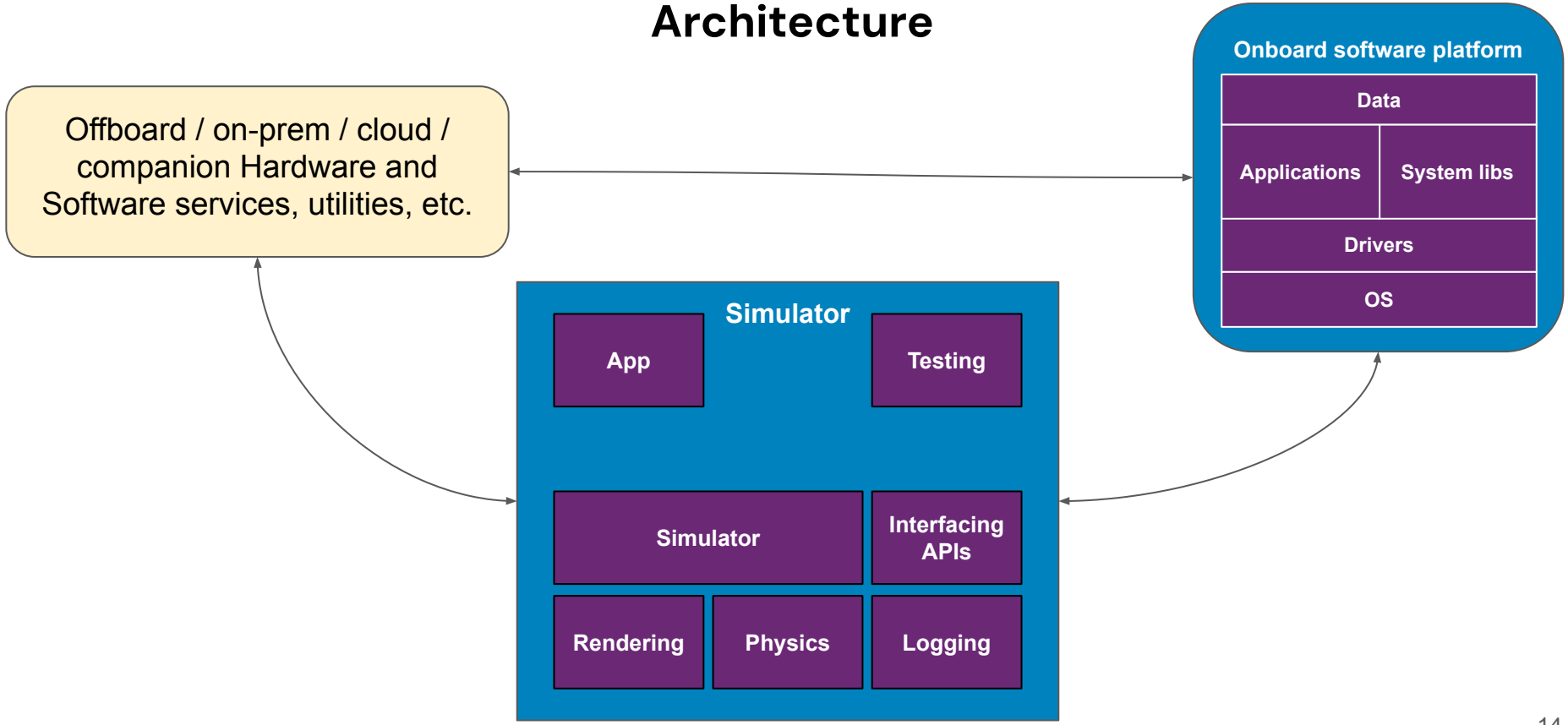
## Architecture



# What is a *robotic* simulator?

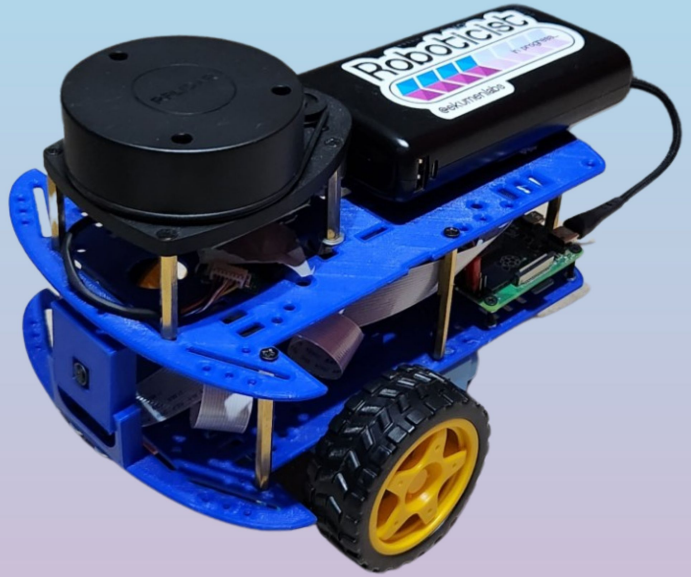


# What is a *robotic* simulator?



# What can I *do* with a robotic simulator?

- Model
- Test
- Validate
- Learn / tune parameters
- Generate data
- Train
- Sell
- …

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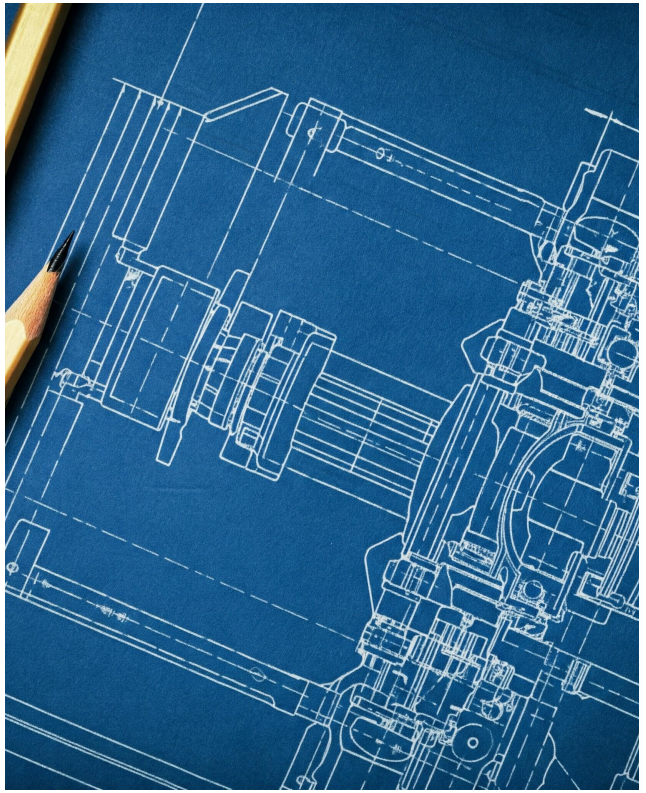
# Picking the right tool for the job

# How to *pick* a robotic simulator?

## Just another blueprint

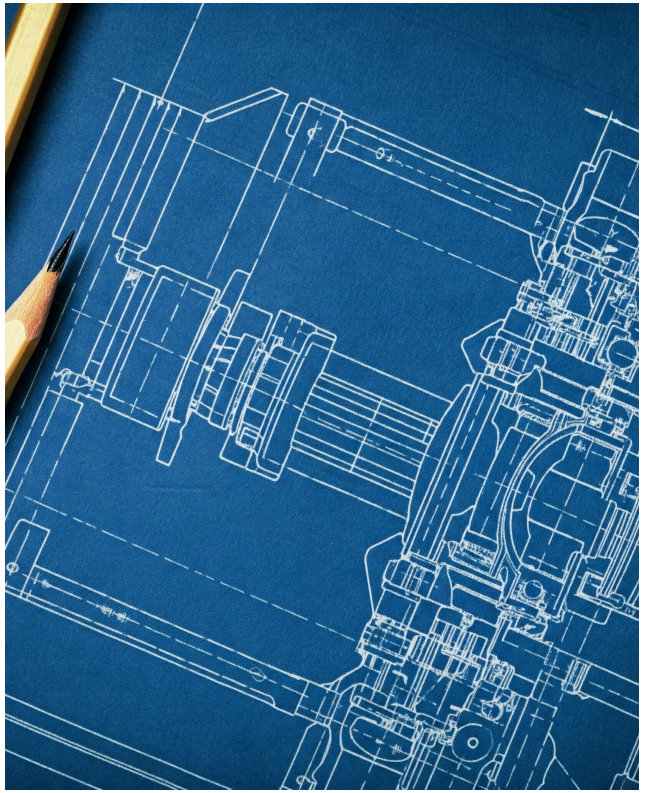
- Identify use cases
  - *Is it a testing tool?*
  - *Is it a validation tool?*
  - *Is it a development tool?*
  - *Is it data gathering tool?*
  - *Do you need a hardware-in-the-loop system?*
- Identify the type of robotic system
  - *Ground / Aerial / Maritime vehicles?*
  - *Robotic arm or mobile robot or custom mechanism?*
- Identify scenarios
  - *Indoor vs outdoor.*
  - *One vs multiple robots.*
  - *Do you have automatisms?*
  - *Do scenarios last long?*
  - *Do you need determinism?*
  - *Scene creation tools?*
  - *Digital asset library requirements?*



# How to *pick* a robotic simulator?

## And the list keeps growing...

- Identify physics requirements
  - *Kinematic vs dynamic vs complex dynamics?*
  - *Which are the required sensors and actuators?*
  - *Do you need soft bodies?*
- Identify rendering requirements
  - Do you need rendering at all?
  - Do you need photorealism?
  - Will it run on the CPU or do you have GPU?
- Identify the maintenance model
  - *Are you relying on the community?*
  - *Is your entire stack moving forward with your technology decision?*

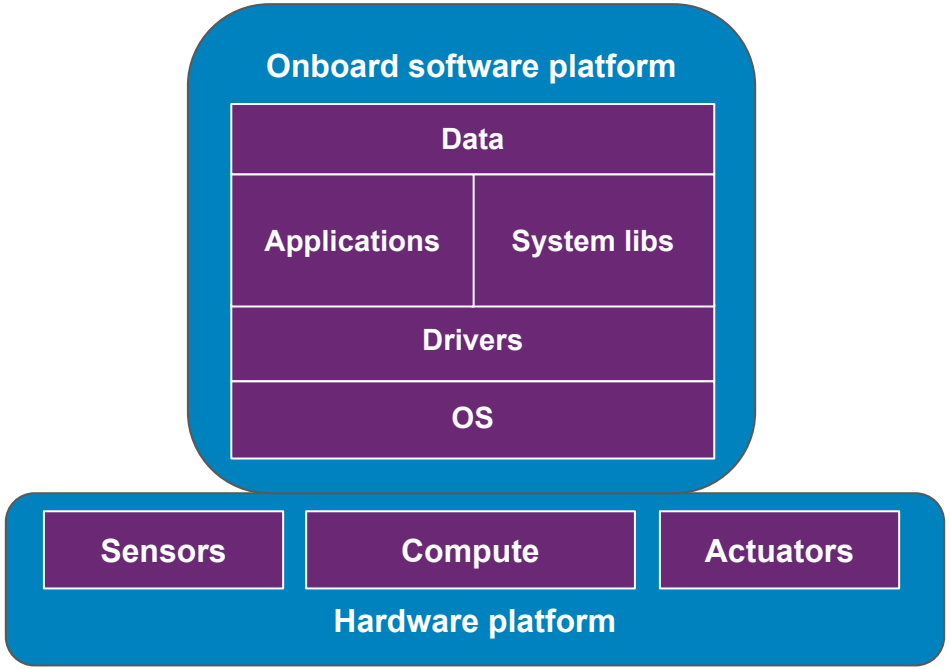


# One robot, many simulators

## Model your robot

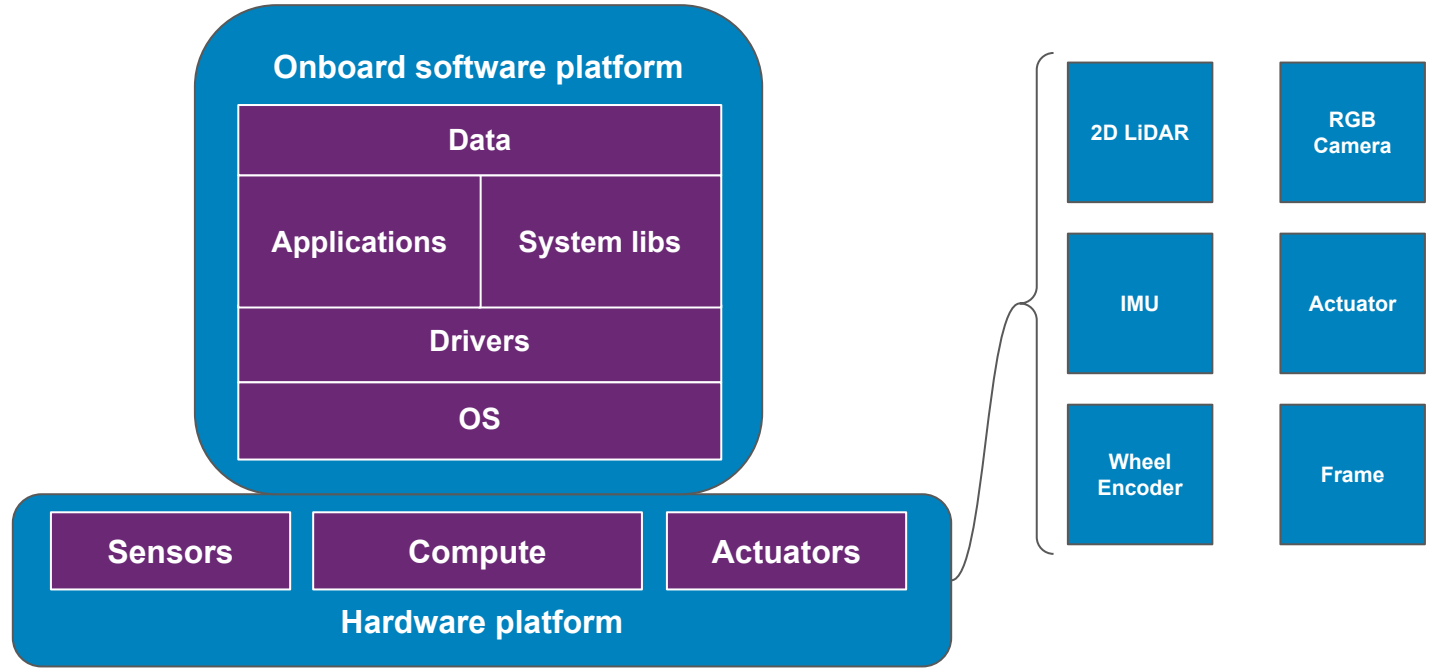
# One robot, many simulators

## Model your robot



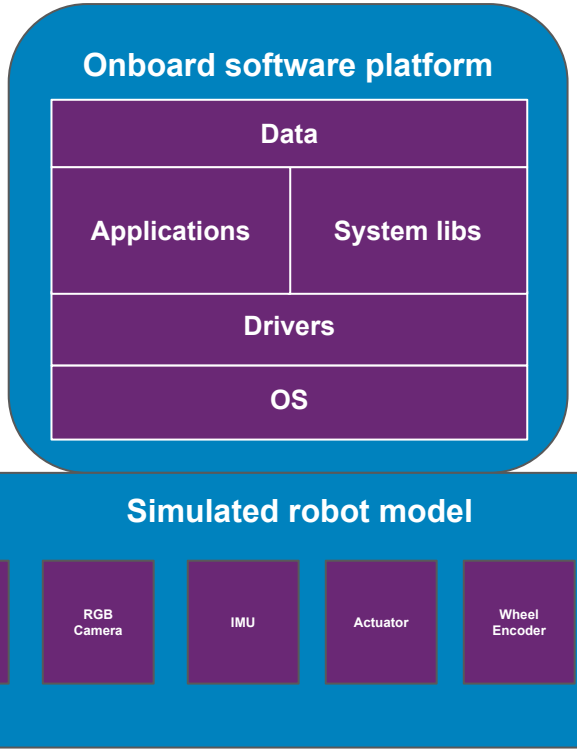
# One robot, many simulators

## Model your robot



# One robot, many simulators

**Build your simulated model for each simulator & benchmark it!**




GAZEBO

O3DE
OPEN 3D ENGINE

MuJoCo

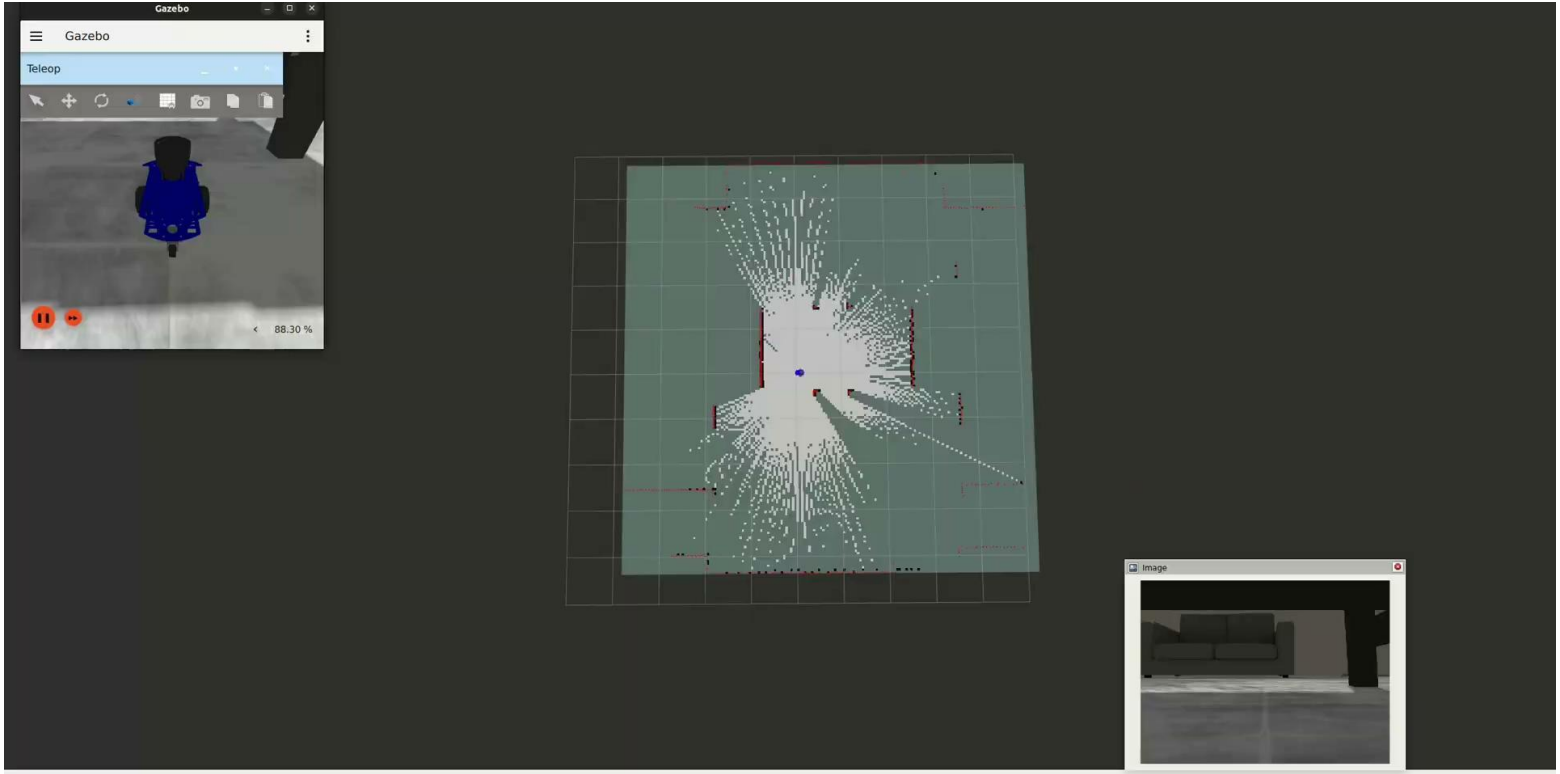
Flatland

## Show me the code!

1. Scan me!
2. Click on “Open Source projects”
3. Ekumen-OS @ Github
   a. Andino ecosystem and all the simulator projects in the upcoming slides.
   b. Beluga
   c. Lambkin
4. ⭐ the projects ;)

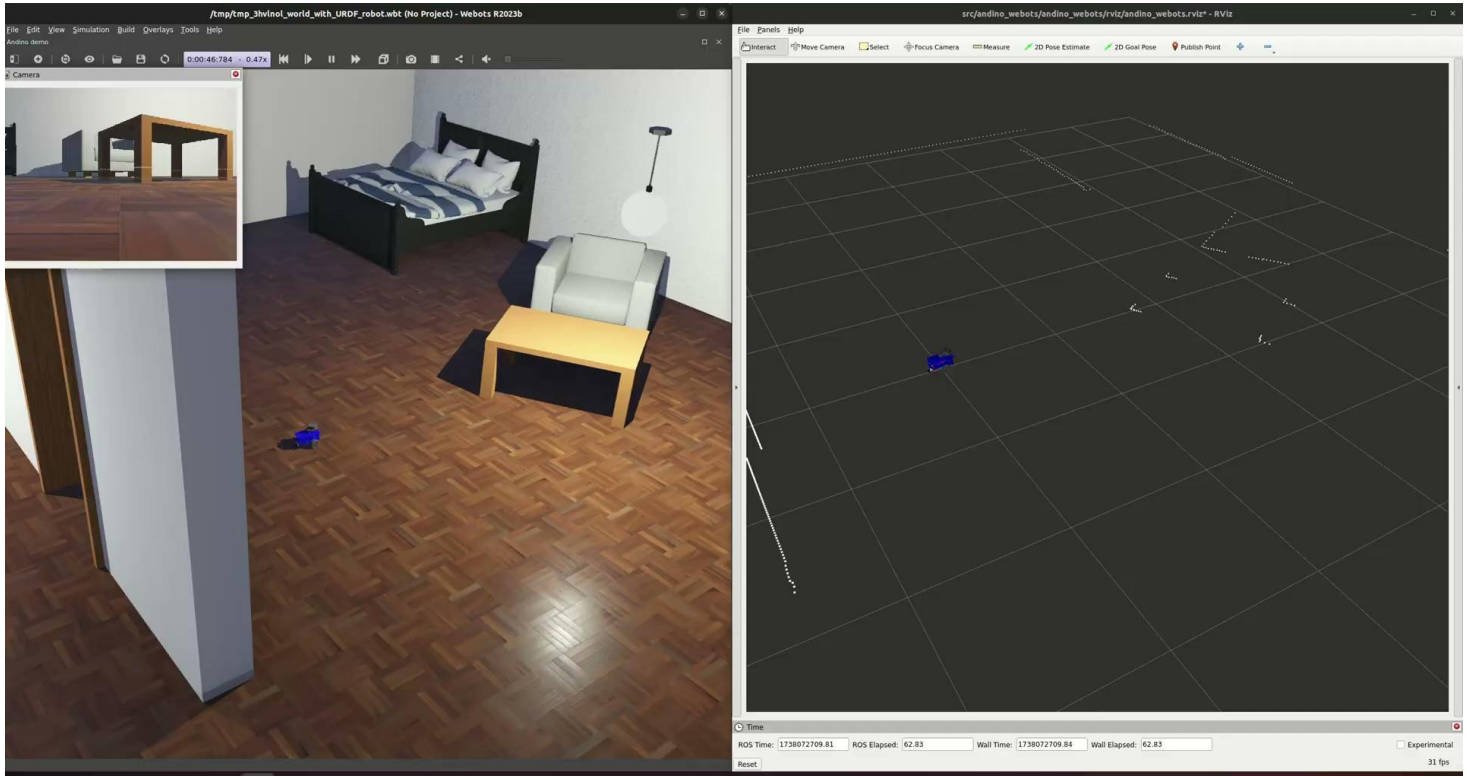
# One robot, many simulators

## Gazebo

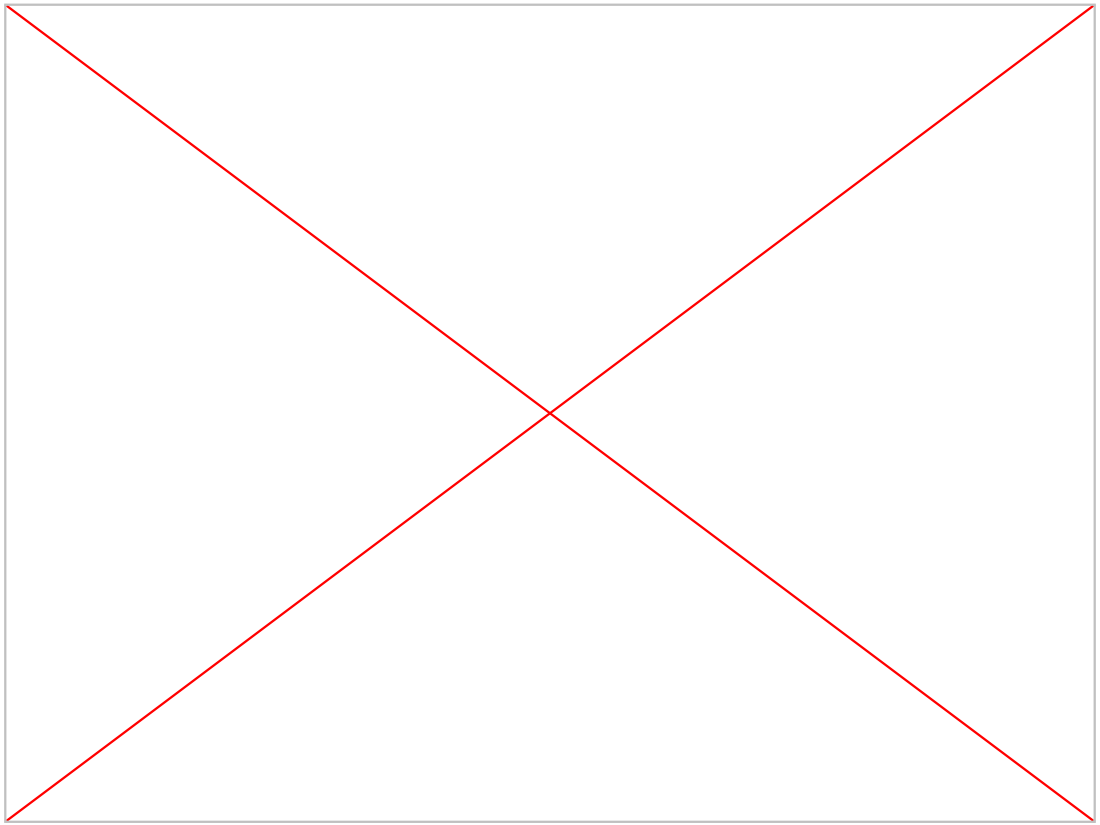


# One robot, many simulators

## Webots

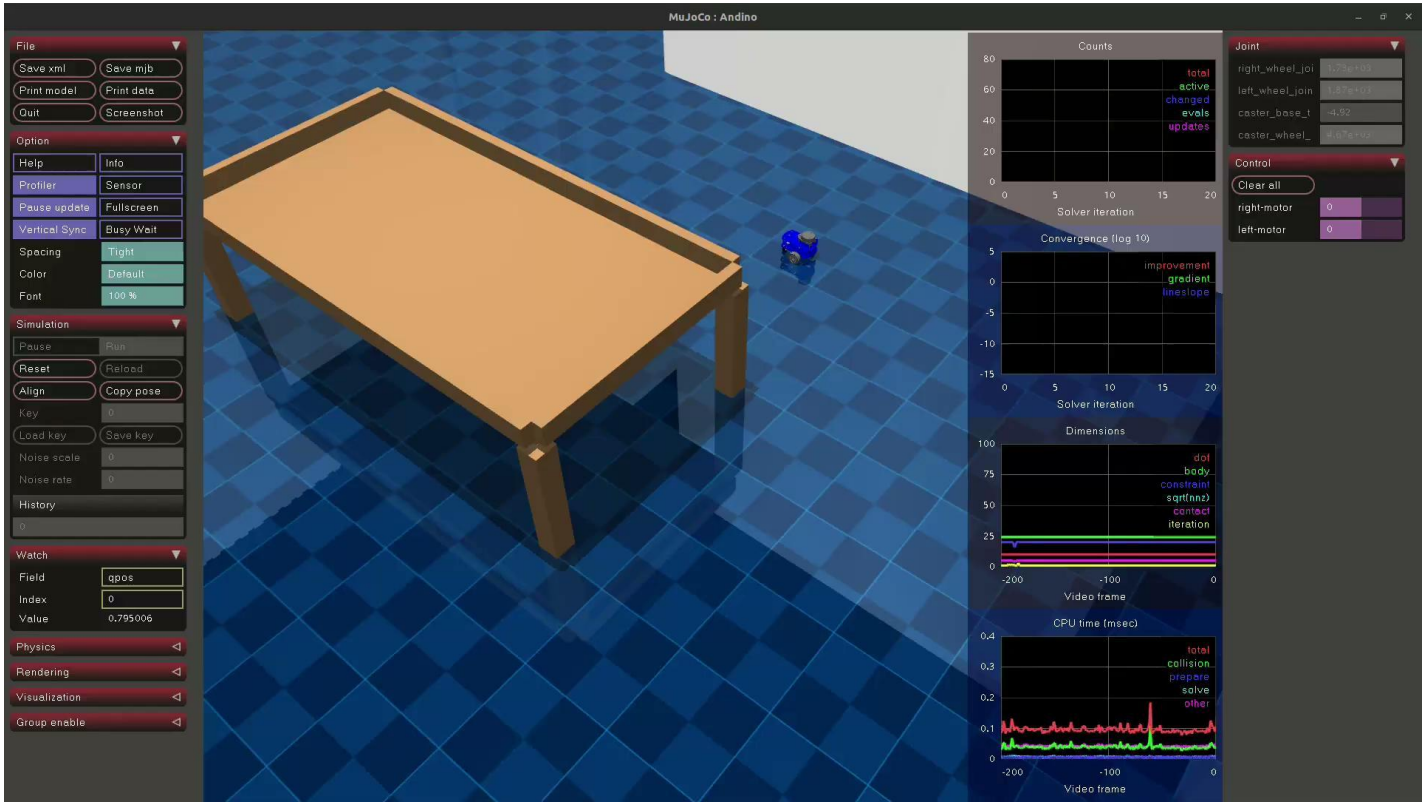


# One robot, many simulators



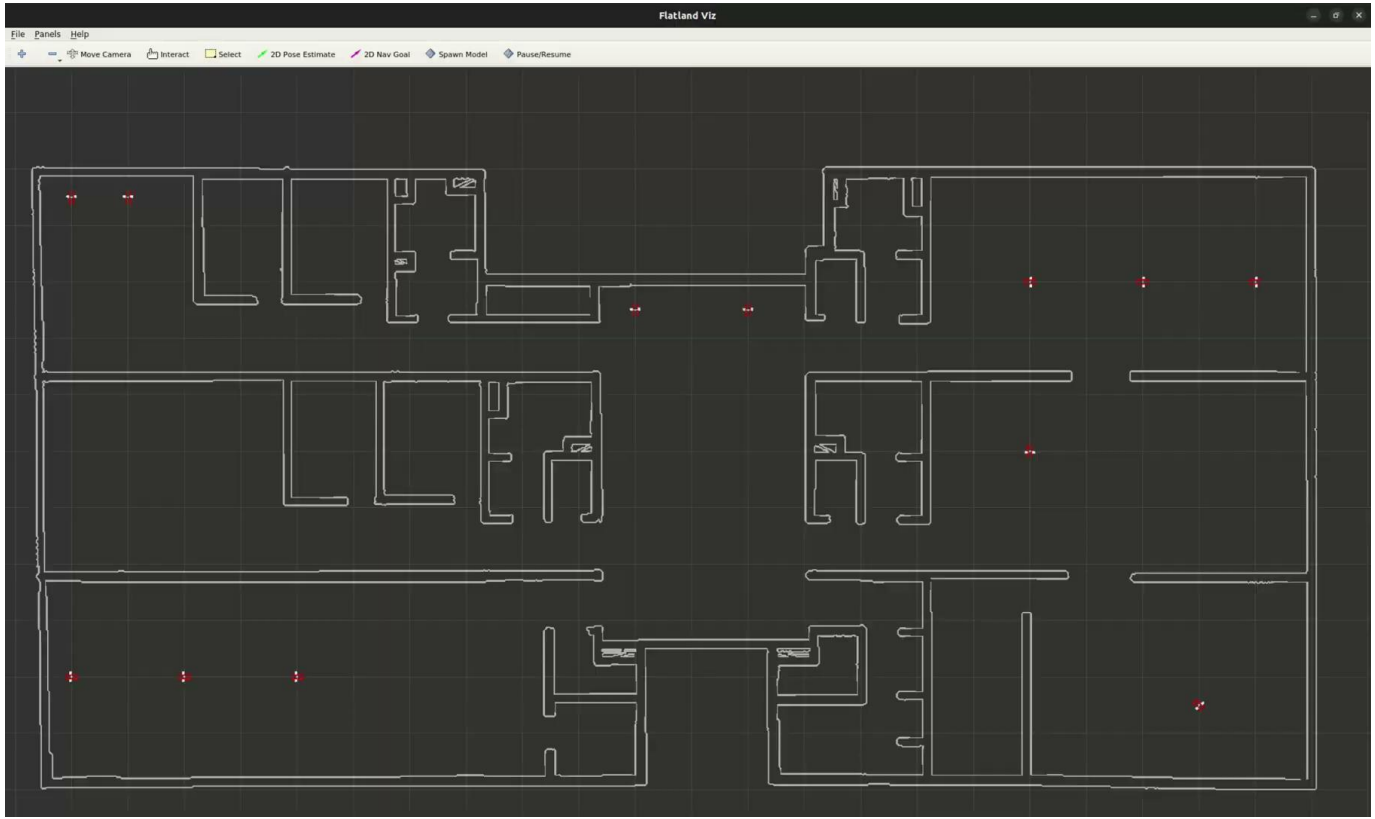
# One robot, many simulators

## MuJoCo



# One robot, many simulators

## Flatland



# Discussion and questions

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# Thank you!