AWS RoboMaker

Develop, Test, and Deploy Intelligent Robotics Applications with AWS

Roger Barga, General Manager

AWS Robotics & Autonomous Services

Please
Do NOT Feed
the Robots
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amazon PrimeAir
amazon PrimeAir

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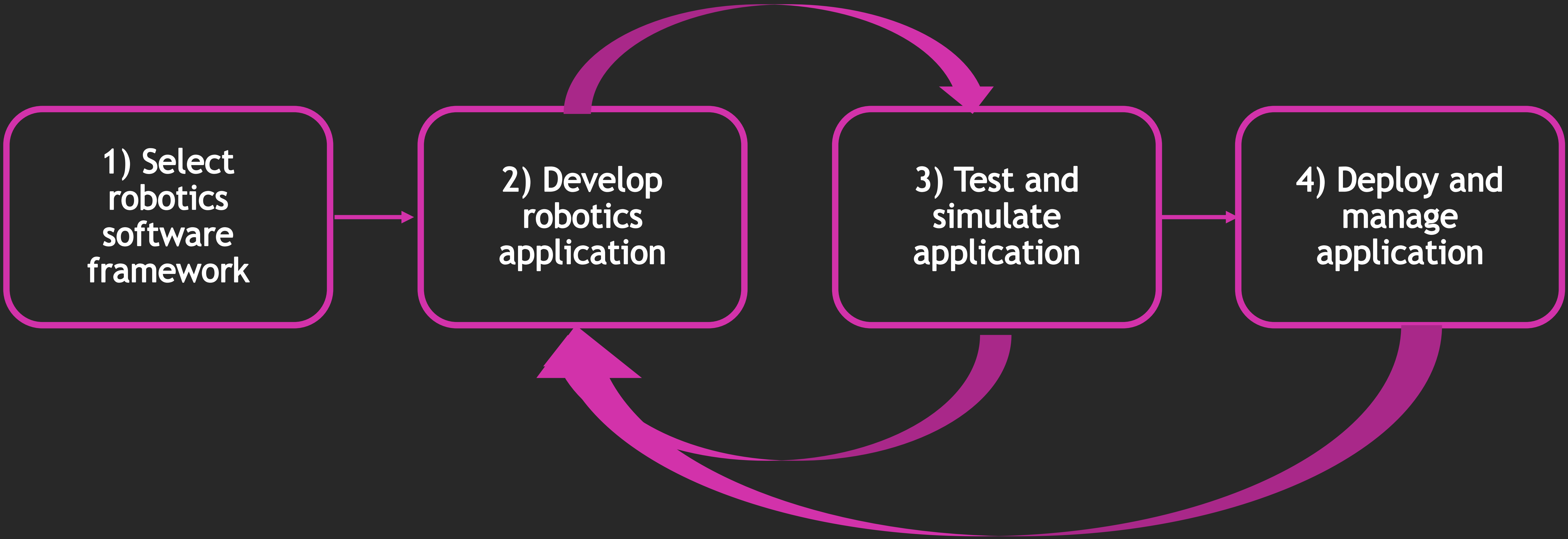
Robotics Application Lifecycle


1) Select robotics software framework
2) Develop robotics application
3) Test and simulate application
4) Deploy and manage application

Application deployment and update

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Capabilities

Development Environment

Cloud Extensions for ROS

Simulation

Fleet Management

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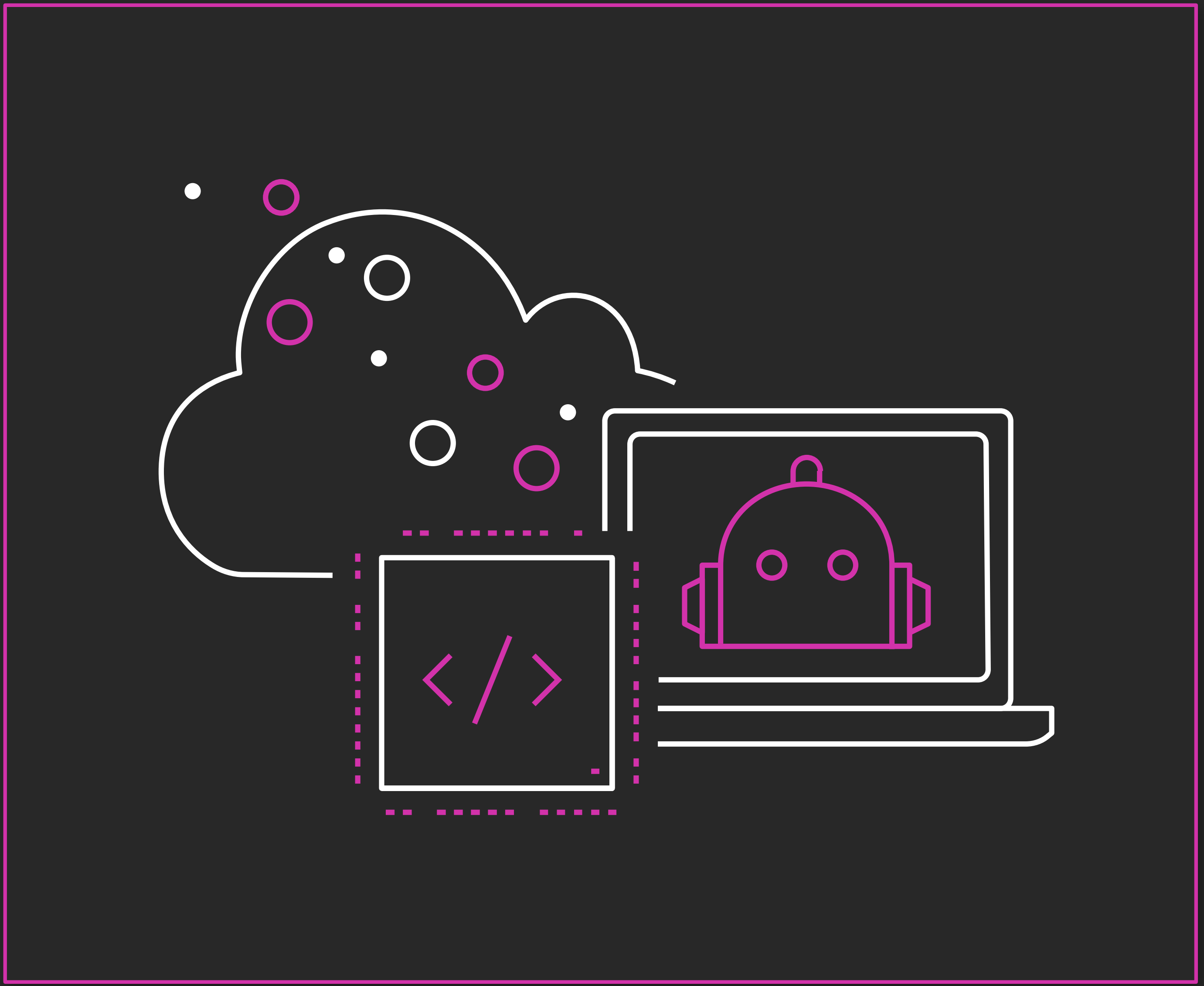
Development Environment

- Start development with zero setup effort
- Automatically download, compile, and configure the operating system, development software, and ROS
- Integrated with RoboMaker Simulation
- Integrated with Cloud Extensions for ROS



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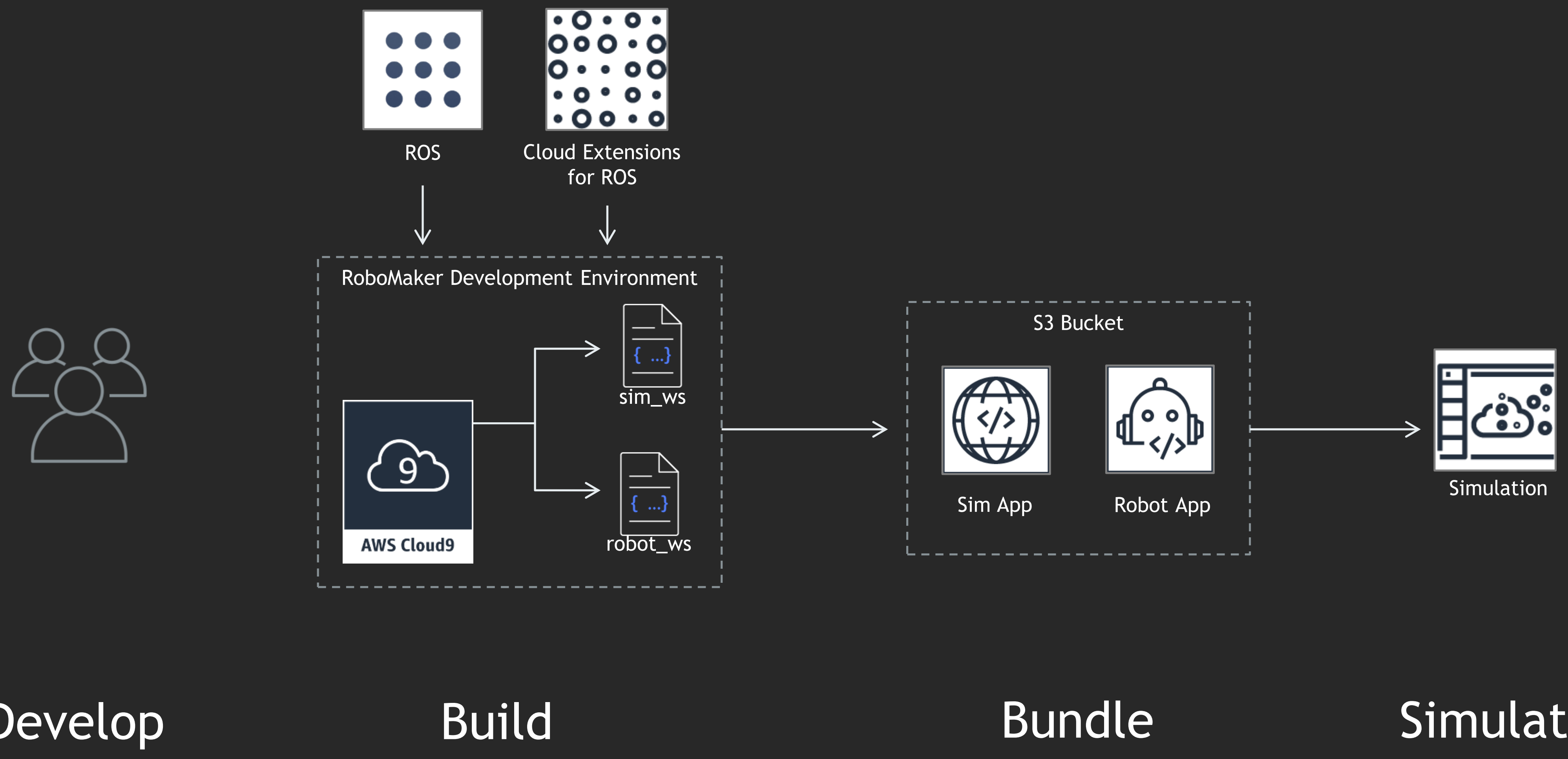
Development Environment



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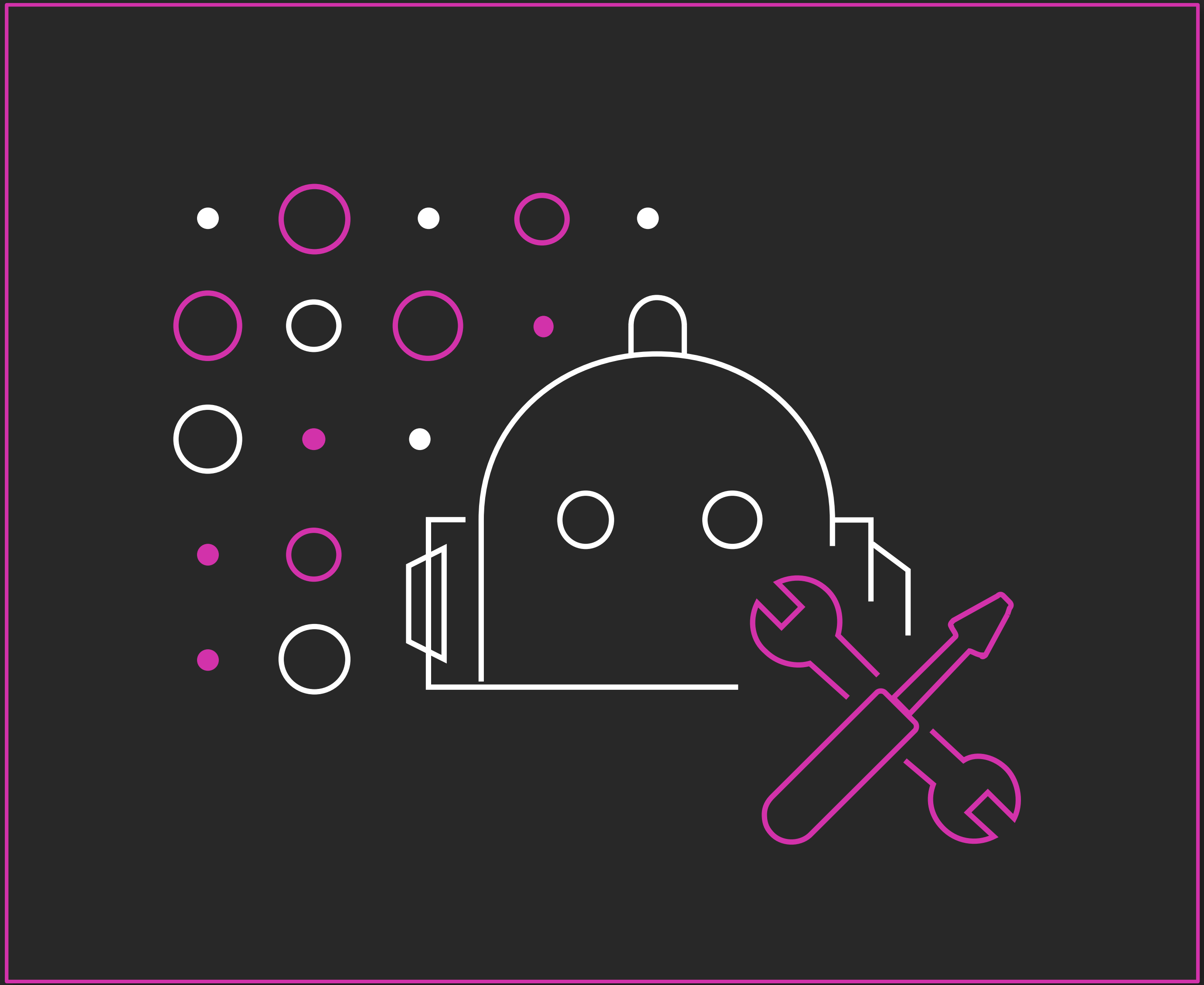
Cloud Extensions for ROS

- Selection of AWS services from machine learning to monitoring and analytics.
- Written as familiar ROS packages
- Secure connections and communications between robots and AWS
- Sample applications to get started



aws

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Cloud Extensions for ROS

Speech Recognition	Speech Generation	Video Streaming	Image and Video Analysis	Logging and Monitoring
Amazon Lex	Amazon Polly	Amazon Kinesis Video Streams	Amazon Rekognition	Amazon CloudWatch

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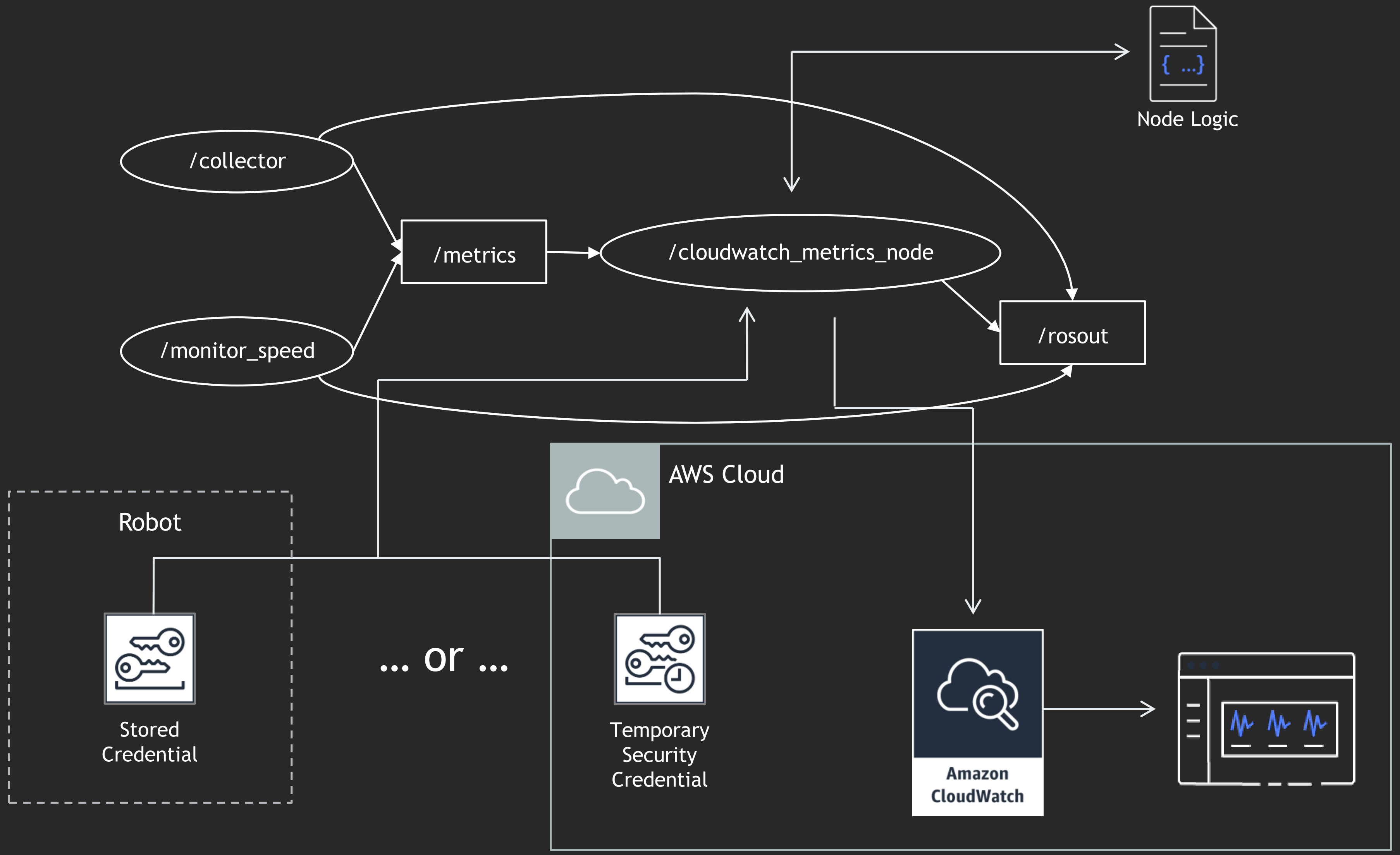
CloudWatch Extension for ROS



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Simulation

- Pre-built 3D simulation worlds, or you can bring your own
- No infrastructure to provision, configure, or to manage
- Run multiple simulations in parallel
- Auto-scaling based on simulation complexity
- Pay-as-you-go based on resource consumption

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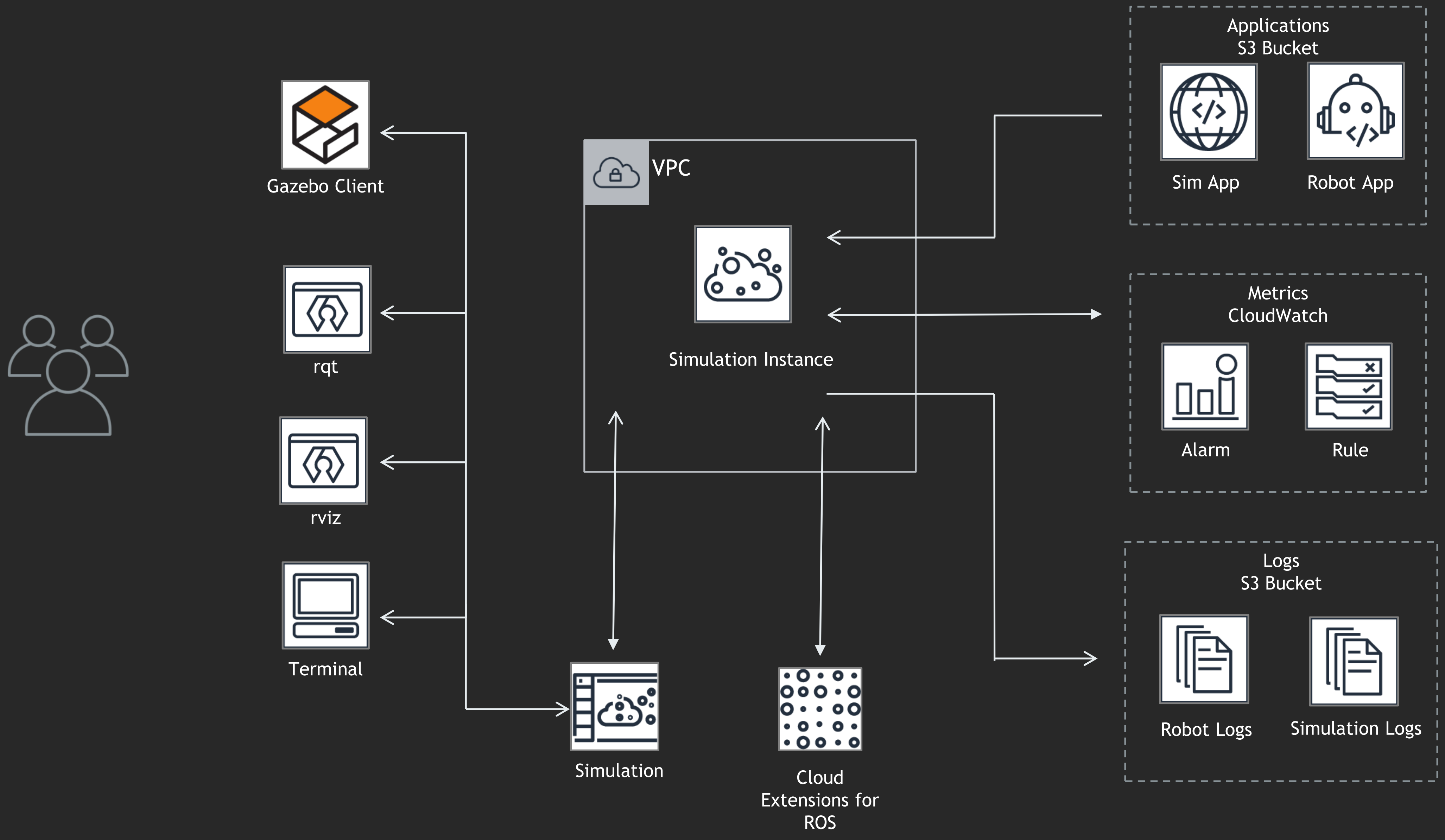
Simulation



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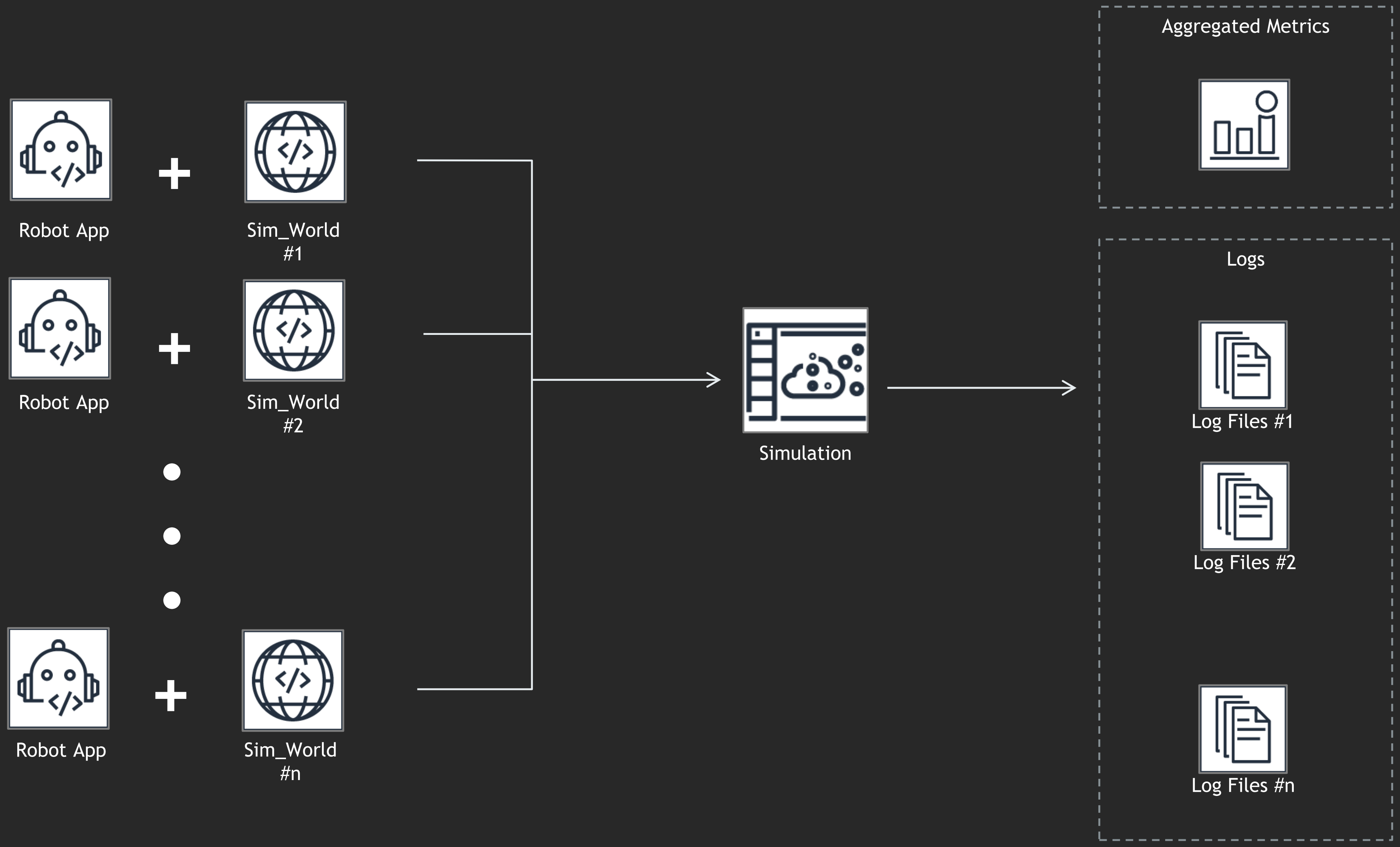
Simulation



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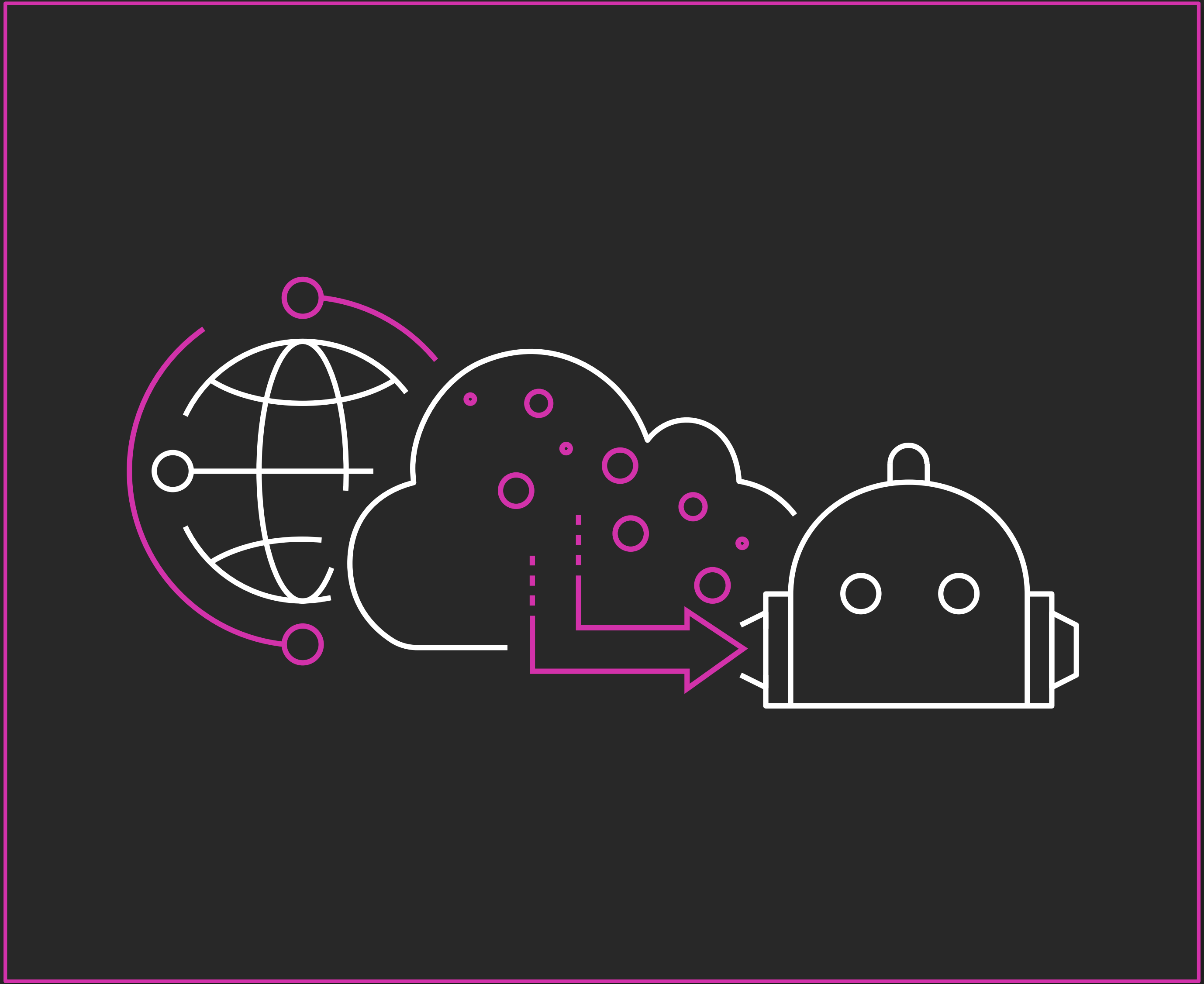
Fleet Management

- Integrated with AWS Greengrass
- Built-in registry, security, & fault-tolerance
- Deploy robotics application over-the-air
- Monitoring, remote control, & orchestration



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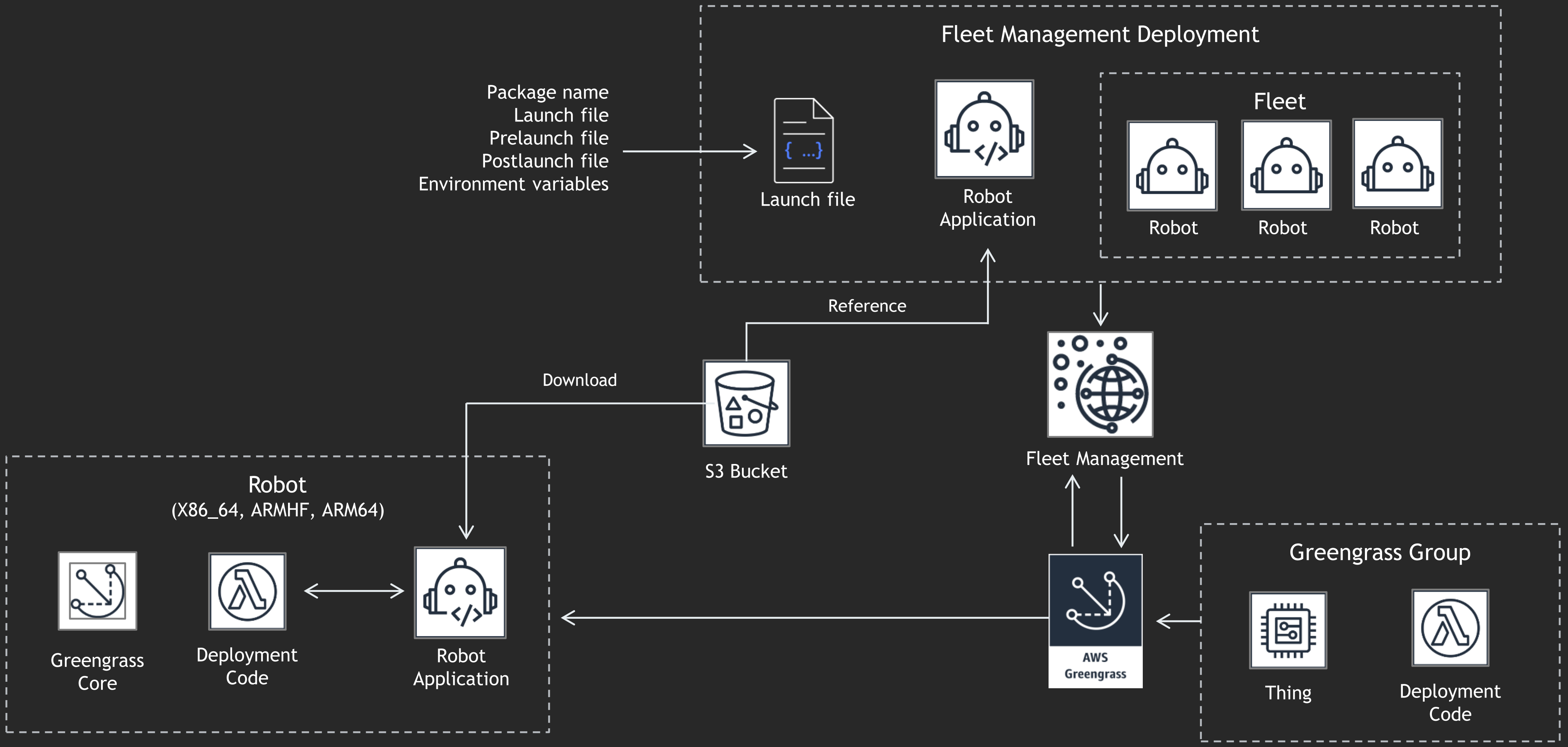
Fleet Management



How can you prepare your robot to navigate or perform some action without writing code?

Reinforcement Learning

Learn by interacting with the environment

Trial and error

Observe results

Optimize learning strategy to maximize long term reward

Model learns how to make complex decisions

AWS RoboMaker Simulation

Reinforcement Learning Environment

Real-world or a representation of the real world

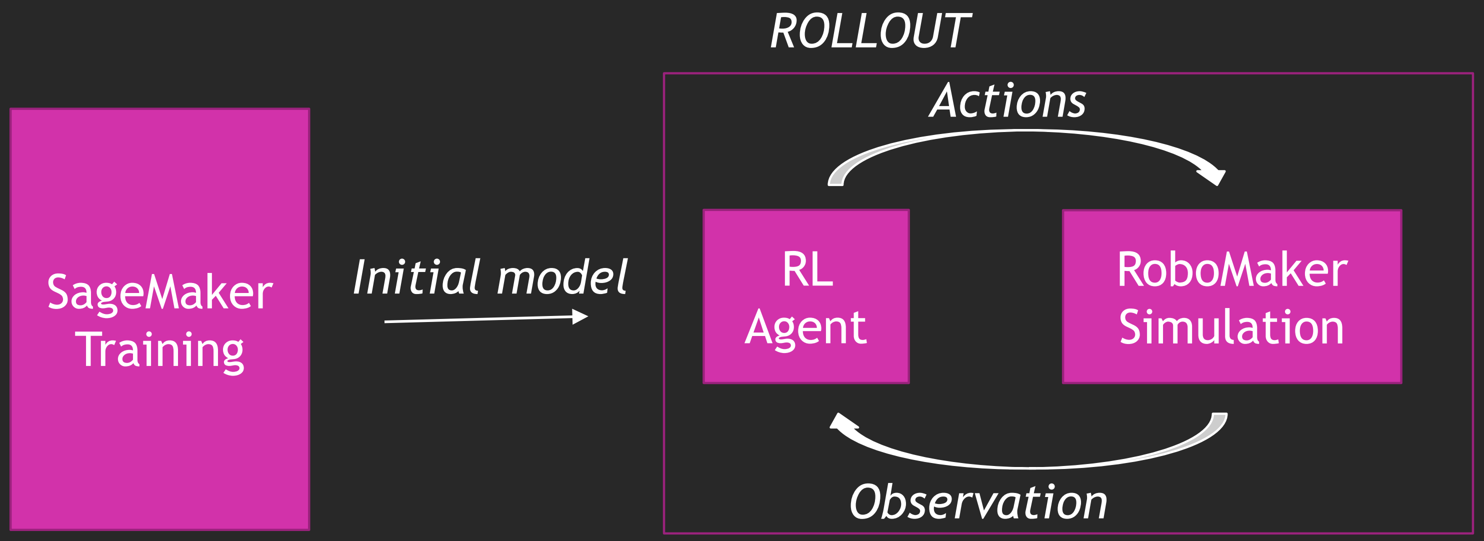
Programmed to represent real world conditions

Enables interaction with user or a computer program

Dynamic and updates itself based on the interactions and programmed behavior

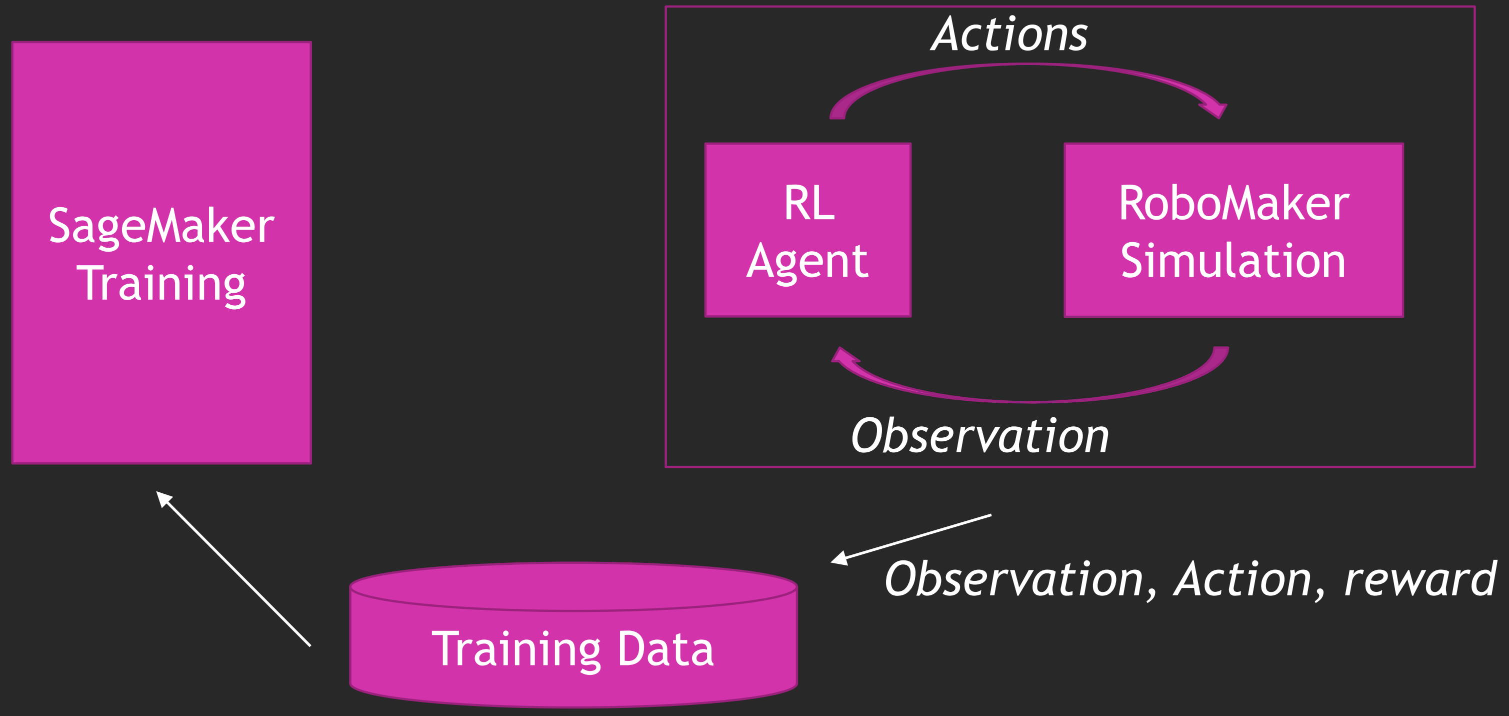
AWS SageMaker and AWS RoboMaker

Actions and Observations



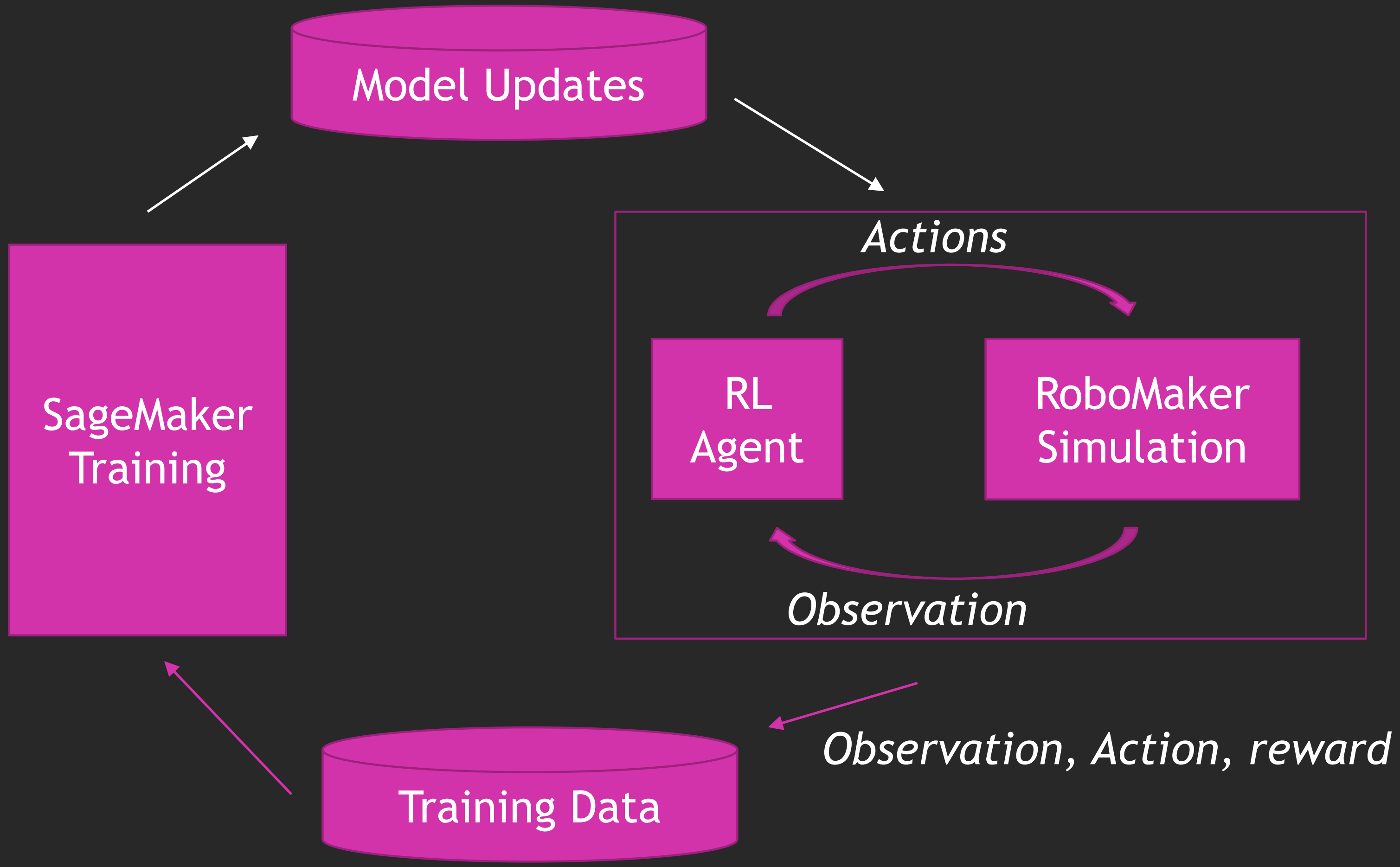
AWS SageMaker and AWS RoboMaker

Interactions in environment generate training data



AWS SageMaker and AWS RoboMaker

Training results in model updates



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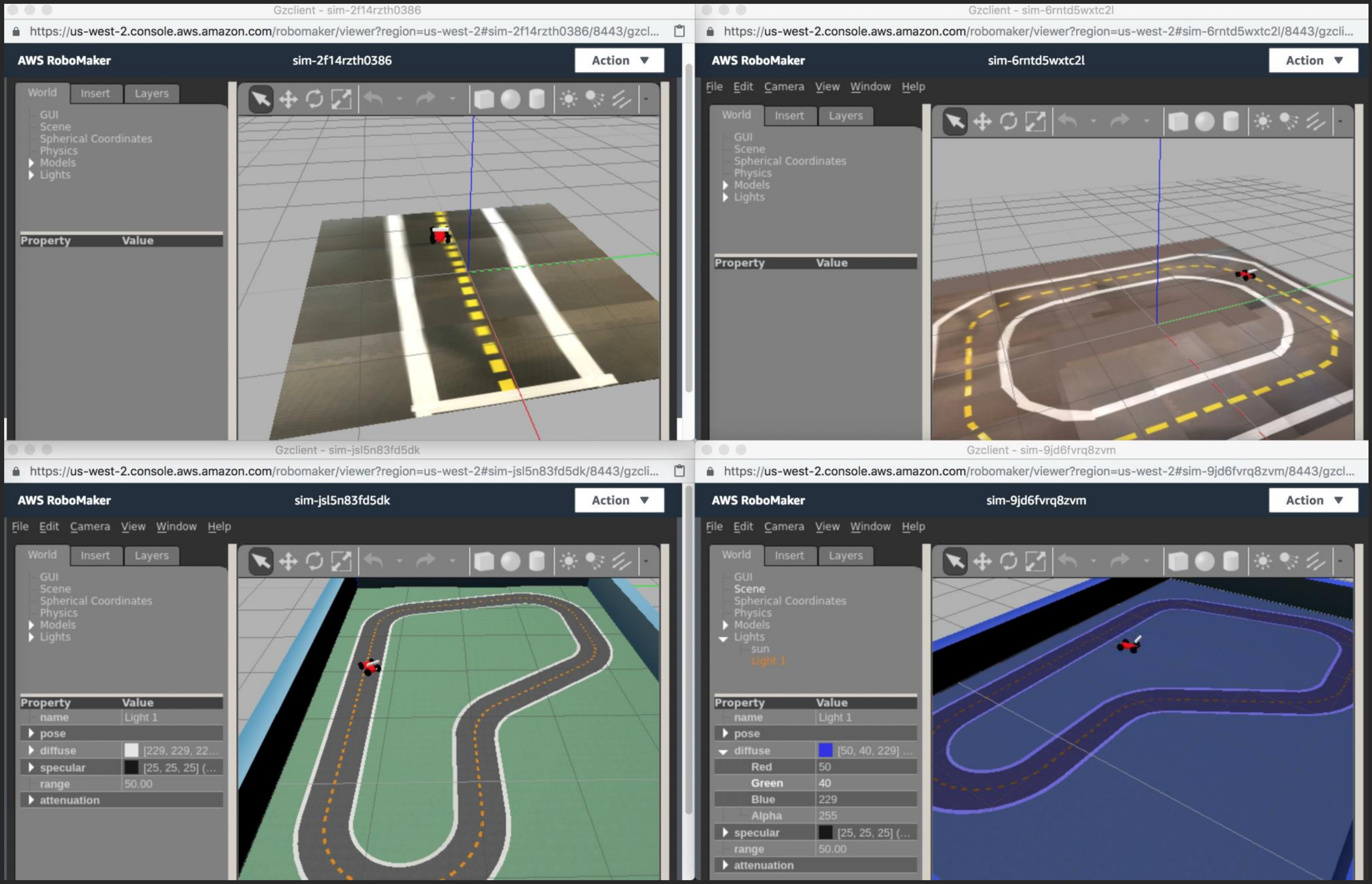
Reinforcement Learning for AWS DeepRacer



Gzclient - sim-2f14rzth0386

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Gzclient - sim-6rntd5wxtc2l

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Gzclient - sim-jsl5n83fd5dk

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Property	Value
name	Light 1
pose	
diffuse	[229, 229, 22...
specular	[25, 25, 25] (...
range	50.00
attenuation	

Gzclient - sim-9jd6fvrq8zvm

https://us-west-2.console.aws.amazon.com/robomaker/viewer?region=us-west-2#sim-9jd6fvrq8zvm/8443/gzcl...

Property	Value
name	Light 1
pose	
diffuse	[50, 40, 229] ...
Red	50
Green	40
Blue	229
Alpha	255
specular	[25, 25, 25] (...
range	50.00
attenuation	

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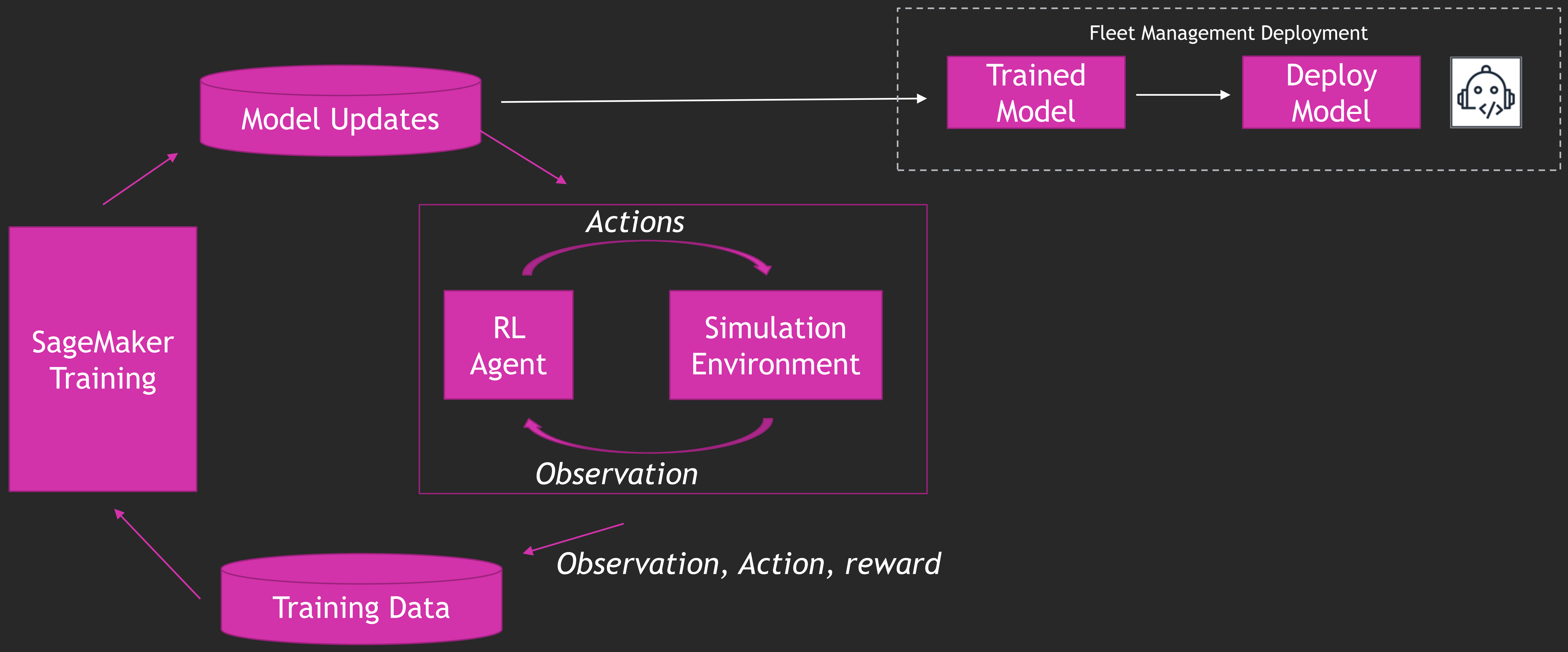
Evaluate and deploy trained models



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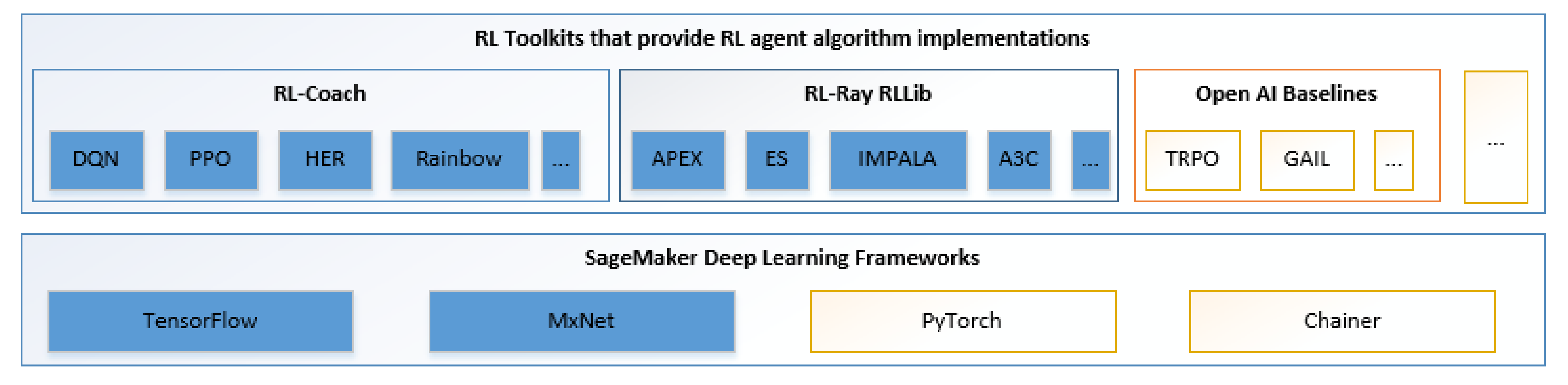
Successful Simulation to Real Transfer

AWS SageMager

Train RL models using state of the art algorithms



🟦 SageMaker supported □ Customer BYO

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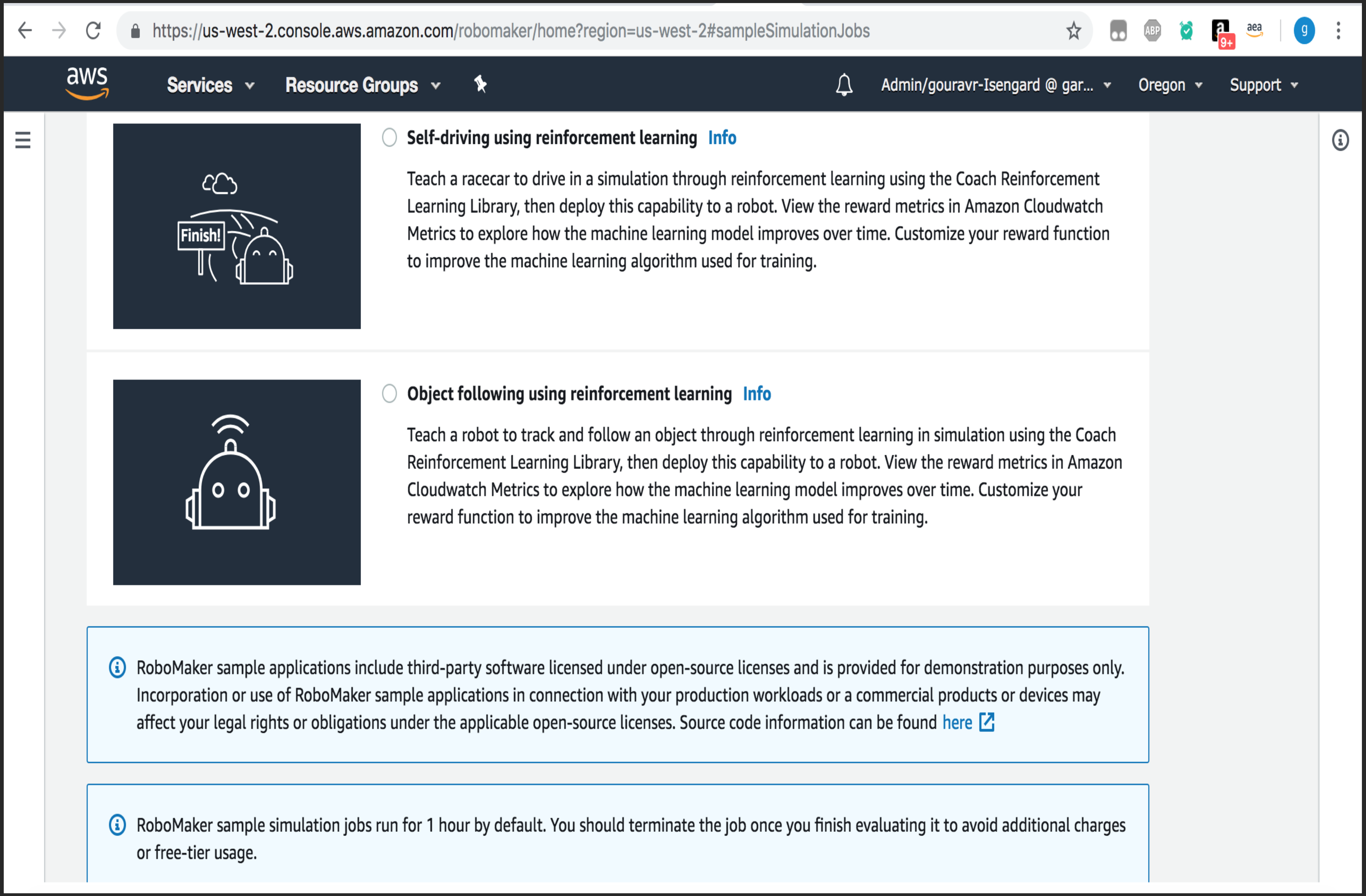
One Click Sample Applications Available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aws
Services
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Oregon
Support
Finish!

○ **Self-driving using reinforcement learning** Info

Teach a racecar to drive in a simulation through reinforcement learning using the Coach Reinforcement Learning Library, then deploy this capability to a robot. View the reward metrics in Amazon Cloudwatch Metrics to explore how the machine learning model improves over time. Customize your reward function to improve the machine learning algorithm used for training.

○ **Object following using reinforcement learning** Info

Teach a robot to track and follow an object through reinforcement learning in simulation using the Coach Reinforcement Learning Library, then deploy this capability to a robot. View the reward metrics in Amazon Cloudwatch Metrics to explore how the machine learning model improves over time. Customize your reward function to improve the machine learning algorithm used for training.

ⓘ RoboMaker sample applications include third-party software licensed under open-source licenses and is provided for demonstration purposes only. Incorporation or use of RoboMaker sample applications in connection with your production workloads or a commercial products or devices may affect your legal rights or obligations under the applicable open-source licenses. Source code information can be found here

ⓘ RoboMaker sample simulation jobs run for 1 hour by default. You should terminate the job once you finish evaluating it to avoid additional charges or free-tier usage.

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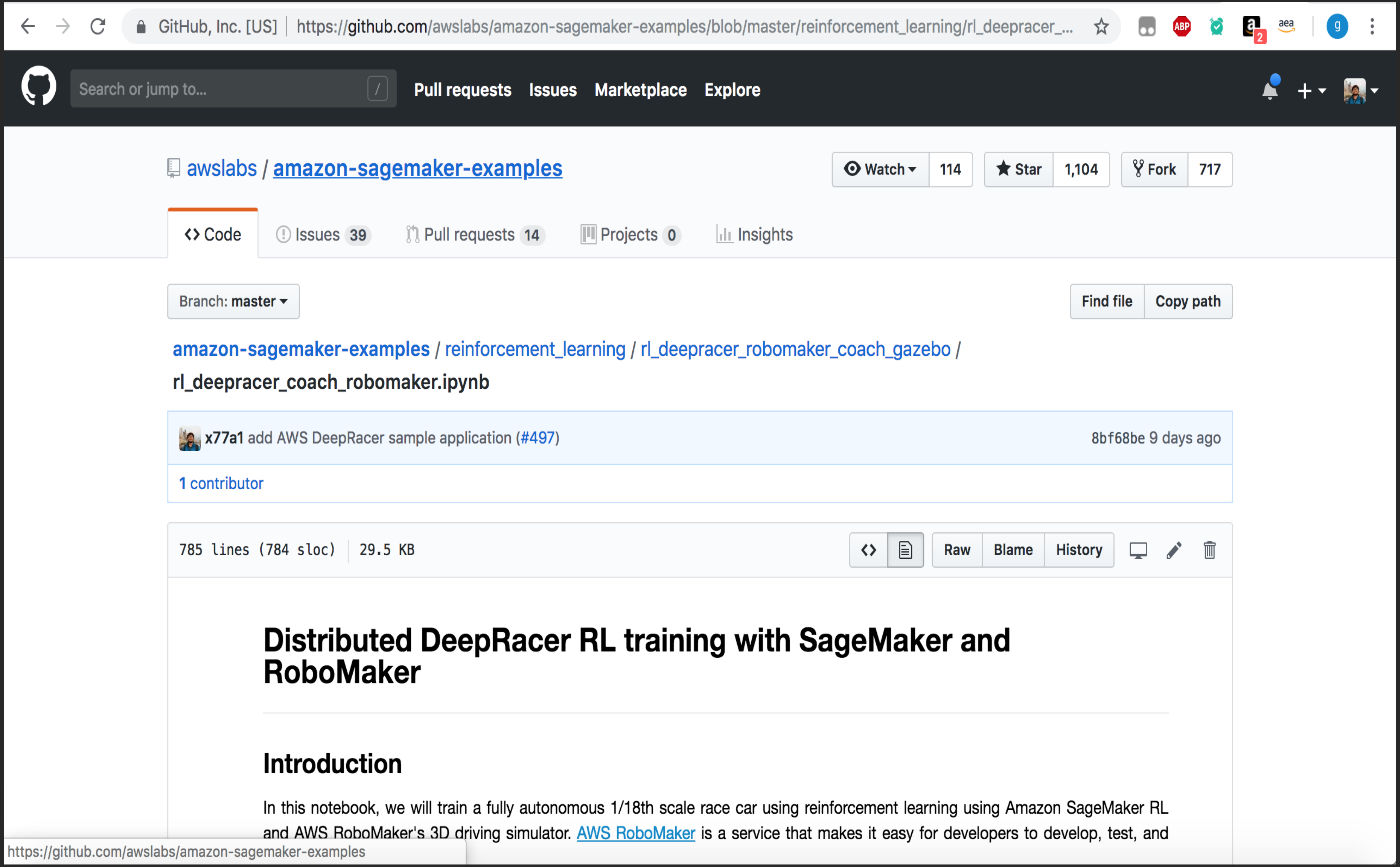
Source Code Publically Available on GitHub



amazon-sagemaker-examples / reinforcement_learning / rl_deepracer_robomaker_coach_gazebo / rl_deepracer_coach_robomaker.ipynb

x77a1 add AWS DeepRacer sample application (#497) 8bf68be 9 days ago

1 contributor

785 lines (784 sloc) | 29.5 KB

Distributed DeepRacer RL training with SageMaker and RoboMaker

Introduction

In this notebook, we will train a fully autonomous 1/18th scale race car using reinforcement learning using Amazon SageMaker RL and AWS RoboMaker's 3D driving simulator. AWS RoboMaker is a service that makes it easy for developers to develop, test, and

https://github.com/awslabs/amazon-sagemaker-examples

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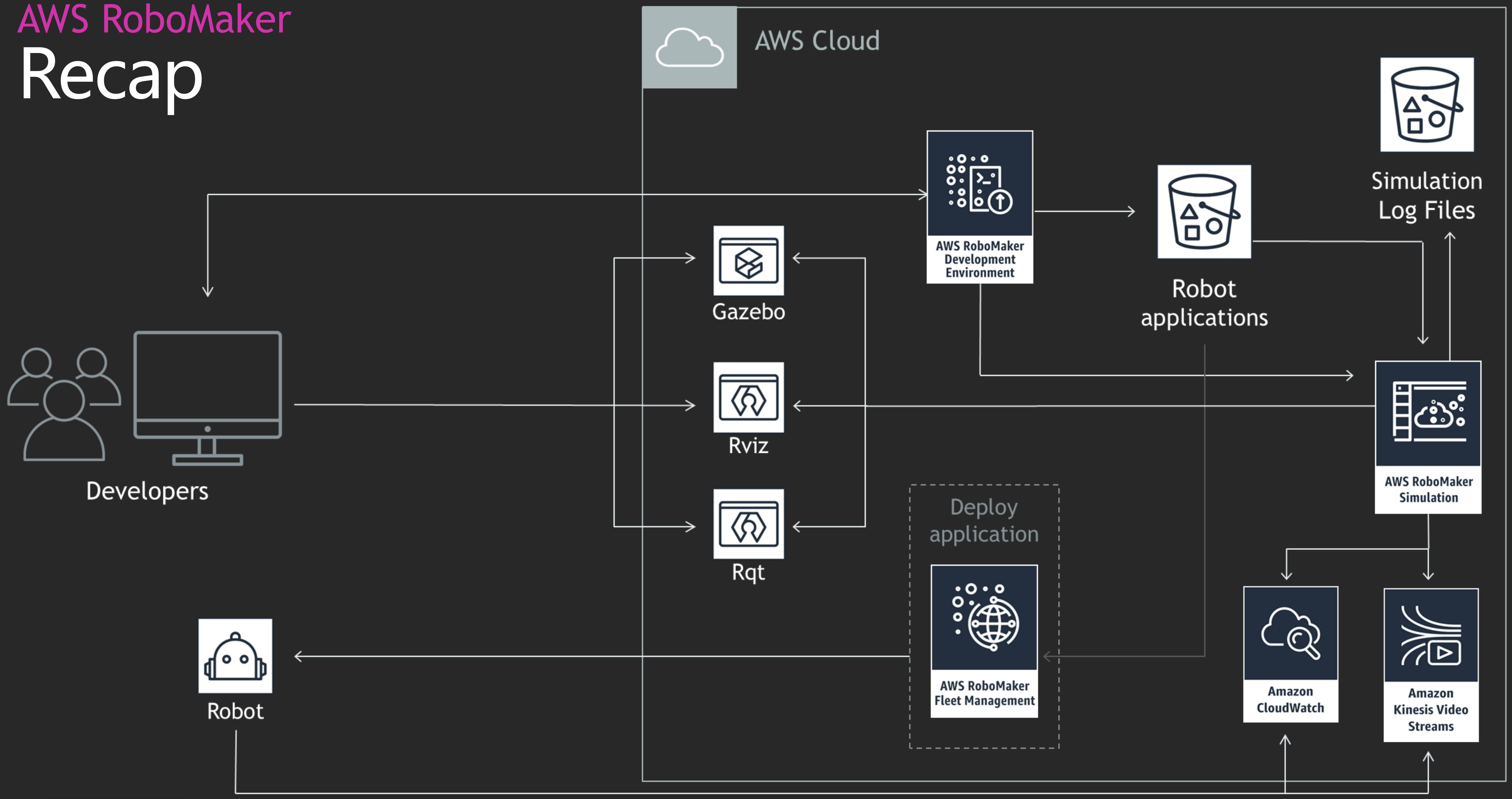
Recap



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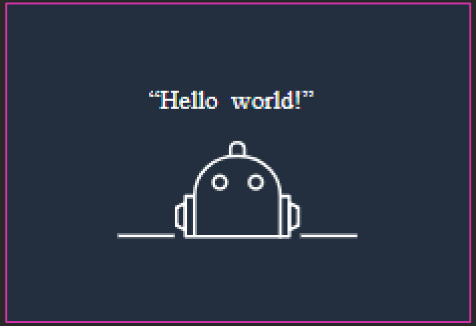
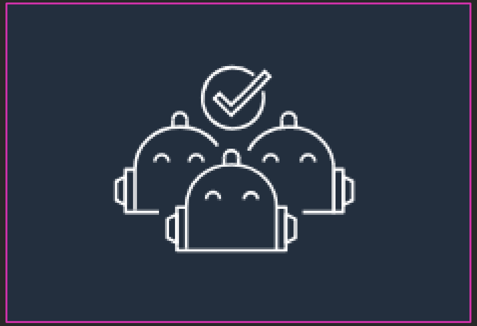
Sample Robot Applications



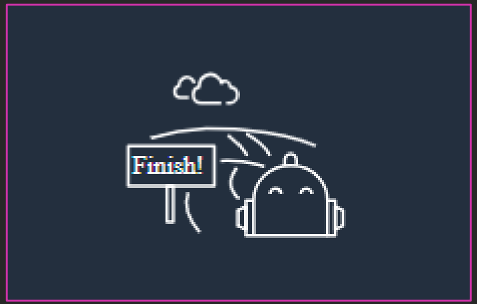
Hello World



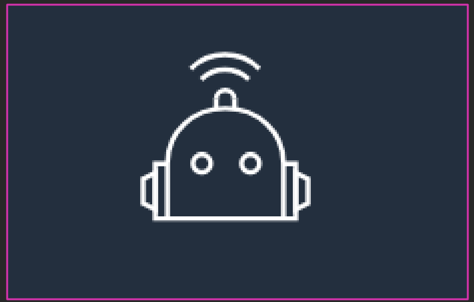
Robot Monitoring

Navigation and Person Recognition

Voice Commands



Self-Driving using RL



Object-Following using RL

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Customers

aibo

Apex.AI

EMBARK

Global Leading Smart Service Robot Company
FUTURE ROBOT

JPL
Jet Propulsion Laboratory
California Institute of Technology

lea™
LEAN
EMPOWERING
ASSISTANT

StanleyBlack&Decker

AWS RoboMaker

Partners

open robotics

FIRST®

ADVANCED Robot Solutions

PERSISTENT

“We’re excited to utilize Amazon RoboMaker, making it easier for students of all ages to develop, test, and deploy robotic applications,” said Don Bossi, President of *FIRST*.

“Offerings like these enable FIRST to better meet its mission - to inspire young people to be science and technology leaders and innovators by engaging them in mentor-based, science-focused programs.”

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Cal Poly

Georgia Tech Research Institute

W University of Washington

RMIT University

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University of Cambridge

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