Track 6| Session 6

透過 AWS AI 服務模擬、部署機器人於產業之應用

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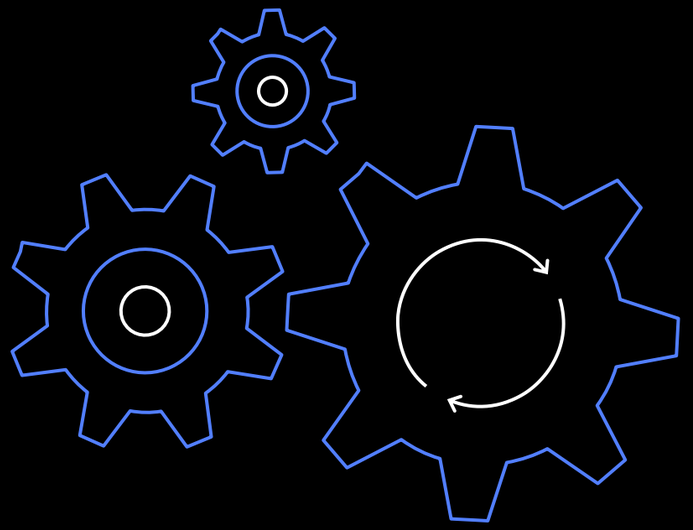
Amazon Web Services

aws SUMMIT

Introduction to robotics

What makes a robot?

Robotics use is accelerating in key industries



Robotics is undergoing fundamental changes in collaboration, autonomous mobility, and increasing intelligence

By 2023, it's estimated that mobile autonomous robots will emerge as the standard for logistic and fulfillment processes

By 2030, 70% of all mobile material handling equipment will be autonomous

Source: IDTechEx

- Logistics
- Construction
- Retail
- Healthcare
- Consumer Home
- Energy and Utilities
- Oil and Gas
- Agriculture

Open-source ROS

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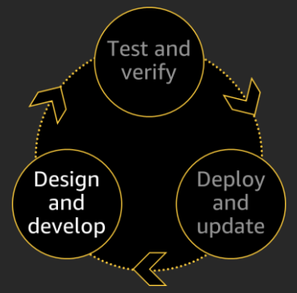

Design and develop robotics applications and functionality

ROS

GAZEBO

Agile development of robotics application requires software reuse and iterative development

AWS contributions to ROS 2

Quality of service (QoS) features for topics

Cross-compilation tools

ROS 2 launch sandboxing extension

Secure-ROS 2 (SROS2) improvements

Runtime analysis tools address and thread sanitizers (Asan/Tsan)

Created and maintains rcpputils core package

https://github.com/aws-robotics

Robotics software development with AWS RoboMaker

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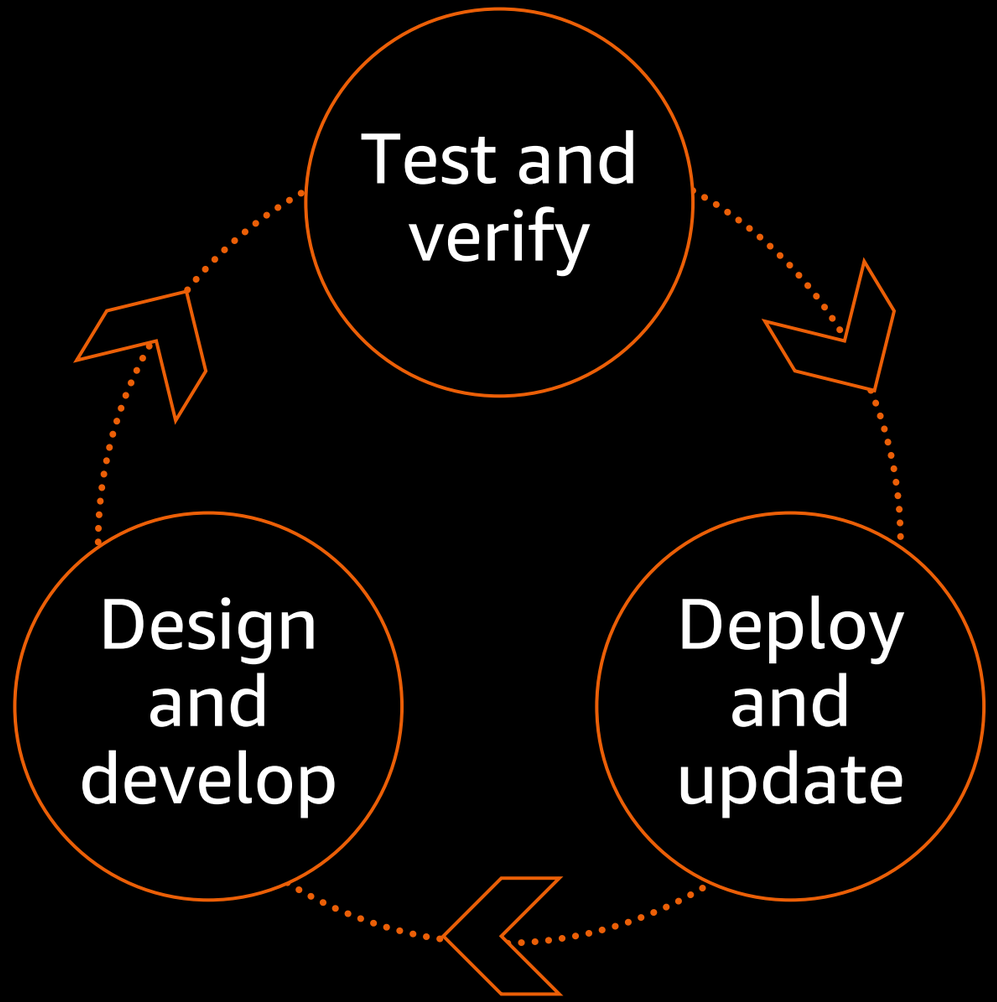
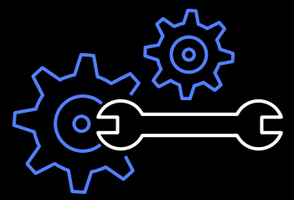
Robotics development lifecycle

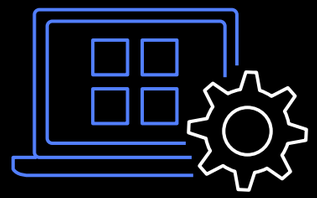


Challenges facing robotics developers

Lack of virtual assets for simulation



Lack of infrastructure to run simulations at scale



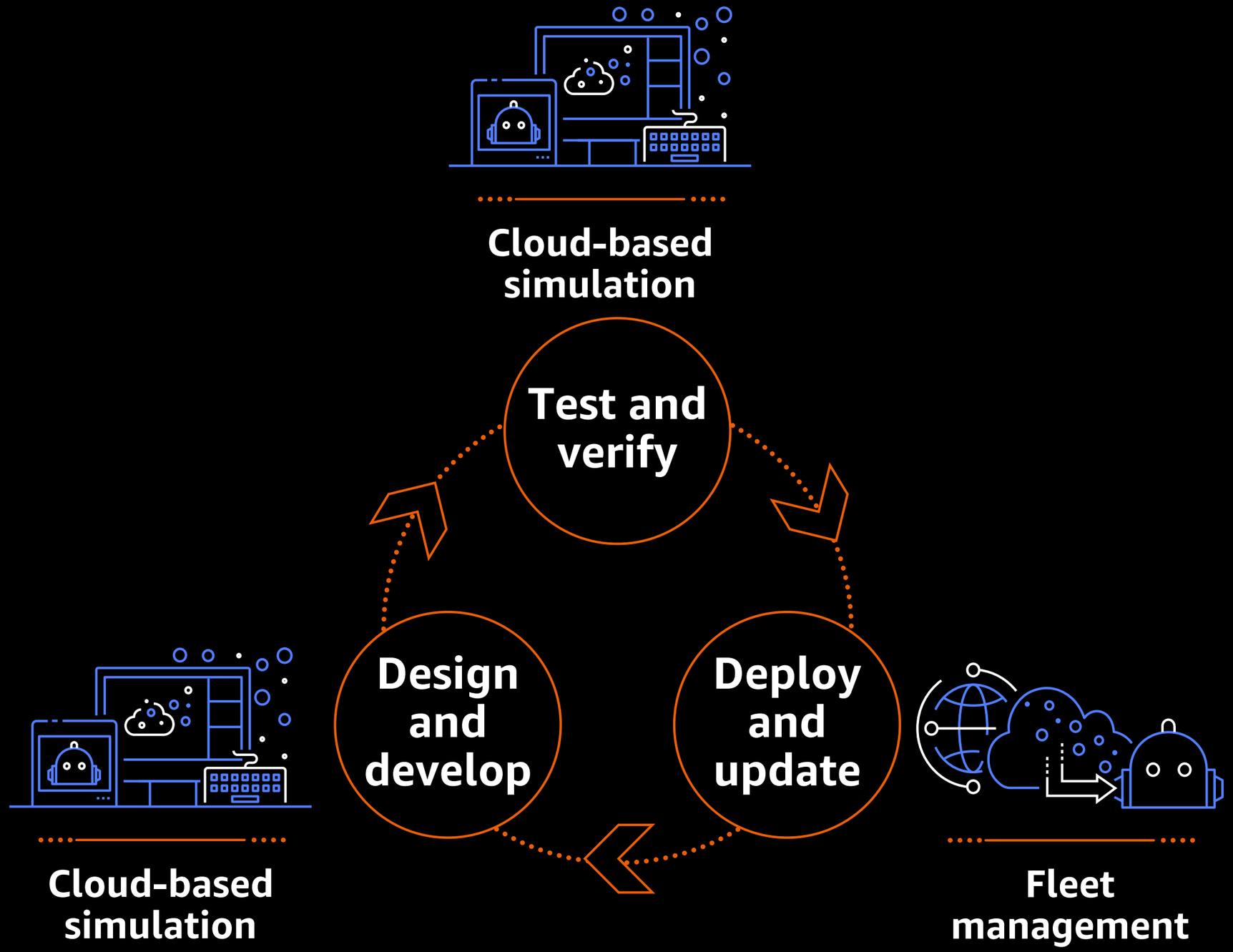
High cost of simulations at scale

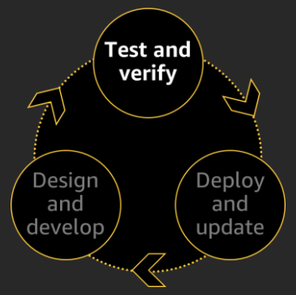
Lack of infrastructure for deployment at scale

Lack of security for deployment and update

AWS RoboMaker

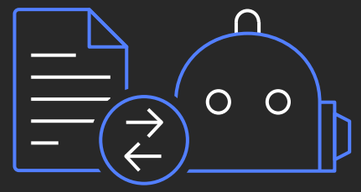
Easily simulate and deploy robotics applications at cloud scale



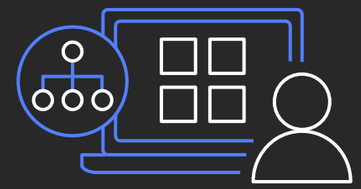


Cloud-scale simulations

Regression testing at cloud scale with CI/CD integration



Multi-robot simulations for testing fleet operations



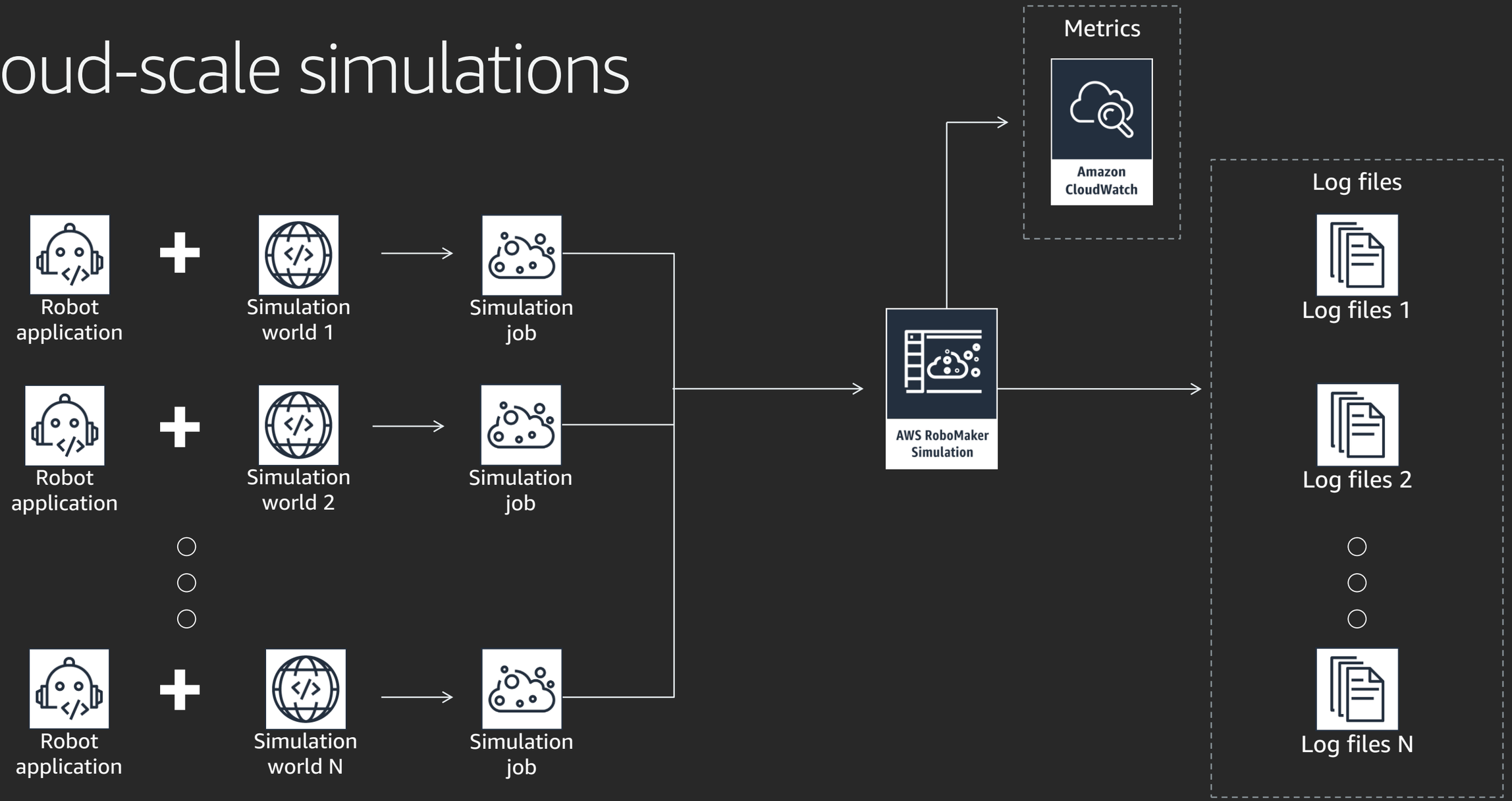
Machine learning model training

Fully managed simulation infrastructure at cloud scale with pay-as-you-go pricing

Cloud-scale simulations

- Use pre-built virtual 3D worlds provided out of the box, or bring your own
- Automatically provisioned, configured, and managed cloud infrastructure for Gazebo simulator
- Automatically scale based on simulation complexity
- Resource-based pay-as-you-go pricing at a minute granularity

Cloud-scale simulations



Simulation use case 1

Regression testing at cloud scale with CI/CD integration

- Regression testing upon every code update and every software release
- Playing back recorded rosbags or running Gazebo-based simulations
- Large-scale and concurrent simulations triggered in a batch using AWS RoboMaker simulation APIs
- Integration with CI pipeline (Jenkins, Travis, AWS CodePipeline, etc.)

iRobot®

Case study: Regression testing

Problem

- Limited test coverage for different floor layouts and scenarios
- Costly and time-consuming to test
- Late bug discovery in the field

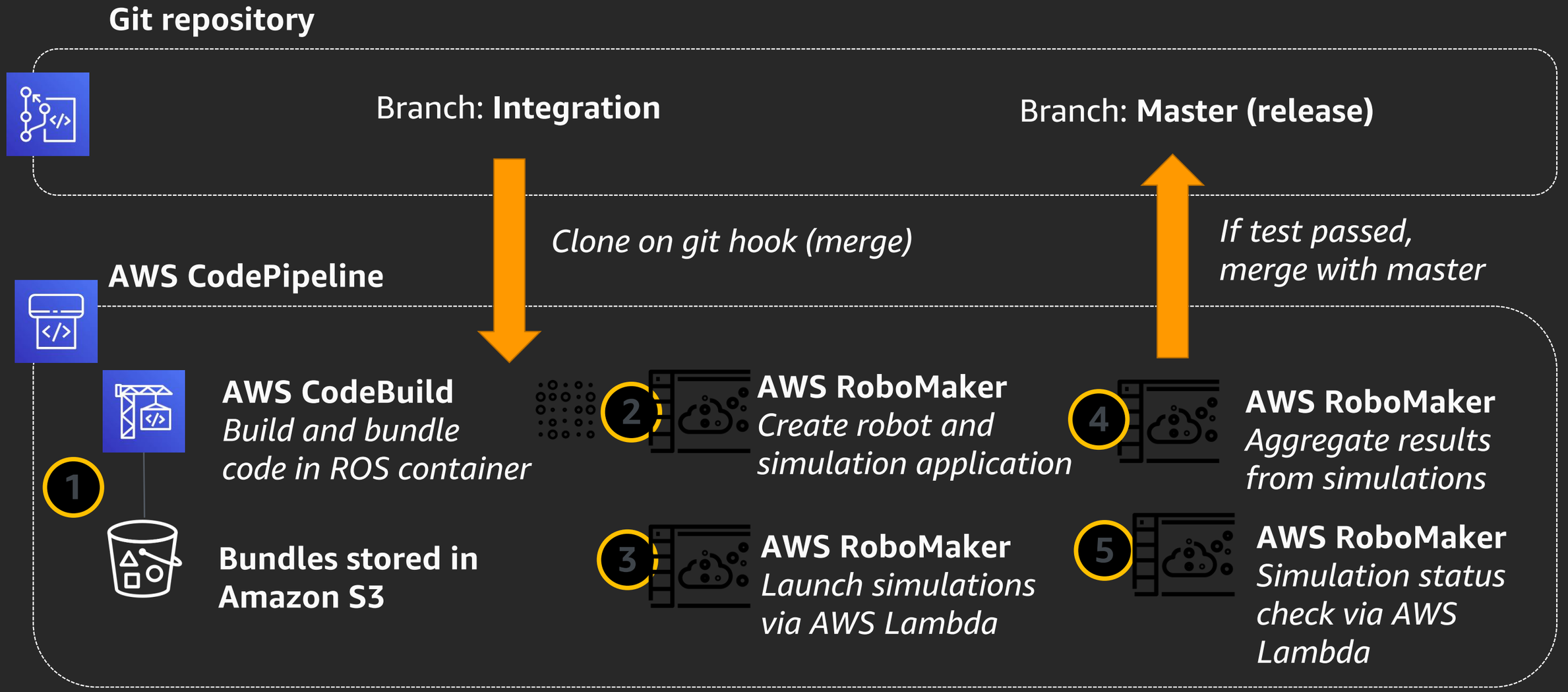
Solution

- iRobot built a CI/CD pipeline for large-scale and automated testing using the AWS RoboMaker simulation service
- More than 40 automated tests on each code commit and more than 500 automated tests for each release candidate

Business benefits

Much faster testing and release cycle (1 hour vs. 3 weeks for testing 70 complex localization scenarios)

Use case 1: Regression testing with CI/CD integration



Simulation use case 2

Multi-robot simulations for testing fleet operations

- Simulate multiple robots within the same environment
- Connect multiple simulations to a central fleet management software to test multi-robot orchestration
- Simulate inter-robot interactions or missions across robots

Bastian SOLUTIONS

Case study 2: Multi-robot simulations

Problem

- Bastian's software solutions enable the orchestration of a fleet of robots
- Software testing currently requires physical robots; practical limitation – can test only 8–10 robots in the lab

Solution

- AWS-enabled simulation of a multi-robot environment with 35+ robots, thus enabling testing without physical robots
- AWS services used: AWS RoboMaker, AWS Lambda

Business benefits

Bastian Solutions is easily able to test applications for larger environments without having to stand up physical devices

Simulation use case 3

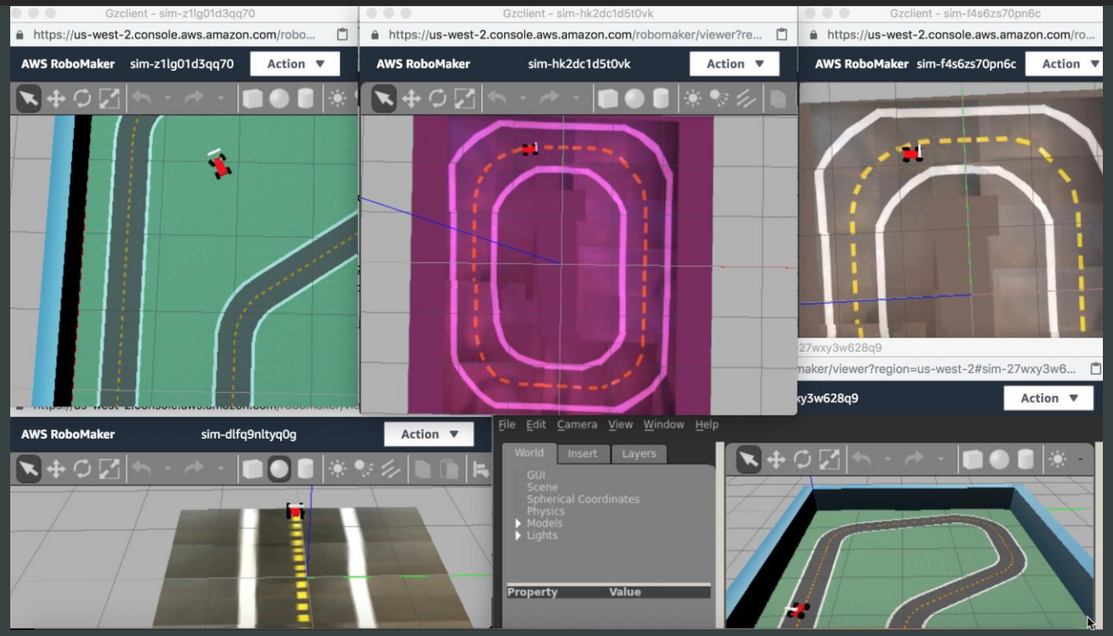
Machine learning model training

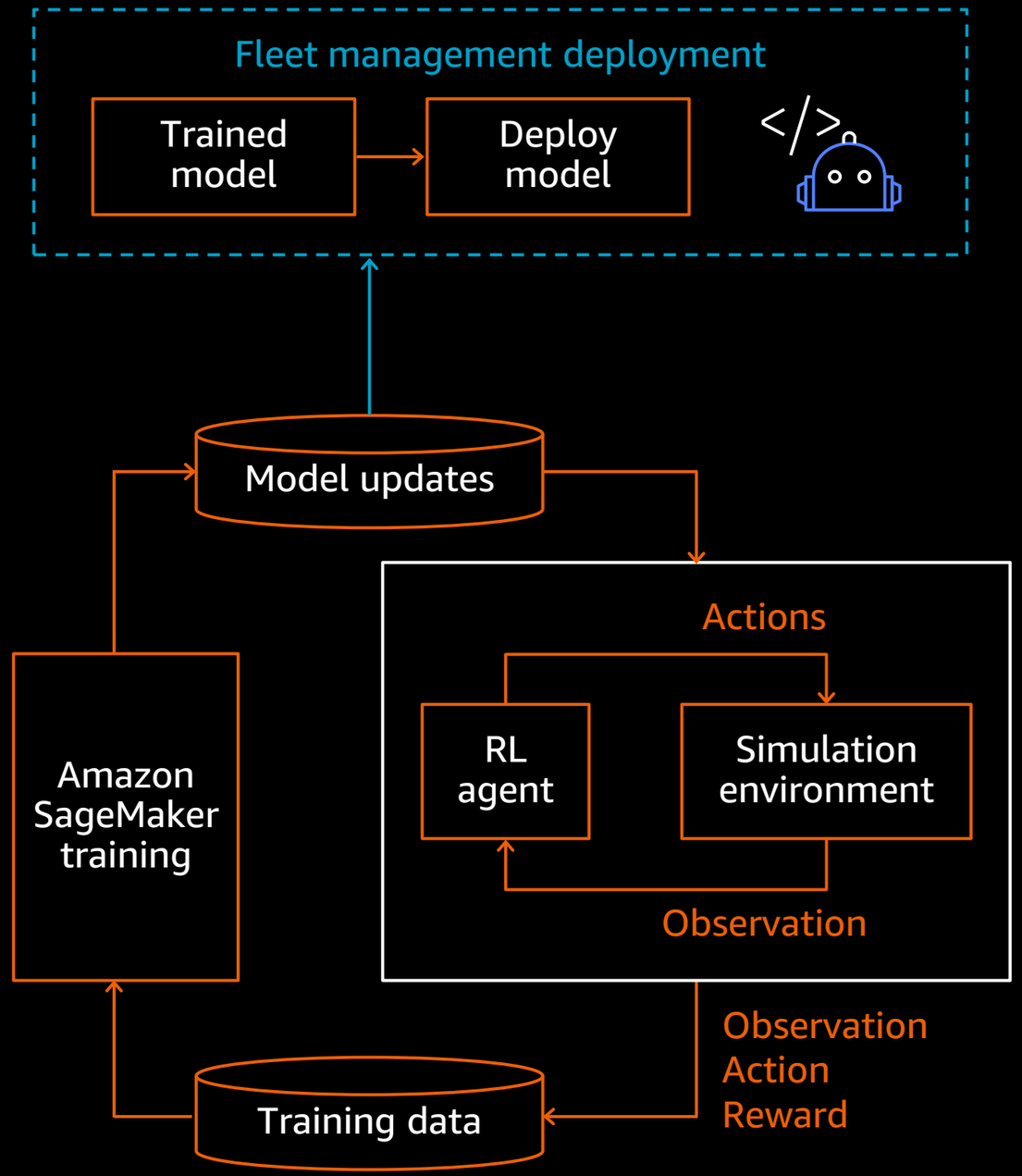
- Rapidly generate trial data in simulation to train reinforcement learning model
- Train reinforcement learning model natively in the simulation or in Amazon SageMaker
- Run concurrent simulations to speed up training of a single model

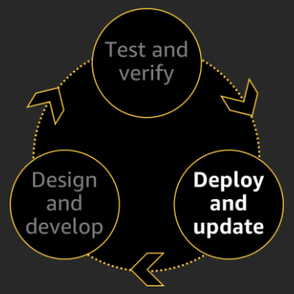
Use case 3: Machine learning model training

Use simulation to generate training data and test trained AI/ML models in simulation

Reinforcement learning (RL) can be used to learn a control scheme in simulation

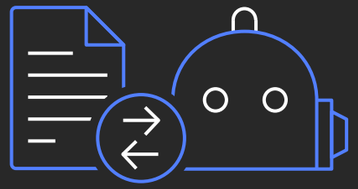






Deploy and update at cloud scale

Organization of robots by logical fleet



Ability to handle large fleet sizes

Built-in security features

Fully managed over-the-air update infrastructure at cloud scale

Cloud-scale fleet management

- Register robots with AWS RoboMaker fleet management, and organize them into fleets
- Deploy a ROS application into a robot fleet securely with just a few clicks
- Conditional over-the-air (OTA) updates
- Fleet monitoring and alerting*
- Fleet deployment auto-rollback*

* Coming soon

Try AWS RoboMaker today

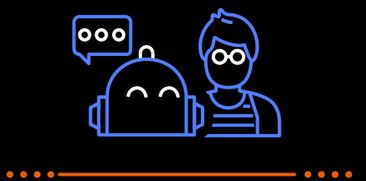
- Regression testing at cloud scale with CI/CD integration
- Multi-robot simulations for testing fleet operations
- Machine learning model training in simulations
- Over-the-air deployment with cloud-scale fleet management

aws.amazon.com/robomaker

Resources

Tutorials and workshops

Developer guide



Blog

Thank you!

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