Build your Smart Robot with AWS IOT/Robotics

Youhana Hana

Solutions Architect
AWS

The use of robotics is accelerating

"Trends suggest the global stock of robots will multiply even faster in the next 20 years, reaching as many as **20 million by 2030**."

Source: Oxford Economics

Industrial	Military	Retail & Hospitality	Exploration
Logistics	Energy, Oil & Gas	Life Sciences	Agriculture

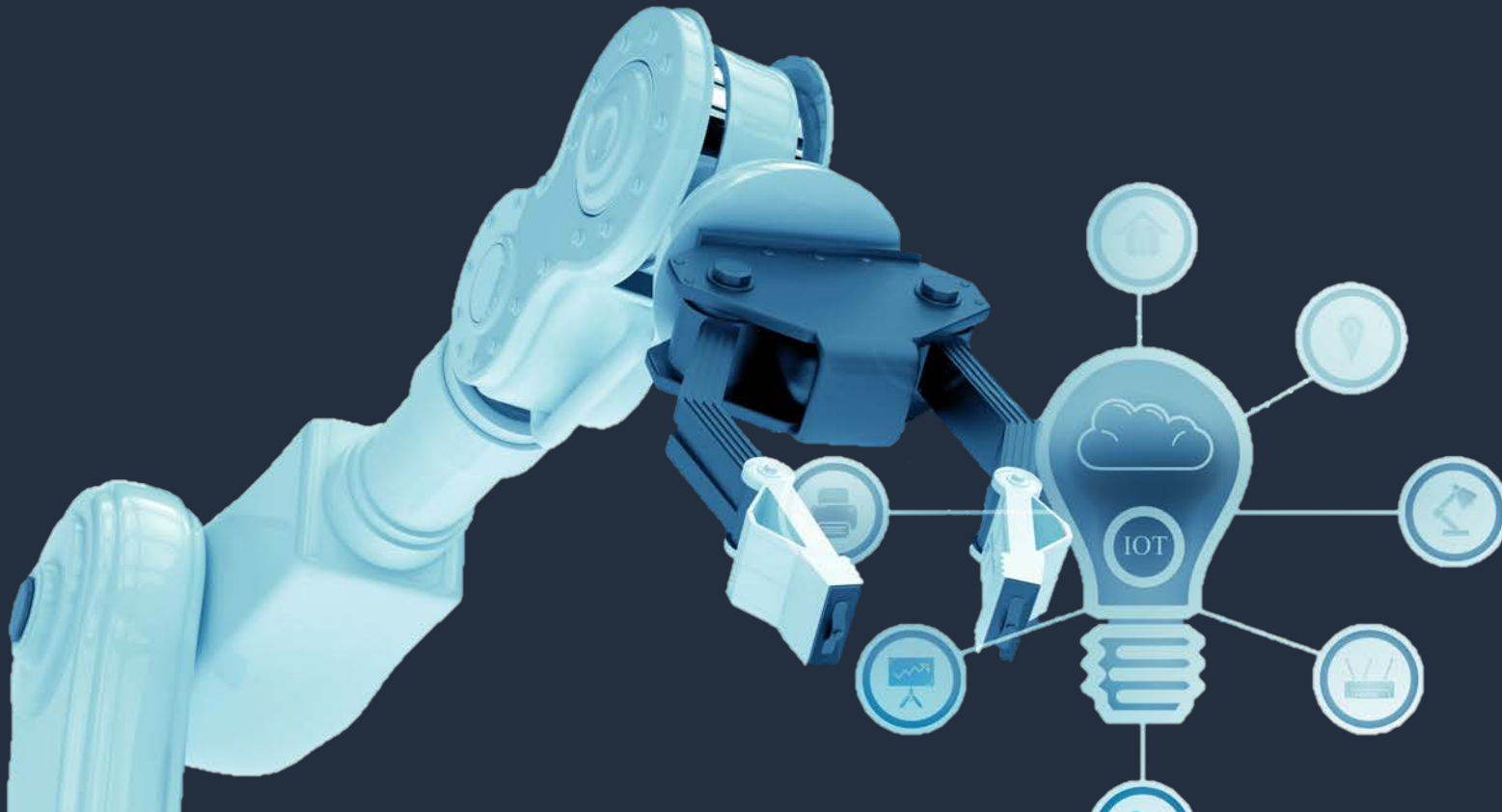# Evolution of robotics

First generations of robots

Simple, systematic tasks
Human directed or pre-programmed
Interaction through GUIs and peripherals

Current generation of robots

Complex, autonomous tasks
Human collaboration
Advanced, data-driven analytics

Data-driven robotics optimization and innovation

AWS makes it easier to capture data from your robots so you can build new applications, optimize automation, and drive efficiency.

Build mature solutions from day one
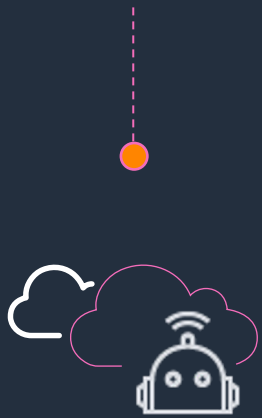
Differentiate with data-driven innovation
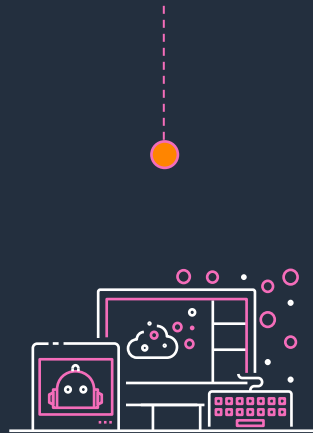
Scale robot fleets easily and reliably

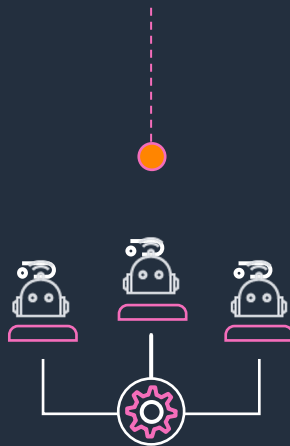**Extract the full value of robotics automation**
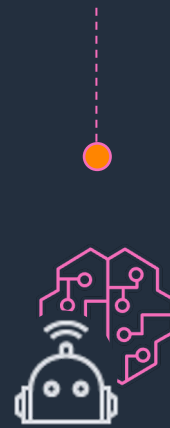
Common use cases
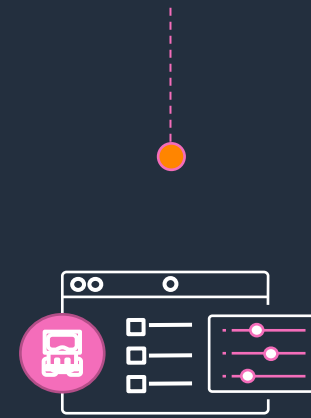

Telemetry data collection and storage

Testing and validation with simulation

Over-the-air (OTA) software provisioning

Machine learning operations (MLOps)

Fleet management and remote teleoperation
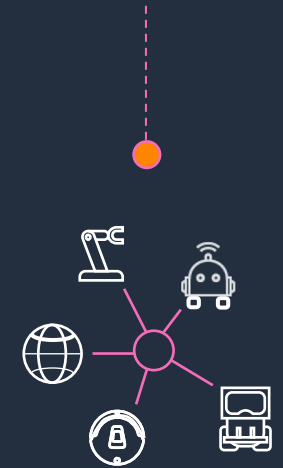
Multi-vendor shared space management

Advancing current generation robots with AWS

Robot fleet

Robots

Edge applications

1. Connect

2. Manage

3. Extend

aws AWS Edge Continuum

AWS Cloud

Local and global infrastructure

Hybrid edge compute services

And more…

Connectivity

Scenario-based testing

Interoperability

Video streaming with CV/ML

Log capture and analytics

Security and device management

And more…

Configuration and security
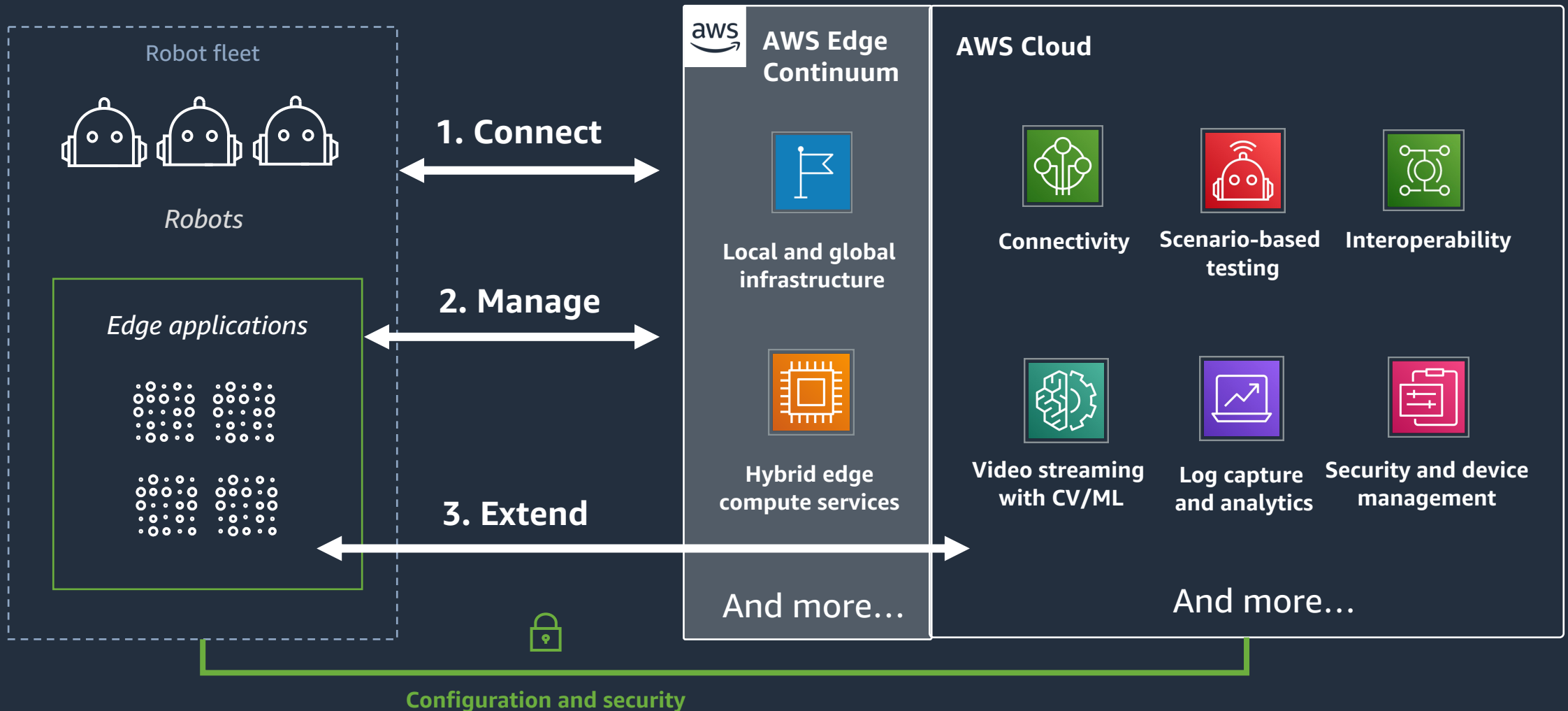
Internet of Robotic Things (IoRT) capabilities

CONNECT

Connect and interoperate with other robots, devices, systems, and equipment

LEARN

Computing and autonomy to execute complex functions, workloads, and make decisions

SENSE

Collect and process data streams from sensors, LiDARs, cameras

ACTUATE

Interact with environment, humans, and other automation safely
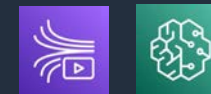
Common Use Case Architectures

AWS **Internet-of-Robotic-Things Connectivity**
Application Architecture

© 2023, Amazon Web Services, Inc. or its affiliates.
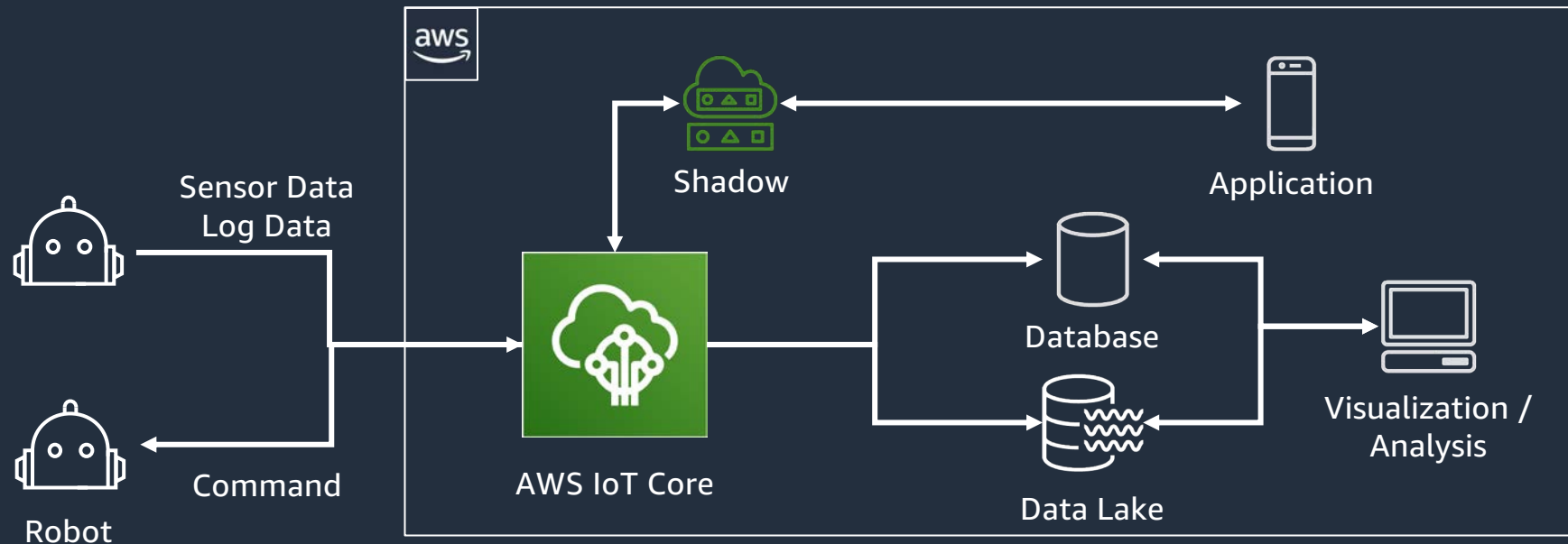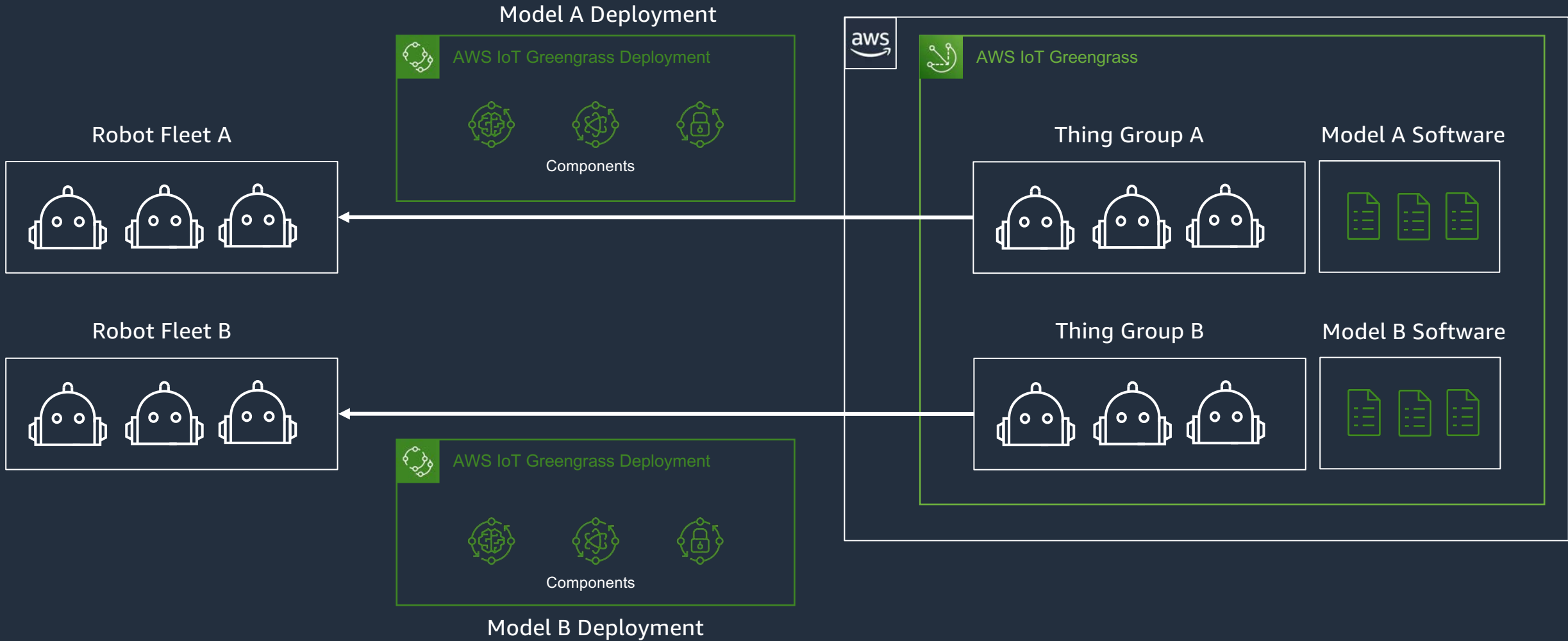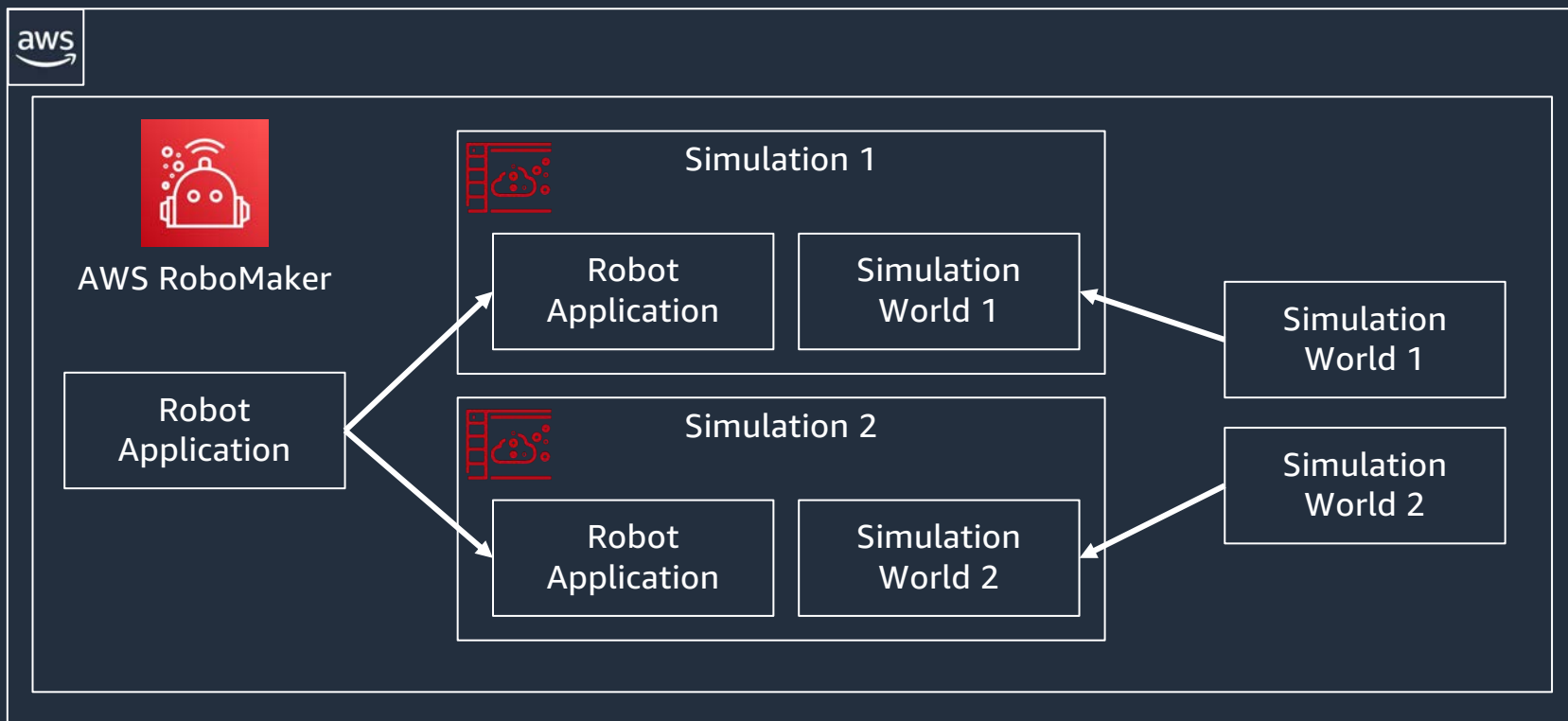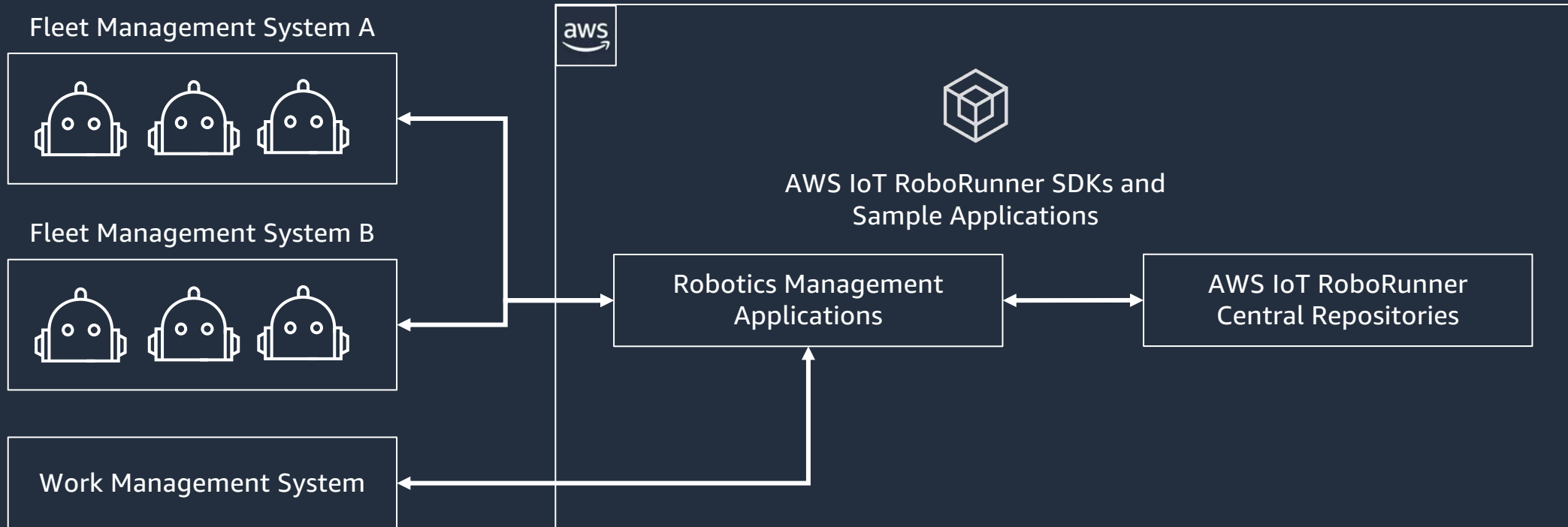
Material movement example: Shared space

Customer facility

Part 2 (Pickup P2)

Robot (R2)

Part 1 (Pickup P1)

Robot (R1)

Shared space

Assembly (Drop-off D1)

Entry points   Exit points
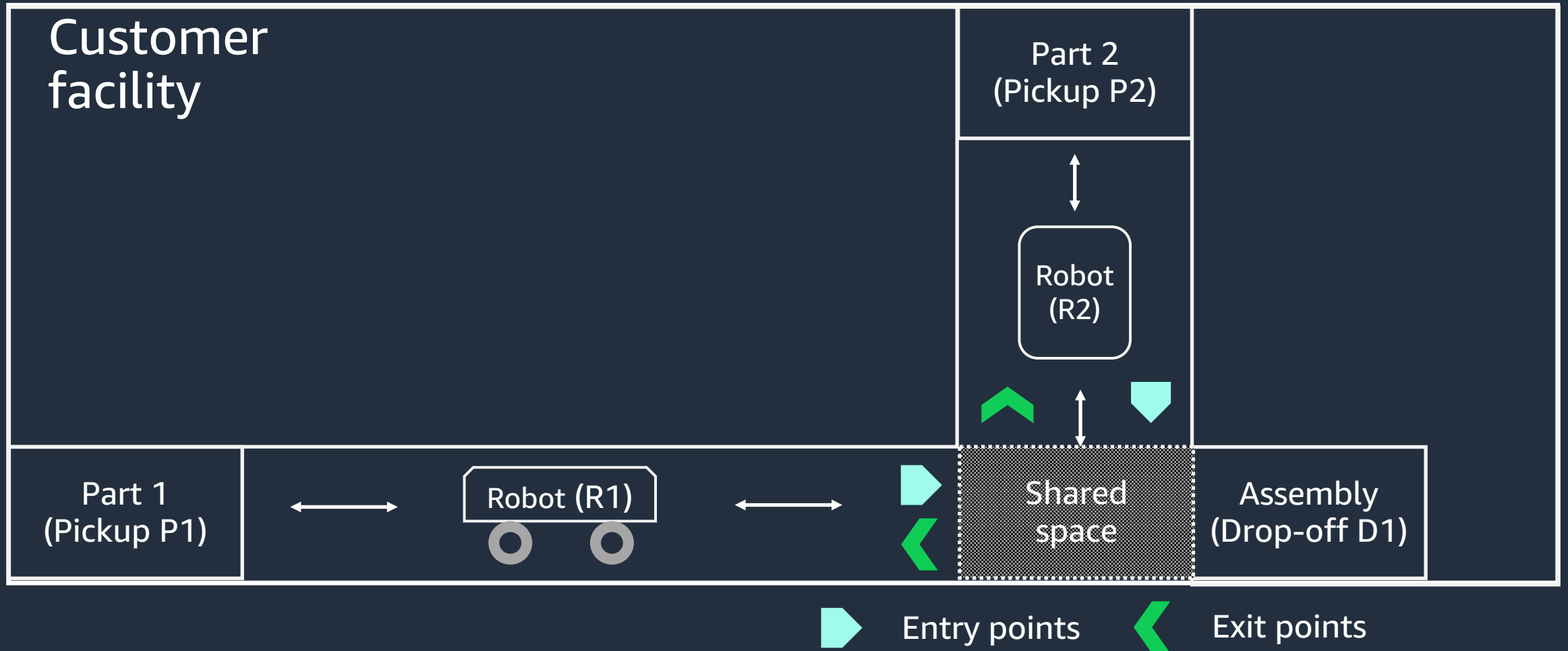
Example Solution: Robot Application CI/CD Pipeline with AWS

AWS CodePipeline

Branch: **feature** — *Pull Request* → *Branch:* **integration**

Merge → *Branch:* **mainline (release)**

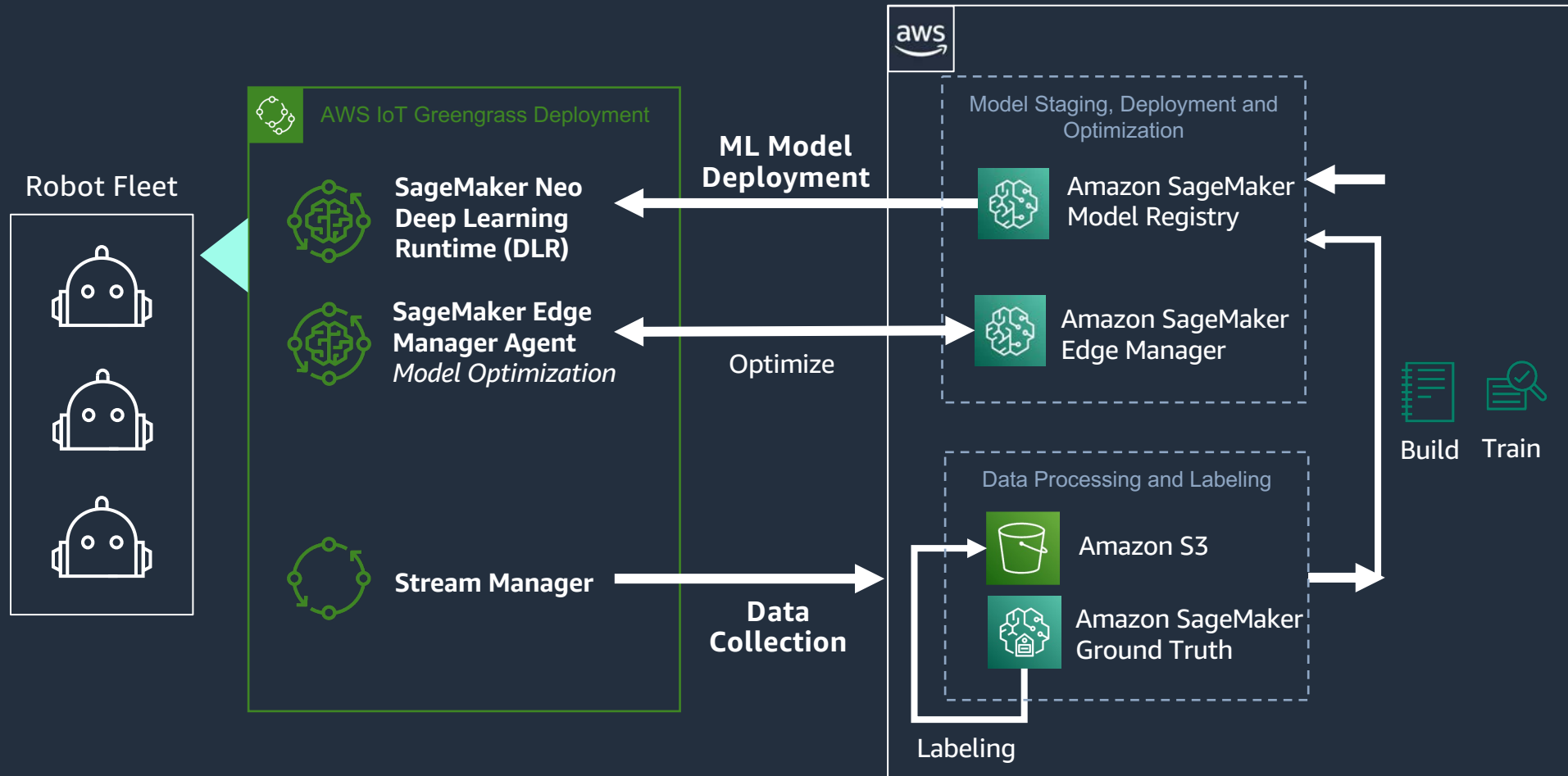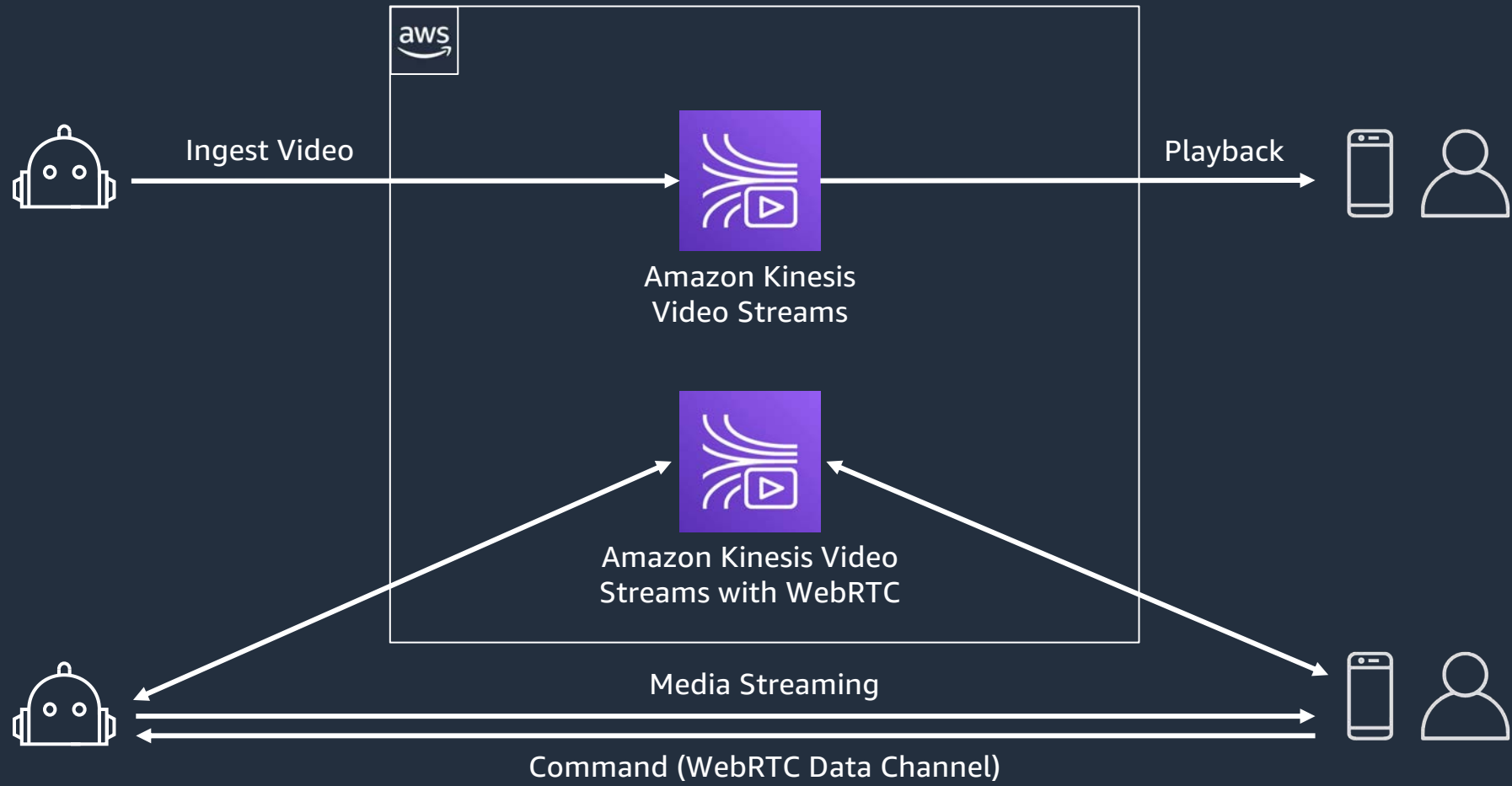| STAGES	>>	Source	>>	Build	>>	Test (Simulation)	>>	Test (Deploy)	>>	Deploy

ROS/ROS2
Development Environment

IGNITION

ROS/ROS2
Simulation Environment

AWS CodeCommit
Merged pull request

AWS CodeBuild
Build docker images and store in ECR

Amazon ECR
Built Container Images

robot:runtime
sim:runtime

AWS Step Functions:
Test in Simulation

AWS RoboMaker
Batch Simulation API

Amazon S3
Results

Amazon Athena
Interactive query service

Amazon QuickSight
Test Data Visualizations

AWS Greengrass
Test on Robots

Stream Manager

Test Fleet (Real-world)

Release Candidate in Amazon ECR

Deploy to Production Robots

AWS Greengrass
Deploy Stage

Production Fleet

aws

Enhancing Spot inspections with AWS

AWS Cloud

- AWS Amplify (Dashboard)
- Amazon DynamoDB (Valve metadata)
- AWS IoT Core
- AWS Lambda (Query metrics)
- AWS AppSync (GraphQL API)
- Tensorflow model (SageMaker endpoint)
- Amazon CloudWatch (Valve metrics)
- AWS Lambda (Valve mutations)
- Amazon S3

Trigger mission start

Publish robot state

Call remote inference in cloud

Upload mission data

Running on Spot compute payload

AWS IoT Greengrass

- Robot State & Mission Replay
- Network Compute Bridge Plug-in
- Network Compute Bridge Server
- NVIDIA Triton Inference Server
- Docking Callback Service
- Local Tensorflow model(s)

Get started today!

Documentation and blogs

AWS Robotics blog: https://aws.amazon.com/blogs/robotics/

AWS IoT Greengrass: https://aws.amazon.com/greengrass

Open-source assets

ROS2 tools, sample applications, cloud extensions,
Gazebo simulation worlds, and more

https://github.com/aws-robotics

https://github.com/aws-samples

Thank you!