
AWS
re:Invent

IOT306

Managing robot fleets with AWS

Jeremy Wallace

Principal Solutions Architect – Robotics

AWS

Massimiliano Angelino

Principal Solutions Architect – IoT

AWS

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Agenda

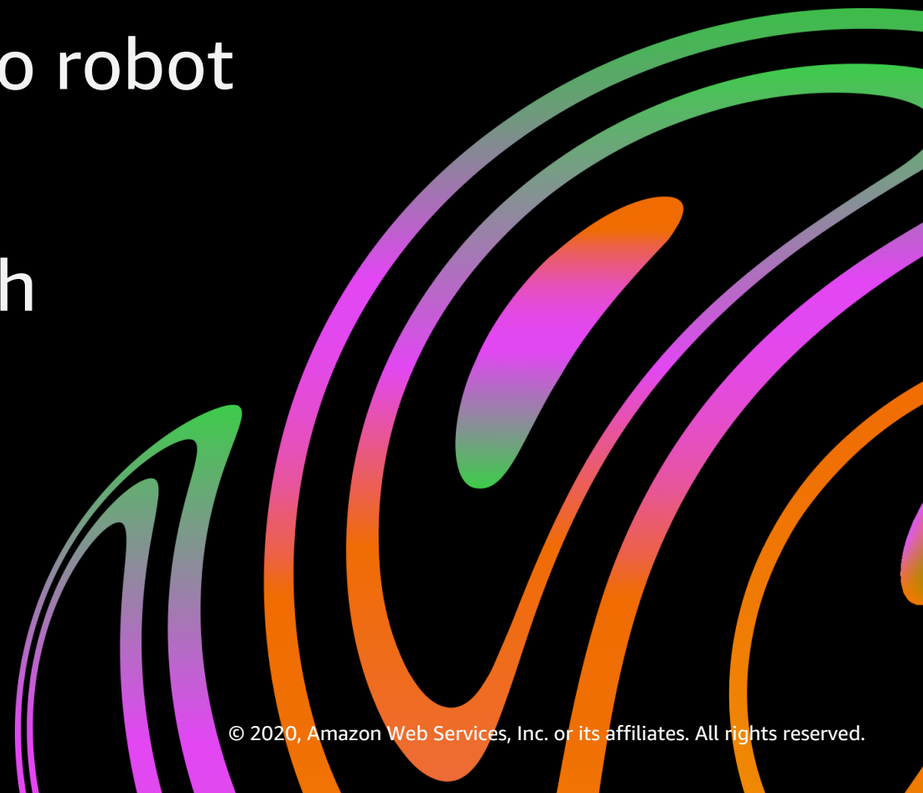
Common challenges in robot fleet management

Introduction to robot application development with Robot Operating System (ROS)

Deploying ROS applications over-the-air (OTA) to robot fleets with AWS IoT Greengrass 2.0

Visualizing and managing active robot fleets with Fleet Hub for IoT Device Management

Demo: Dance party with robots!



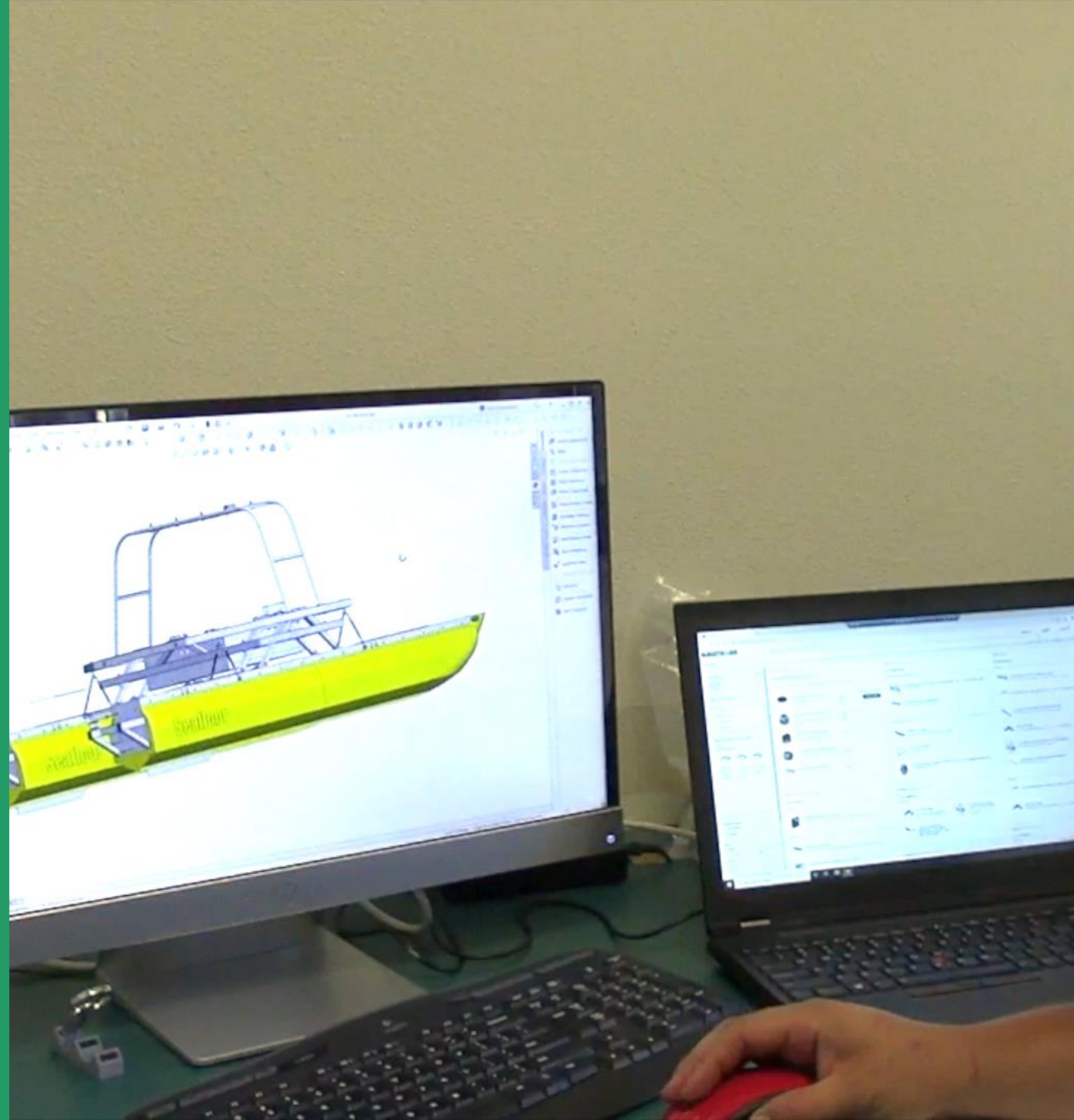
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Seafloor™

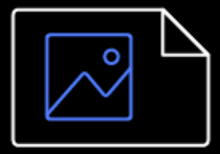
Complete survey solutions
***from* hydrographers, *for* hydrographers.**

“Using AWS Greengrass, our ROS-based software can now be easily provisioned and updated over-the-air.

This will save countless technician hours and enable us to focus on what we do best – building state-of-the-art tools and robots for hydrographers.”



Common challenges with robot fleet management



Over-the-air software updates



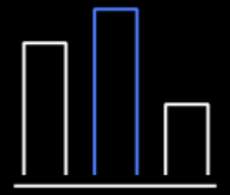
Secure access control



Remote operations



Remote troubleshooting



Fleet monitoring and alerting

Building robot applications with ROS



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Robot Operating System (ROS)

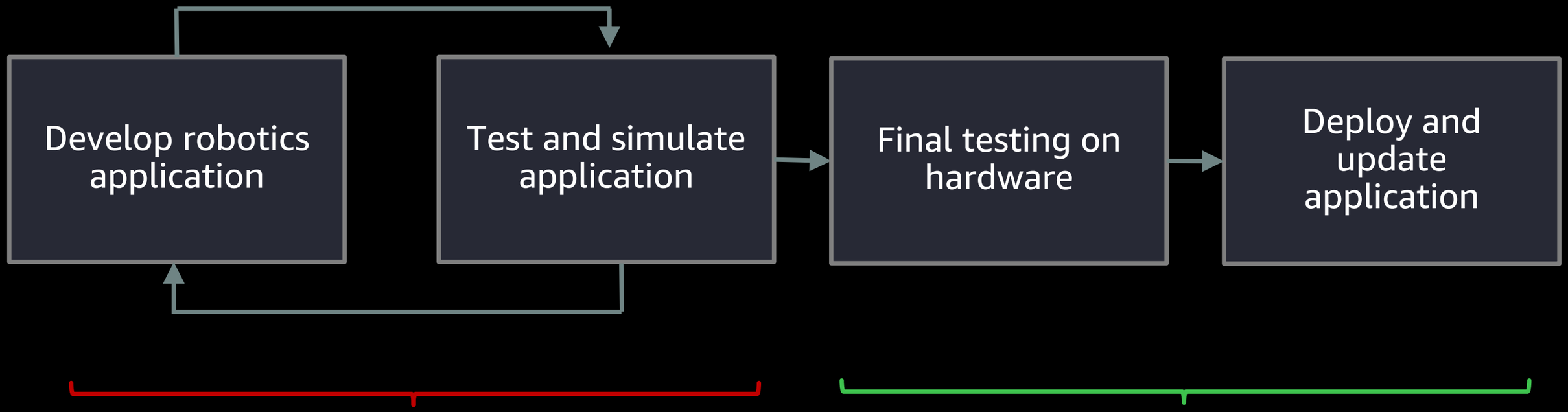
Built to encourage collaborative robot application development



The Robot Operating System (ROS) is a flexible framework for writing robot software. It is a collection of tools, libraries, and conventions that aim to simplify the task of creating complex and robust robot behavior across a wide variety of robotic platforms.

https://www.ros.org

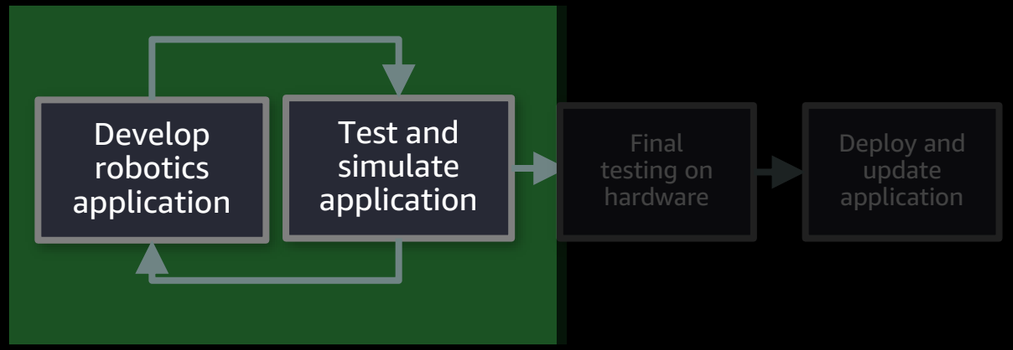
Robot software development cycle



AWS RoboMaker
simulation service

AWS IoT Greengrass 2.0

Building and bundling ROS applications



Build

ROS workspace:
src/
- jetbot_dance
- jetbot_dance_simulation

```
$ colcon build
$ colcon bundle
```

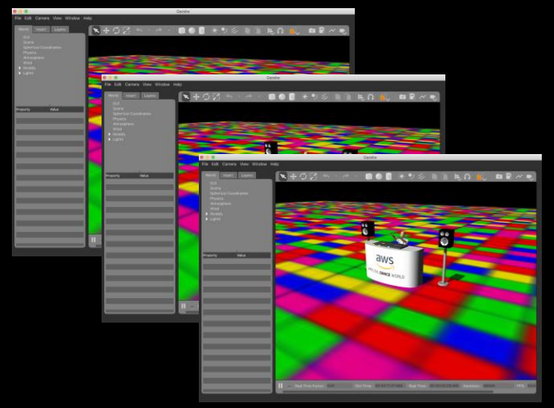
Bundle

TAR **output.tar**

Dependencies

Built workspace

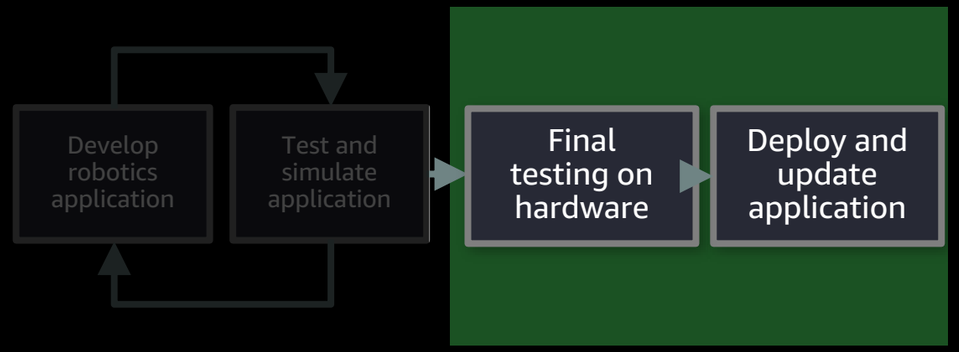
Simulate



Colcon is a common build tool used with ROS applications

AWS RoboMaker
simulation service

Building and bundling ROS applications



Build

ROS workspace:
src/
- jetbot_dance

```
$ colcon build
$ colcon bundle
```

Bundle

TAR **output.tar**

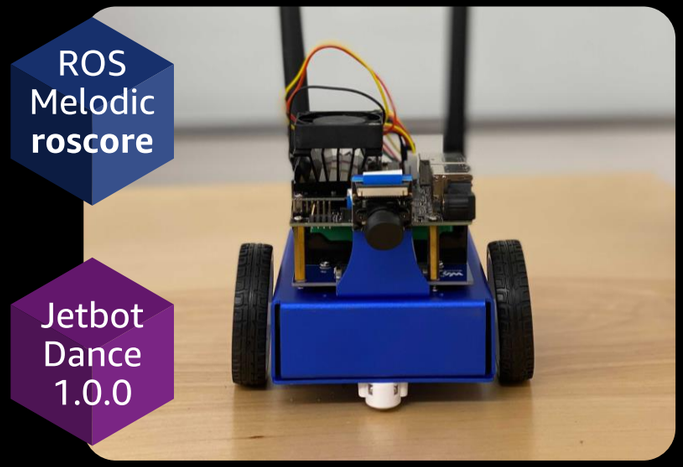
dependencies.tar.gz
- ROS distribution
- System dependencies

built_workspace.tar.gz
- ROS application packages

Deploy

ROS PACKAGE NAME | LAUNCH FILE

roslaunch jetbot_dance dance.launch



AWS IoT Greengrass 2.0

Deploying and launching ROS applications with AWS IoT Greengrass 2.0

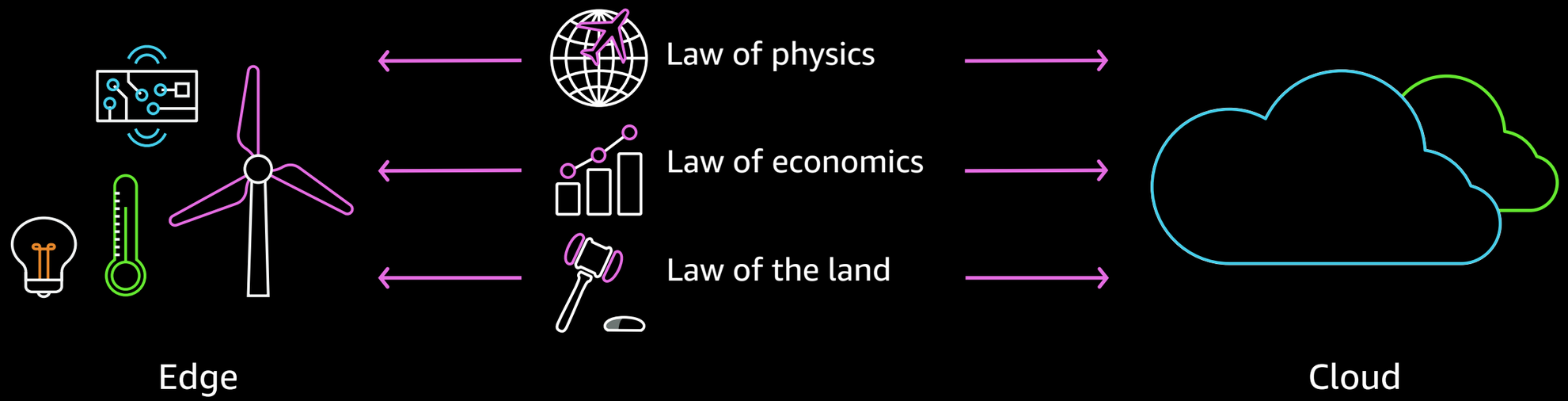


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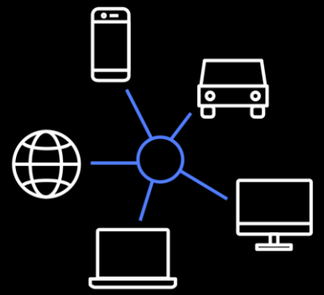
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What is AWS IoT Greengrass?

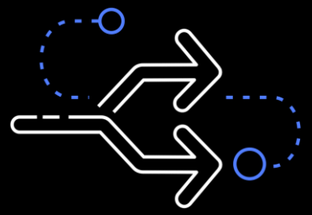
AWS IoT Greengrass extends AWS services onto your devices so that they can act locally on the data they generate while still taking advantage of the cloud



AWS IoT Greengrass 2.0



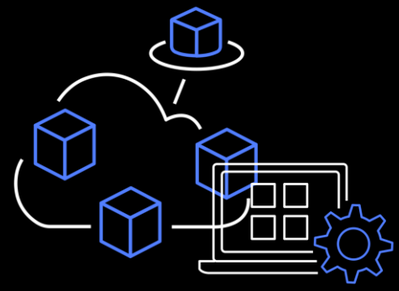
Portable Java core engine



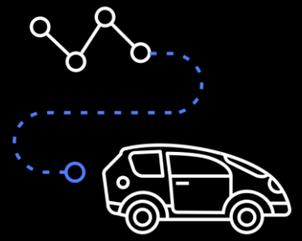
Component's dependency and lifecycle management



Lambda, Docker, and BYOR



Local edge development and cloud orchestration



Deployments to individual devices and groups of devices

Provisioning robots with AWS IoT Greengrass 2.0

Component recipe

Dancebot 1.0.0

```
---
RecipeFormatVersion: 2020-01-25
ComponentName: com.example.jetbot
ComponentVersion: 1.0.0
ComponentDescription: Jetbot.Dance Component
ComponentDependencies:
  com.example.ros.melodic:
    VersionRequirement: 1.0.0
    DependencyType: HARD
Manifests:
  - Platform:
      os: linux
    Lifecycle:
      Install: |
        tar xvf {artifacts:path}/workspace.tar.gz
      Run: |
        source /path/to/deployment/setup.sh
        roslaunch jetbot_app {configuration:/launch}
```

Depends on

Component recipe

ROS 1.0.0

Thing group

Configuration

Dancebot 1.0.0

CMD_TOPIC=cmd/fleet1

Robo1 Robo2 Robo3

Robo4 Robo5 Robo6

Robo1

AWS IoT Greengrass

From zero to AWS IoT Greengrass

Development

Download, unpack, and install core software

Provide IAM credentials

Run AWS IoT Greengrass with `--provision` flag

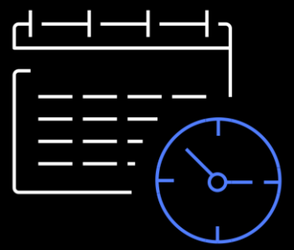
(Optional) `--setup-system-service`

Production

Download, unpack, and install core software; bake it in the OS image

Pre-provision certificates for fleet provisioning or just-in-time provisioning

Reliable deployments



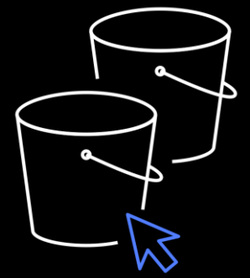
Configurable deployment rate



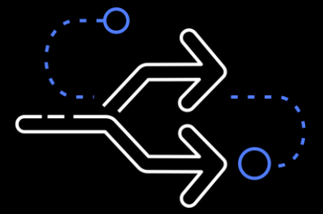
Failure thresholds



Timeouts



Component rollback



Conditional update workflow

Demo: Deploy and launch ROS applications with AWS IoT Greengrass 2.0



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Robot fleet dashboards with Fleet Hub for AWS IoT Device Management



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What is Fleet Hub for AWS IoT Device Management?

Preview

Fleet Hub for AWS IoT Device Management provides a single pane of glass to view the state of your robot fleets, identify issues, and take actions

- **Simple interface** for support technicians and operators to use without code
- **Customizable dashboard** to visualize, filter device lists, set alerts, and take actions
- **Fully managed web application** so customers don’t need to build and maintain their own custom applications

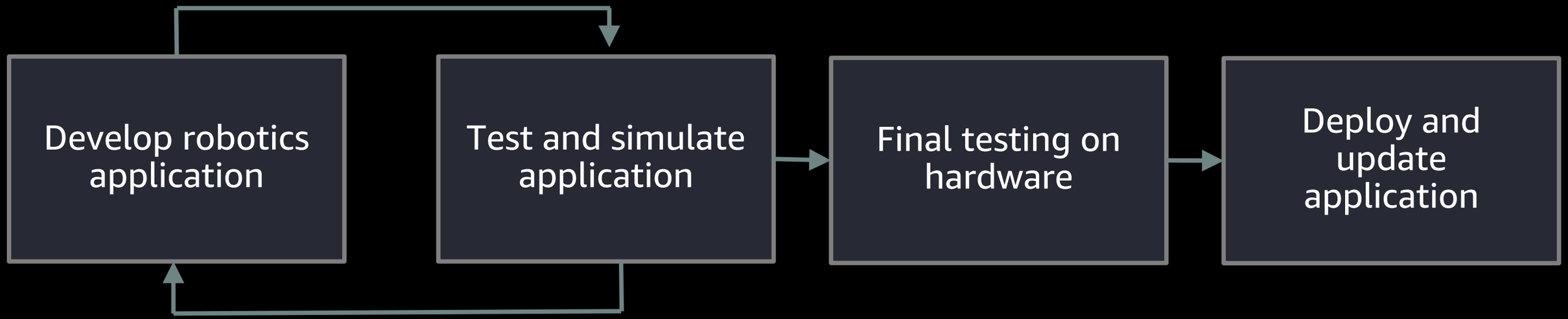
Demo: Create an operator dashboard in minutes with Fleet Hub for AWS IoT Device Management



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Recap: Robot software development cycle

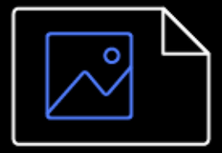


What we covered today

AWS RoboMaker
simulation service

AWS IoT Greengrass 2.0

Recap: Robot fleet management with AWS



Over-the-air software updates



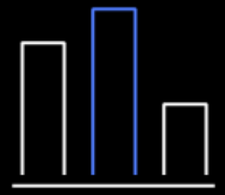
Secure access control



Remote operations



Remote troubleshooting



Fleet monitoring and alerting

AWS IoT Greengrass 2.0

Fleet Hub for AWS IoT Device Management (Preview)

Get started today!

Documentation and blogs

AWS Robotics blog:	https://aws.amazon.com/blogs/robotics/
AWS IoT Greengrass 2.0:	https://aws.amazon.com/greengrassv2/
Fleet Hub for AWS IoT Device Management (Preview)	https://aws.amazon.com/fleethub/

Open-source assets

ROS1 and ROS2 tools, sample applications, cloud extensions, Gazebo simulation worlds, and more

https://github.com/aws-robotics

https://github.com/aws-samples

Thank you!

Jeremy Wallace

Principal Solutions Architect, Robotics
@biojer

Massimiliano Angelino

Principal Solutions Architect, IoT
@mangelino

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