Build Intelligent Robots Faster with Simulation

aws

Table of Contents

Computer Simulation: Essential for Building Intelligent Robots

Robots perform increasingly complex tasks in our houses, warehouses, and even hospitals. But to work effectively and safely in the real world, robots need sophisticated software. Such software requires robust, repetitive, and scaled testing and training to eliminate code errors and ensure safety.

Even so, testing robotics applications and training machine-learning models present their own set of challenges. Real-world testing is expensive, time-consuming, and difficult to scale. That's why computer simulation is an essential tool for developers to build and test intelligent robotics applications.
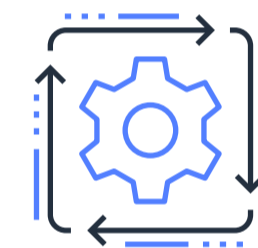
Benefits of simulation
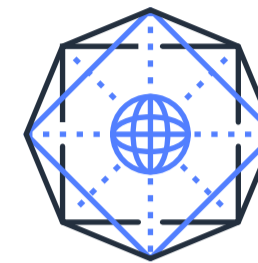
Reduce the risk and cost of testing in the real world with 3-dimensional virtual environments, or "simulation worlds"

Run hundreds of varied tests simultaneously to accelerate testing and increase testing coverage
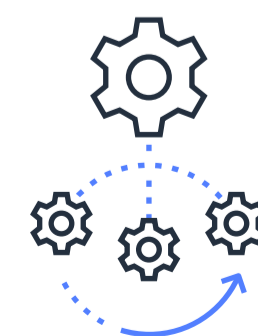
Automate testing into a DevOps workflow to find and fix bugs earlier

Hurdles to using local-computer simulation

Building 3D simulation worlds is expensive, time-consuming, and requires specialized skills

Sizing, procuring, deploying, managing, troubleshooting, and scaling server infrastructure to run simulations is expensive

aws

AWS RoboMaker Cloud-Based Simulation

AWS RoboMaker provides a cloud-based simulation service that makes it faster and easier than ever to build and test robotics applications. AWS RoboMaker makes simulation affordable and accessible by providing the tools developers need to test and iterate code in virtual environments. That way, you can focus on your core mission: building better robots.
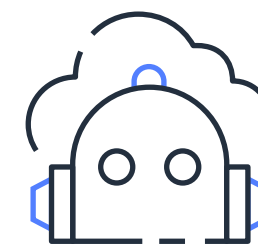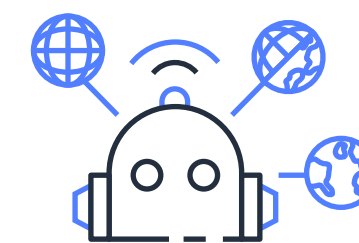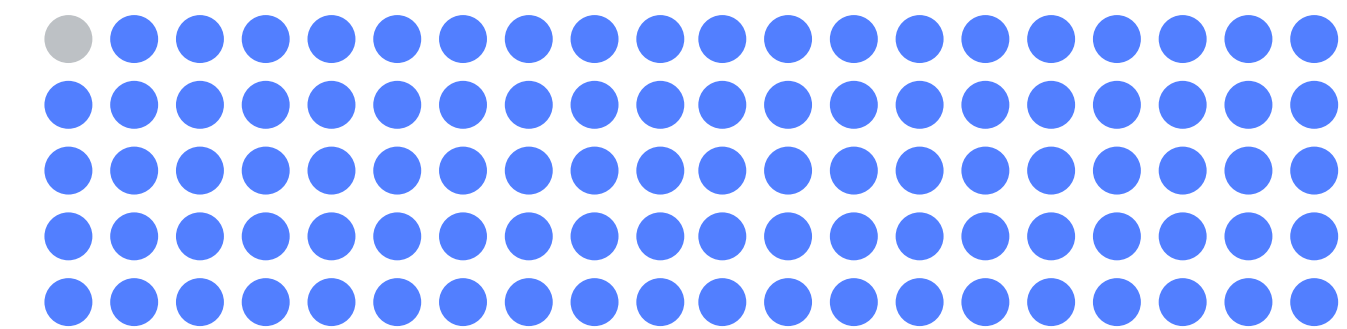
Benefits of RoboMaker Simulation
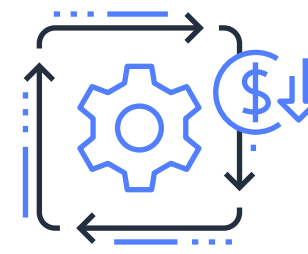
Cost-effectively run, scale, and automate simulation

Improve testing without additional development resources

Run **hundreds** more simulations per day than local-computer simulation

Easily create user-defined, randomized 3D virtual environments with RoboMaker WorldForge

No infrastructure to buy or manage

4 Simulation Use Cases

AWS RoboMaker Simulation supports a variety of robotics development use cases, many of which would be extremely difficult or impossible without cloud-based simulation. Here are a few.

Challenges:
Bugs and compatibility issues are introduced when developers write code separately
Impact:
- Longer QA cycles
- Costly production errors and support time

Defects can be missed until late in development or even in production
Impact: Costly to fix

1 **Automated Regression Testing**

The RoboMaker Solution

Test robotics applications automatically while they're being developed
- Automate regression testing within a continuous integration and continuous delivery (CI/CD) pipeline
- Run batch simulations using API calls

Challenge: Testing robots individually in simulation environments doesn't prepare them to operate effectively with other robots

Impact: Robots can behave unexpectedly, poorly, and even dangerously when interacting in the real world

2 **Multi-Robot Fleet Testing**

The RoboMaker Solution

Test multiple robots together in a realistic 3D environment
- Connect multiple concurrent simulations to your central fleet-management software for testing

aws

4 Simulation Use Cases

3 **Reinforcement Learning**

For some complex tasks in unpredictable environments, such as autonomous navigation and object manipulation, developers can't simply program an effective function. Instead, they train a robot iteratively with a system of reward functions so that the robot's software learns how to react properly. This is known as reinforcement learning (RL).

Challenge: It's nearly impossible to train RL models adequately in real-world environments because of the large number of iterative training cycles needed for a model to learn quickly

The RoboMaker Solution

Perform high volumes of iterative trials simultaneously in parameterized environments

---

4 **Sandbox Testing**

Organizations that use robots or integrate robotics hardware into solutions often need to customize their robot functionality for specific use cases. They do this by developing Android, iOS, or web applications that work with the robot's software.

Challenge: It is costly or even impossible to provide every developer a physical robot to test external mobile and web applications

The RoboMaker Solution

Test applications in sandbox simulated environments—with no simulation experience needed

aws

Simulation Success Stories

Let's take a look at how a variety of organizations are using AWS RoboMaker Simulation to develop better intelligent-robotics applications while drastically reducing time-to-market.
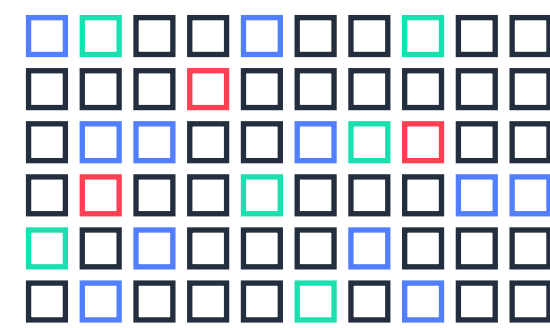
aws

iRobot: Dramatically Faster & More Robust Testing

iRobot, a leading producer of robot mops and vacuums, uses AWS RoboMaker Simulation as part of its automated development and testing processes to increase code quality and release velocity while improving test coverage. With AWS RoboMaker, iRobot achieved:
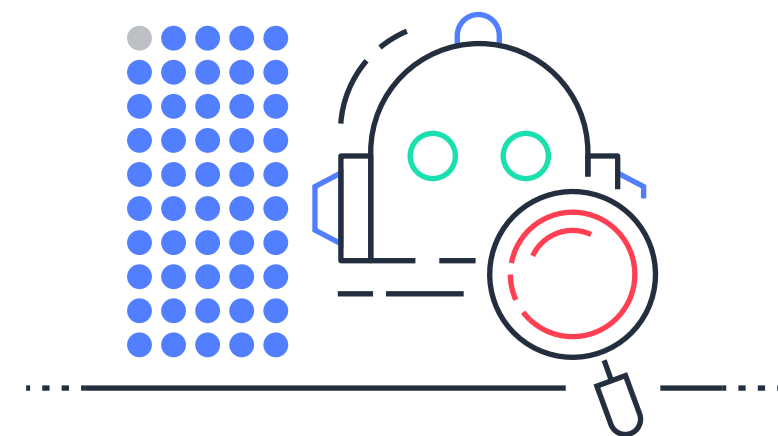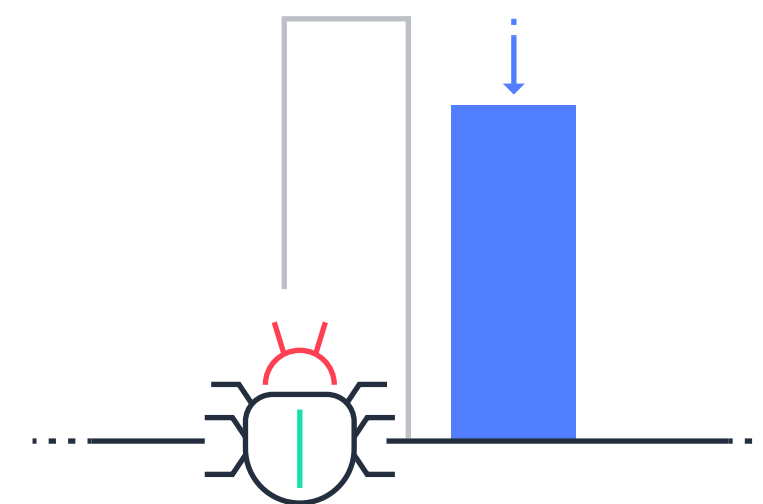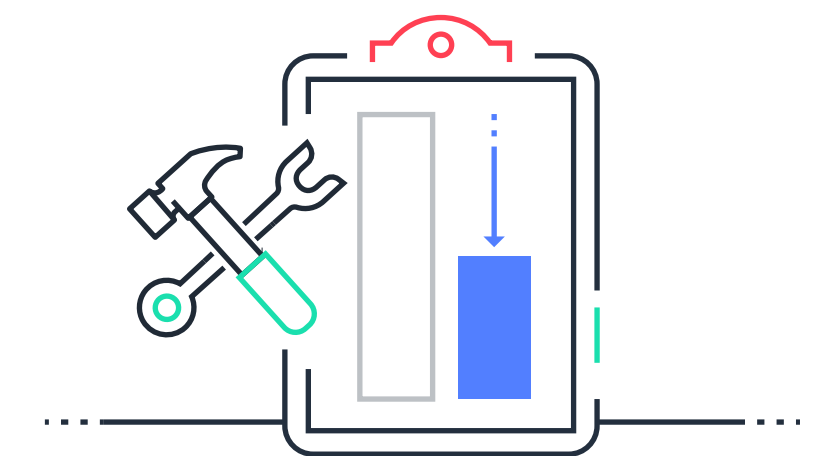
50x more tests per day

60 automated tests on each code commit

>5,000 automated tests for each software release candidate

20% reduction in bugs published to their production code

50% reduction in manual testing

"Like having 20 more QA testers"

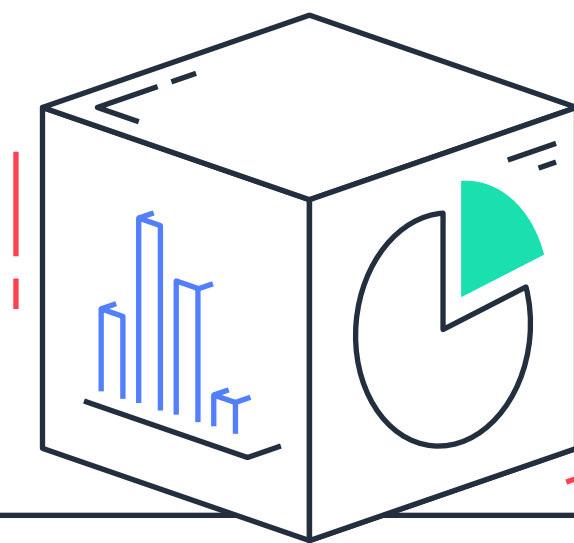—Chris Kruger, iRobot Director of Software Engineering

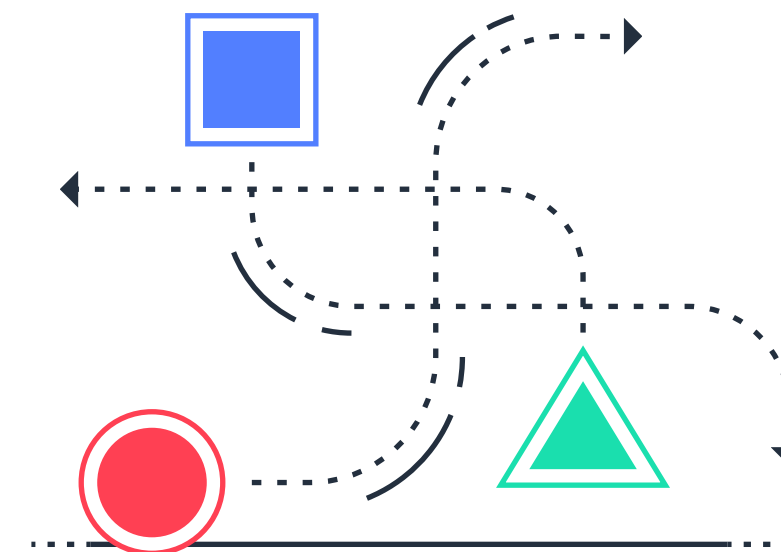# Bastian Solutions: Fleet Testing in Simulation Environments

Bastian Solutions, a Toyota Advanced Logistics company, produces robot-powered material handling equipment and information systems. AWS RoboMaker multi-robot fleet simulations enabled them to:
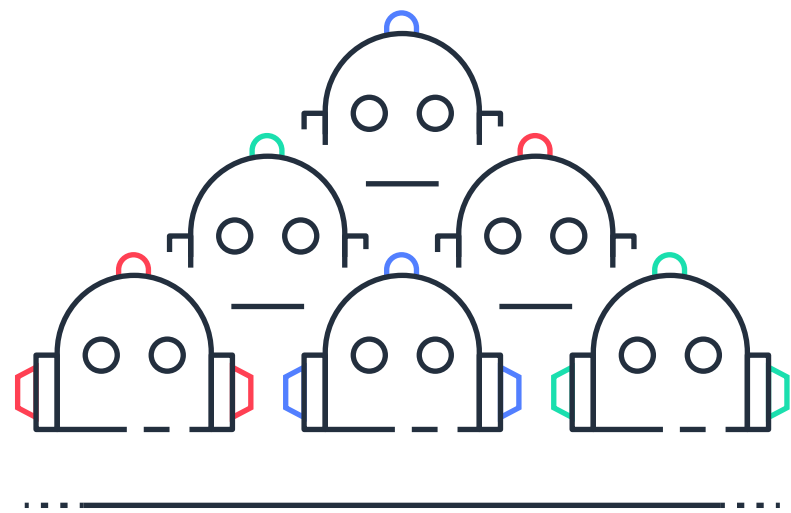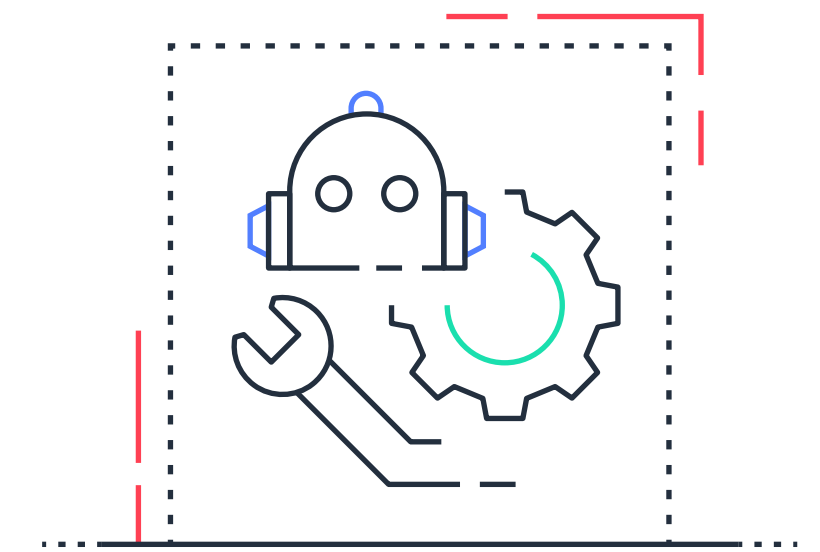
Test a fleet of **>35** robots

Build a realistic simulation environment

Run simulations on multi-robot orchestration

Avoid procuring costly robotics hardware and testing space

Orion Star: 80% Lower Simulation Development Costs

Orion Star and its subsidiary, Cheetah Mobile, develop service robots that can be used in environments such as houses, museums, and airports. AWS RoboMaker makes it easy and cost-effective for Orion Star to enable their robotics customers to test their applications on virtual robots in simulation. Using AWS RoboMaker Simulation sandbox testing environments, they were able to:
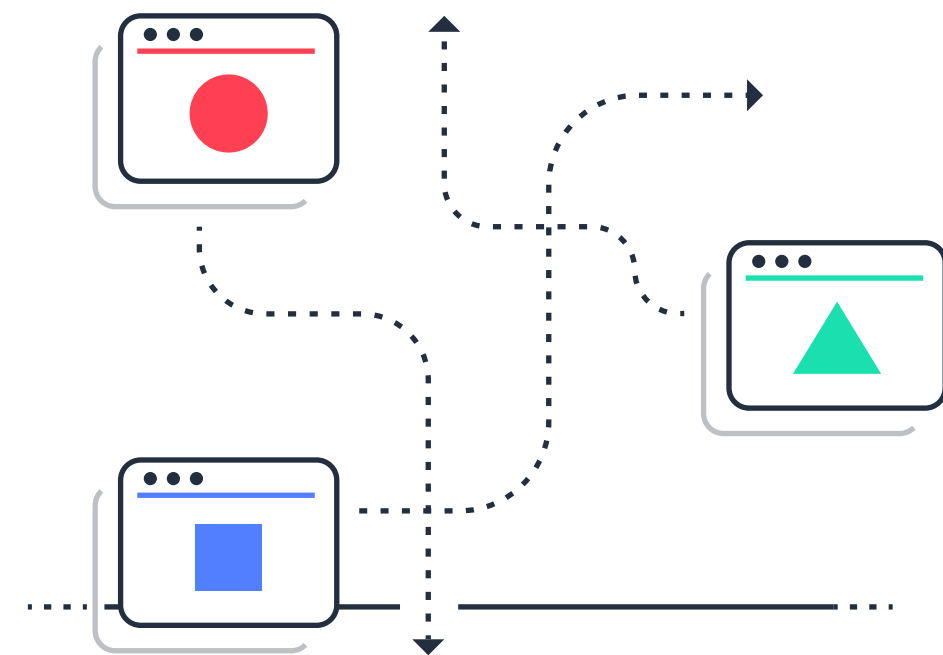
Empower customer developer teams to build robot applications that enhance the functionality of Orion Star robots
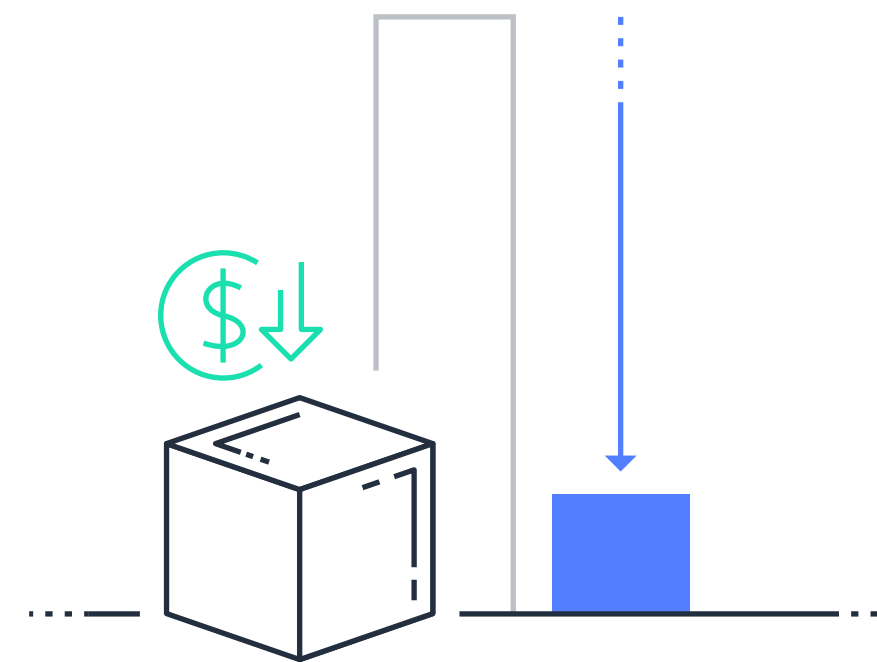
Reduce simulation development costs by **80%**

Cut the cost of operating simulators by **40%**

AWS RoboMaker Simulation: Enabling Faster Robotics Testing & Training

Intelligent robots are enabling commercial automation and improving consumers' lives. To be competitive in a quickly expanding robotics market, your organization needs to be able to build and maintain intelligent, high-quality robotics applications. Let AWS RoboMaker help improve the way you build robots, so you can get them to market more quickly, safely, and cost-effectively.

aws.amazon.com/robomaker