Lessons Learned: A Brief History of

Autonomous Robot Operations

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Agenda

Let's talk about RaaS ops infra

- Operation challenges vis-a-vis Product lifecycle
- A glance at industry practices
- Building blocks for robot operations infrastructure
- Popular tools and technologies
- Q & A

The journey of a robotics company

PROTOTYPE

“We have an idea. Let’s build it.”

INITIAL DEPLOYMENT

“Time to get our baby into the field.”

SCALING

“Let’s conquer the market.”

GROWTH

“Slow but steady. We are here to stay.”

Operation challenges: prototype

- Getting an **MVP**
- **Fusing** and **visualizing** multiple **sensors data**
- Dealing with robot **autonomy imperfections**

Operation challenges: market

- **Connectivity**
- **Security**
- Developing **remote monitoring tools**
- Interacting with **humans**

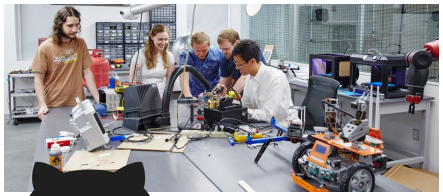
Operation challenges: fleet

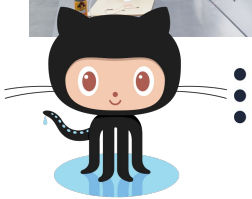
PROTOTYPE → PRODUCT MARKET FIT → **FLEET**

- **Scaling tools**
- **Non-expert supervision**
- **Real time management**
- **Coordinating tasks** among operators
- **Visualizing** the **performance** in the field

Popular practices

Lab Tooling





ROS

Robot Operations Center

In house

Outsourced

on-demand

L1 support

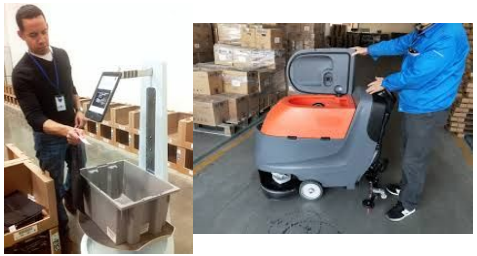
L2 success

L3 engineering

Jira salesforce pd slack

Behind the Curtain support

EngineerOping

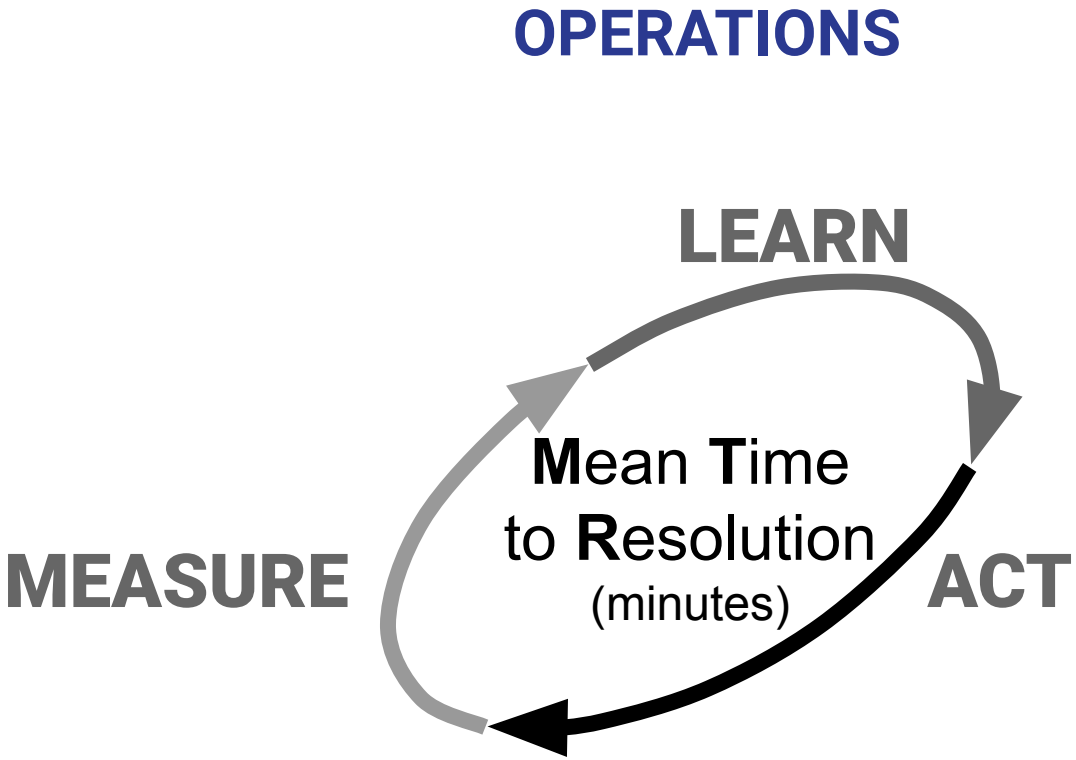


Customer Operation

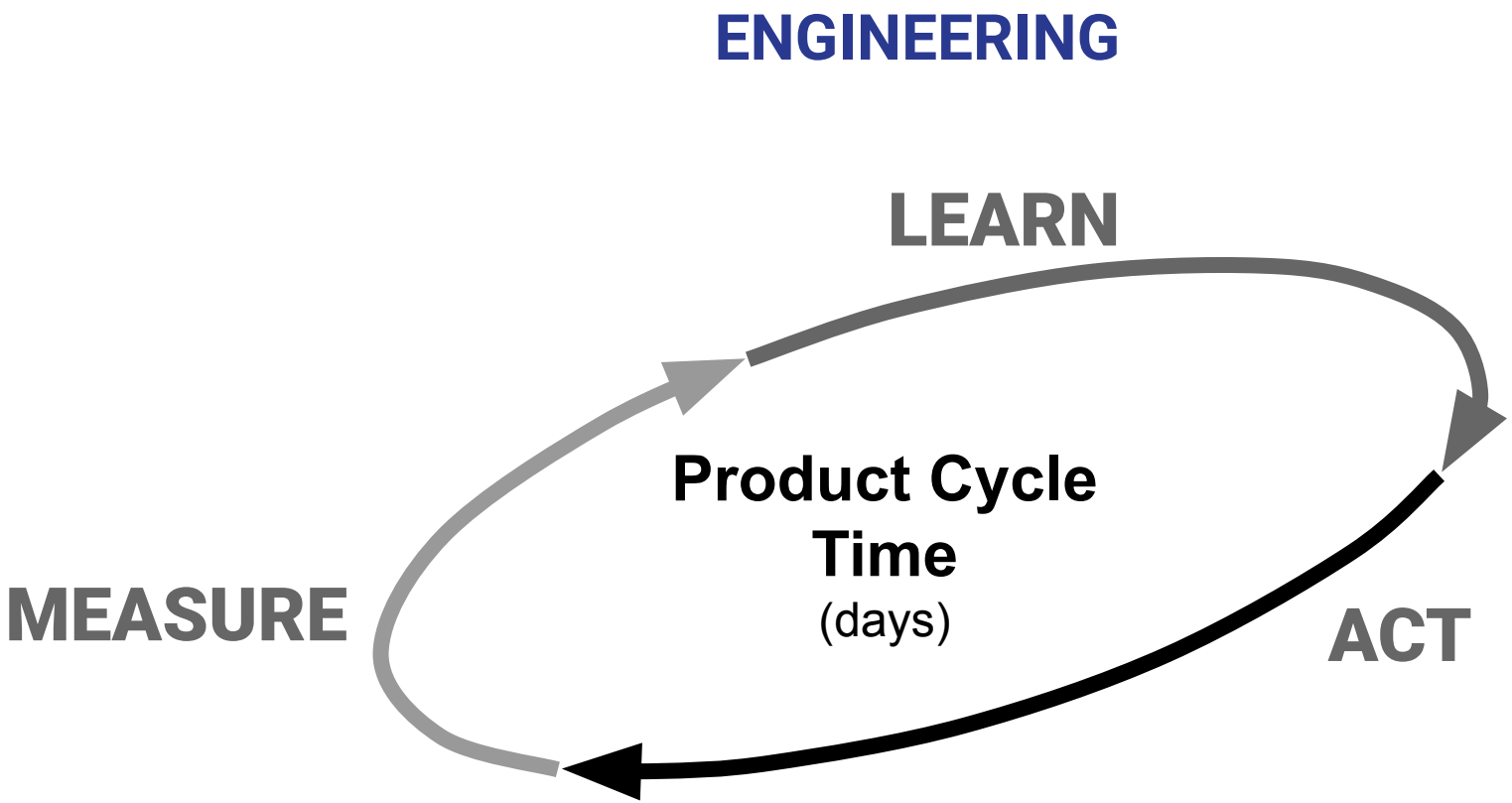
Building Blocks

of Robot Operations Infrastructure

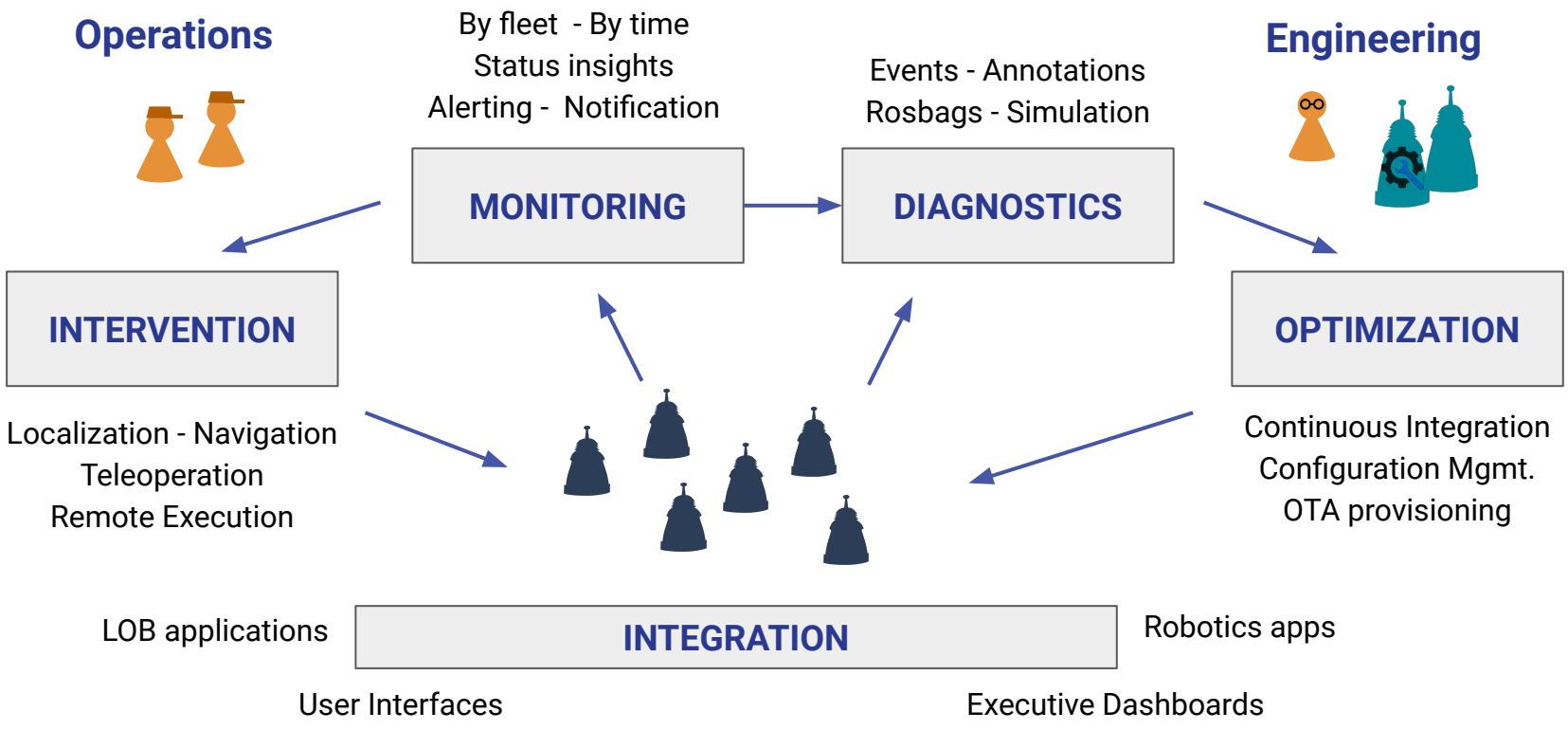
Virtuous cycles of robotics services



Virtuous cycles of robotics services



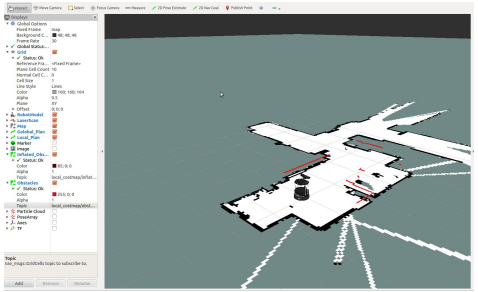
Capabilities diagram



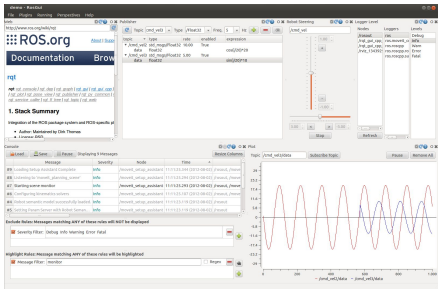
Technologies

One Robot / research & prototype

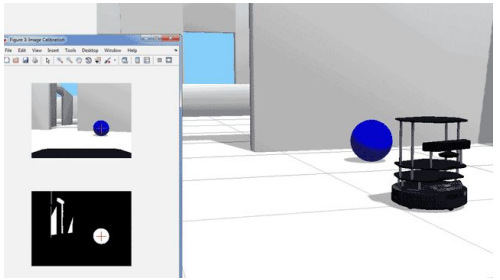
RViz



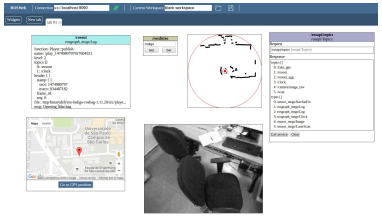
rqt

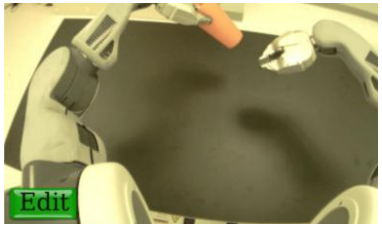


Matlab



Robot Web Tools





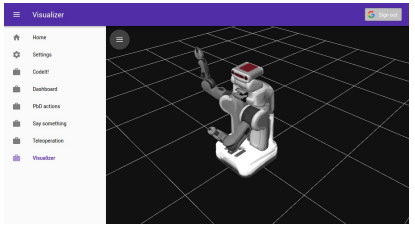
roslib.js

rosbridge

ROSWeb

Web Video Server

Robot Web Server

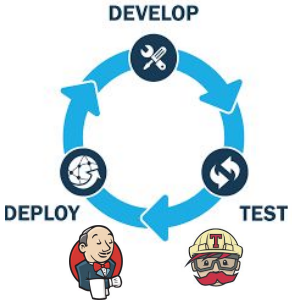


Technologies: fleet-scale

Testing

unittest, GTest, ROSTest

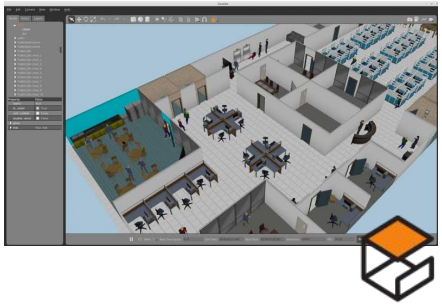
CI



Deployment

docker debian

Simulation

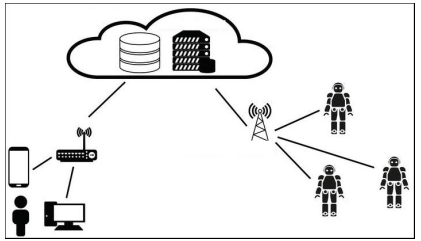


Debugging

logz.io QGIS ROS

Cloud Infrastructure

kubernetes kafka



MQTT gRPC

Market growth > Maturity > Specialization

Google Cloud Platform

inOrbit

ROCOS

Rapyuta Robotics

ROSHub

COGNICEPT

Formant

FREEDOM ROBOTICS

RAVEN[OPS]

Technologies: references

- Docker, Debian, Ansible, Mender
- Gazebo
- gRPC, MQTT, protobuf
- Gtest, ROSTest, unittest
- kafka, kubernetes
- Logz.io, QGIS-ROS, Webviz
- Matlab
- Robot Web Server, RobotWebTools
- Rqt, RViz
- RMF Core
- InOrbit
- AWS RoboMaker
- Cognicept
- Formant
- Freedom Robotics
- Rapyuta robotics
- Raven[Ops]
- ROCOS
- ROSHub

Full, evolving list at inorbit.ai/rowg/content

Our 2c

- **Focus on your value prop** - don't bother with interesting distractions

- **Differentiate** - between what's unique about your offering vs. everything about it being different than the rest

- **Embrace the ecosystem** - we are all in a blue space with more to discover than to compete for

Questions & Contact

Contact

- Join the **R**obot **O**perations **W**orking **G**roup at **inorbit.ai/rowg**
- More about us at **ekumenlabs.com** and **inorbit.ai**
- Go to **control.inorbit.ai** and get your robot InOrbit in less than a minute

Thank you!

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