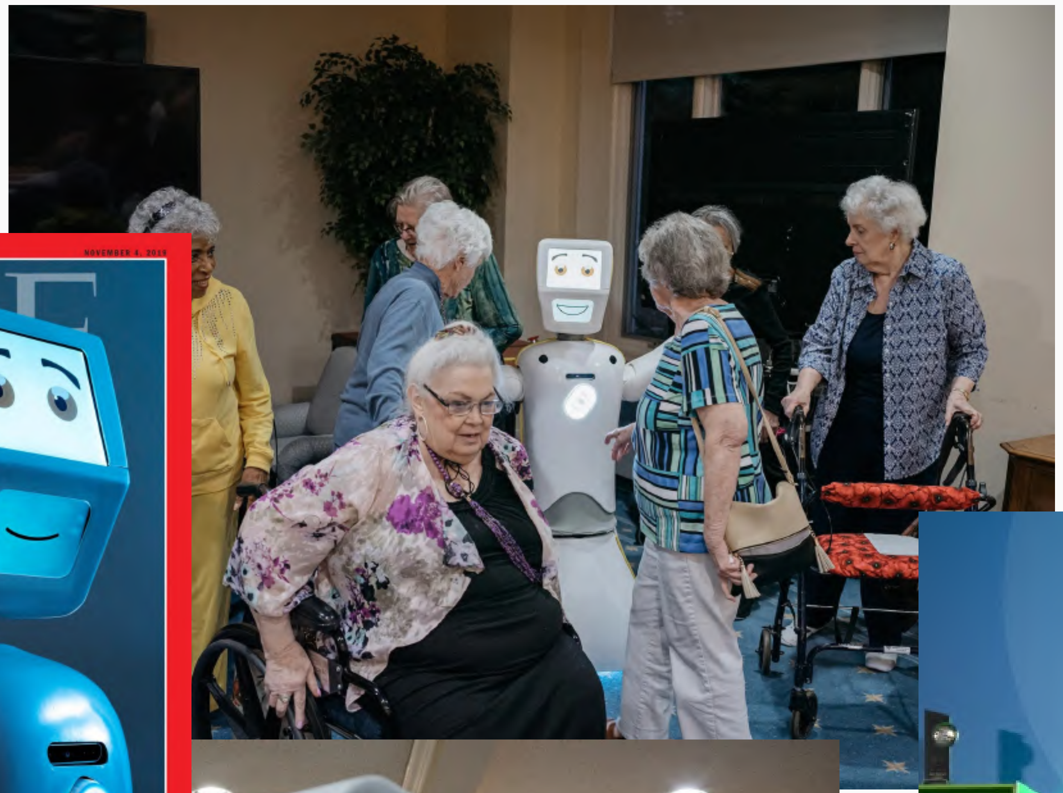
airbotics

The DevOps platform for robotics

Our background



TIME

HEALTH INNOVATION ISSUE

WHO GETS TO BE HEALTHY

by Francis S. Collins • Raj Panjabi
Jennifer Doudna • Bernard J. Tyson

WHAT WOMEN NEED

by Angelina Jolie

THE ROBOT WILL SEE YOU NOW

by Corinne Purtill

SOLVING SUICIDE

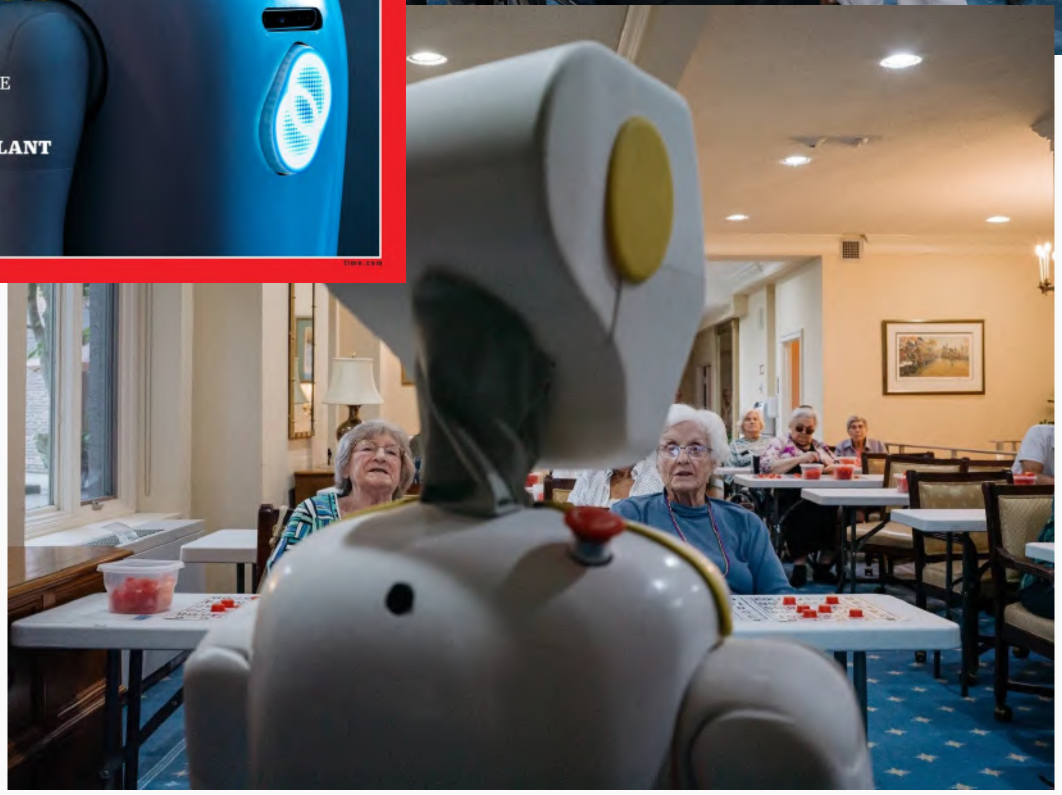
by Mandy Oaklander

A HISTORIC FACE TRANSPLANT

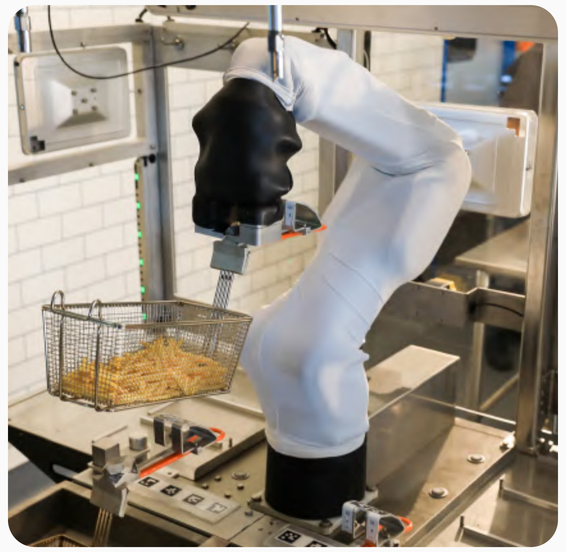
by Jamie Ducharme

ELECTRIFYING MEDICINE

by Alice Park



Robotics market - Segmentation



1 Industrial Robots

2 Professional Service Robots

Robotics market - Current state of OTA

- Extremely fragmented
- Often 'hacky'
- Often an afterthought
- Poor fleet visibility
- Often insecure

Start with scripts

git

Move to SCM tools designed for servers

ANSIBLE

Commercial IoT vendors

balena

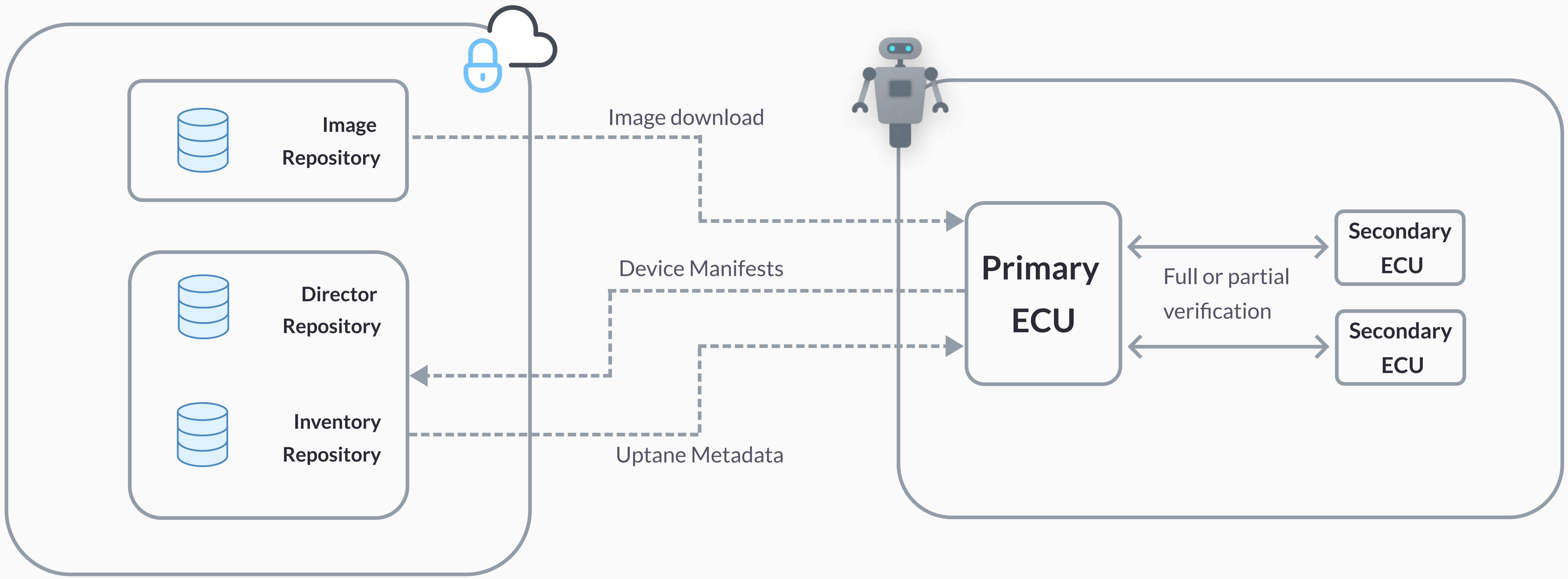
MENDER

Build in-house

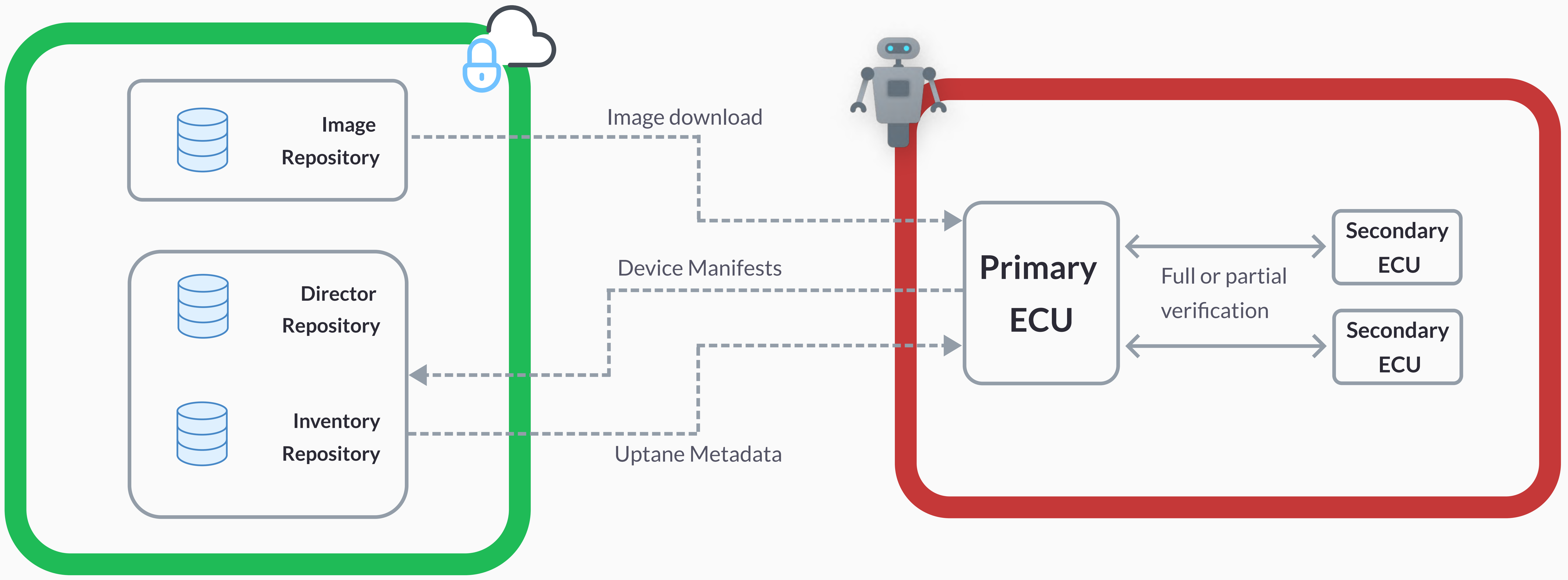
Why Uptane?

- Robots exhibit many of the same attributes as automobiles
  - Multiple ECUs
  - Large physical devices that work alongside humans
  - Often require regular software updates
  - Often operate in constrained network envirnoments
- Security is of paramount importence
  - A compromised fleet of robots could be catostrophic
  - Uptane provides the most protection from potential attack vectors we've seen from any framework

Uptane Inital thoughts



Implementation Decisions



Implementation - Prep

The Update Framework Specification

Version: 1.0.32
Last modified: 2 March 2023

https://theupdateframework.github.io/specification/latest/

+

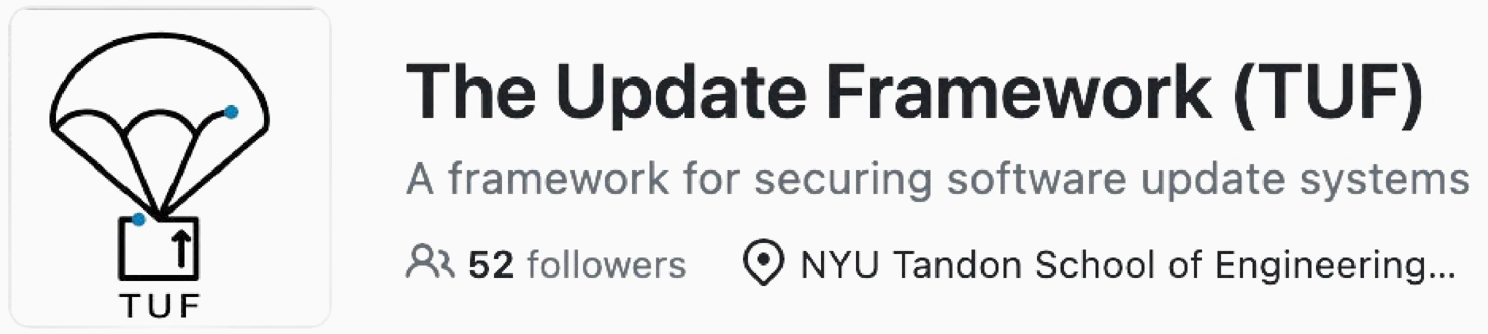
Uptane Standard for Design and Implementation 2.0.0

uptane-standard-design

https://uptane.github.io/papers/uptane-standard.2.0.0.html

=

Implementation - Prep

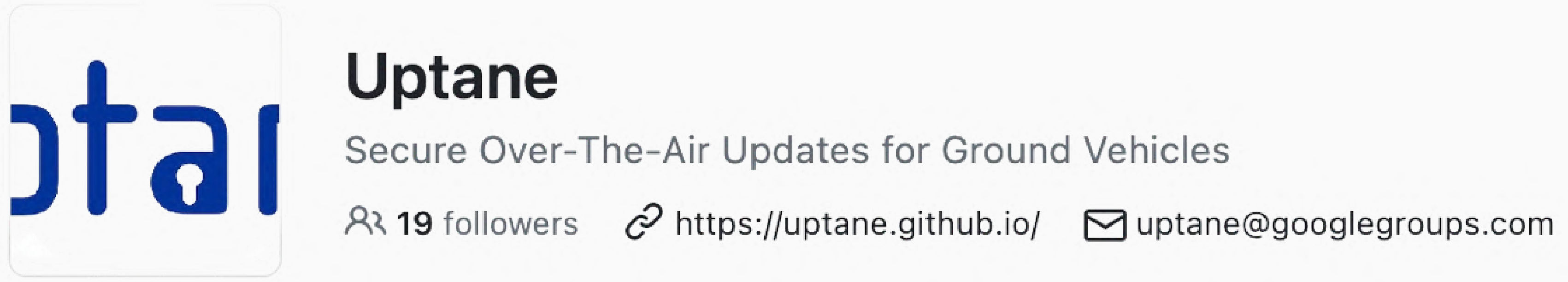


The Update Framework (TUF)

A framework for securing software update systems

52 followers NYU Tandon School of Engineering...

https://github.com/theupdateframework



Uptane

Secure Over-The-Air Updates for Ground Vehicles

19 followers https://uptane.github.io/ uptane@googlegroups.com

https://github.com/uptane

ota-lith Public

https://github.com/simao/ota-lith

Implementation - Image Repo

1 Initialisation

Generate key pairs for 4 roles

Generate TUF metadata for 4 roles, Root, Targets, Snapshot & Timestamp

Store the keypairs, in dev we simply write them to disk

Other app specific init, like team inititisation etc.

2 Operations

Handle new target being uploaded

Handle fetching of metadata files

Handle delegations

3 Extras

Handle the resigning of metadata

Handle deletion of repos

Implementation - Inventory Repo

1 Provisioning

Generate keypair for robot

Use keypair to issue x509 cert for robot

Associate each ECU with the robot,

2 Operations

DB schema to represent robot and associated ECUs

Most the endpoints associated with managment side, eg list devices, add device to group, get device ECUs

Implementation - Director Repo

1 Initialisation

Generate TUF metadata for 3 roles, Targets, Snapshot & Timestamp

Store the ECUs public key so we can verify manifest reports later

2 Operations

Validate robot manifest

Handle fetching of metadata files

Creation of new metadata

3 Extras

Handling rollouts

Handle the resigning of metadata

Implementation - Challenges

- Testing can be difficult without a reference implementation
- Managing key pairs and certs is challenging
- Quite a few moving parts
- A lot of helper classes required to serialize, de-serialize, canonicalize and manipulate data.
- Some actions require a lot of operations, especially initialisations, it is hard to ensure these are always atomic

Recommendations

To other implementors

- Start with TUF and reference implementations
- Make use of the open source implementations
- Reach out to the Uptane community or other implementers for help

To the Uptane community

- A reference implementation for Uptane like python_tuf would be very useful
- Standard nomenclature for "official" Uptane sources.

Closing Thoughts

- Huge thanks to the Uptane community for being so welcoming and helpful.
- Open source repos from ATS/HERE and a special thanks to Simão Mata and Phil Wise for their time.

Questions?

Andrew Murtagh

CEO

Robbie Fryers

CTO

airbotics

The DevOps platform for robotics