
AWS
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IOT308

# Accelerating the future of connected vehicles with AWS

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AWS

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Senior Manager
Seattle Innovation Lab
DENSO

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# Agenda

1. Amazon in Automobile

2. AWS Connected Mobility Solution (CMS) Overview

3. AWS CMS Deep Dive

4. DENSO IoT Mobility Solution Overview

5. DENSO Demo & Deep Dive

6. Summary

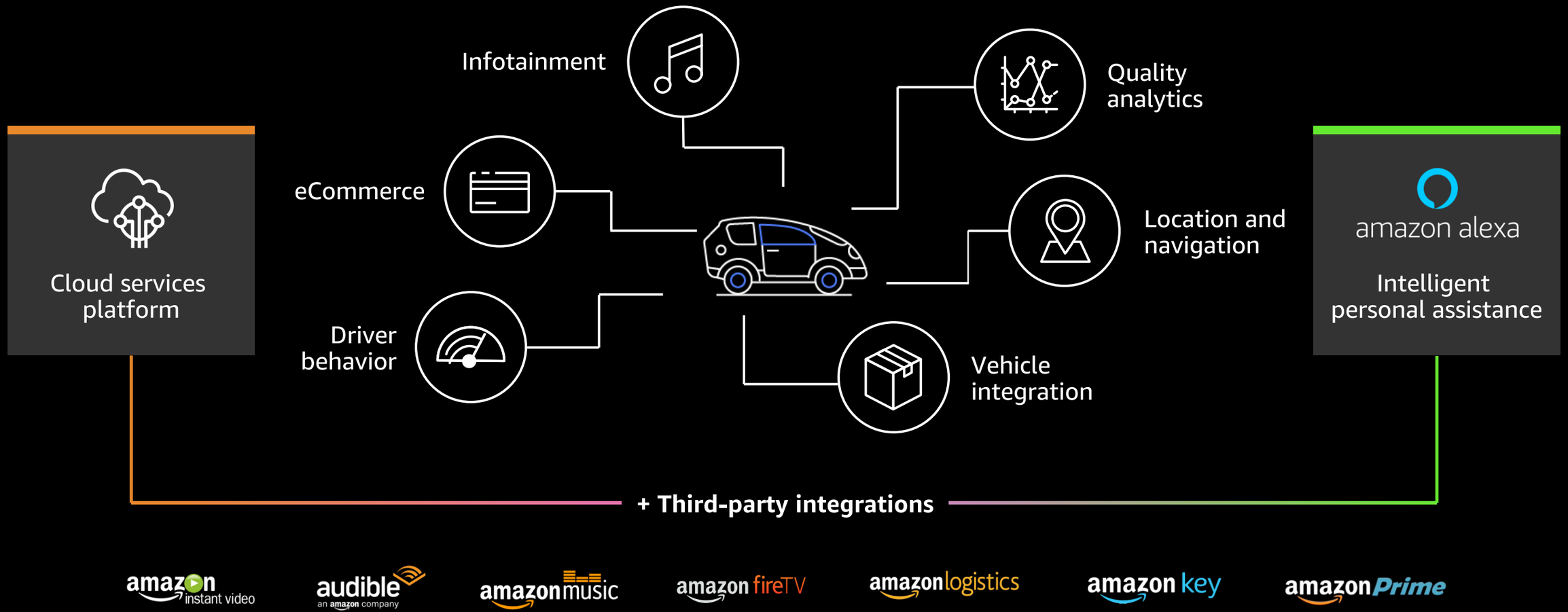




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# Amazon’s approach to connected vehicles

A HOLISTIC VIEW WITH A VARIETY OF SERVICES, PRODUCTS, AND FEATURES



# Select automotive customers building on AWS































































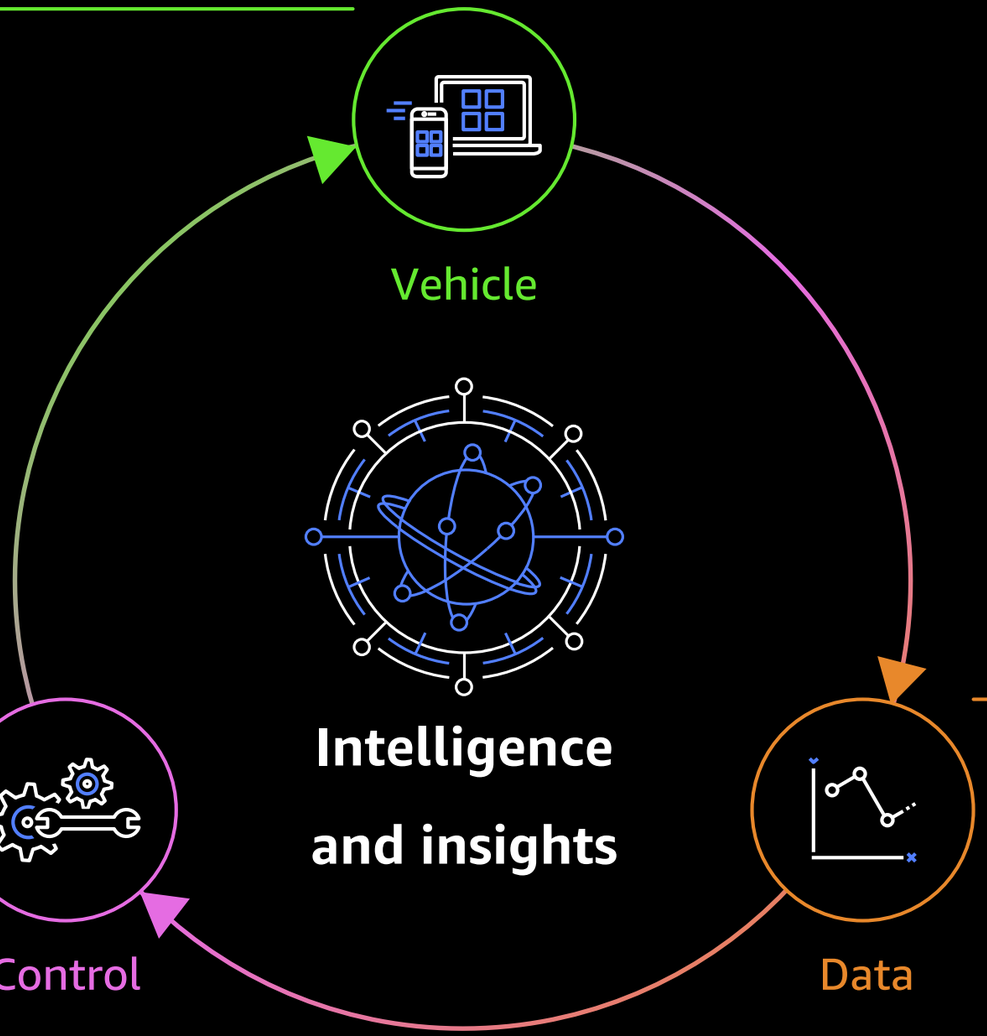
# AWS mobility flywheel

## Fleet provisioning

Registration

Activation

Ownership




## Fleet management

Maintenance

Configuration

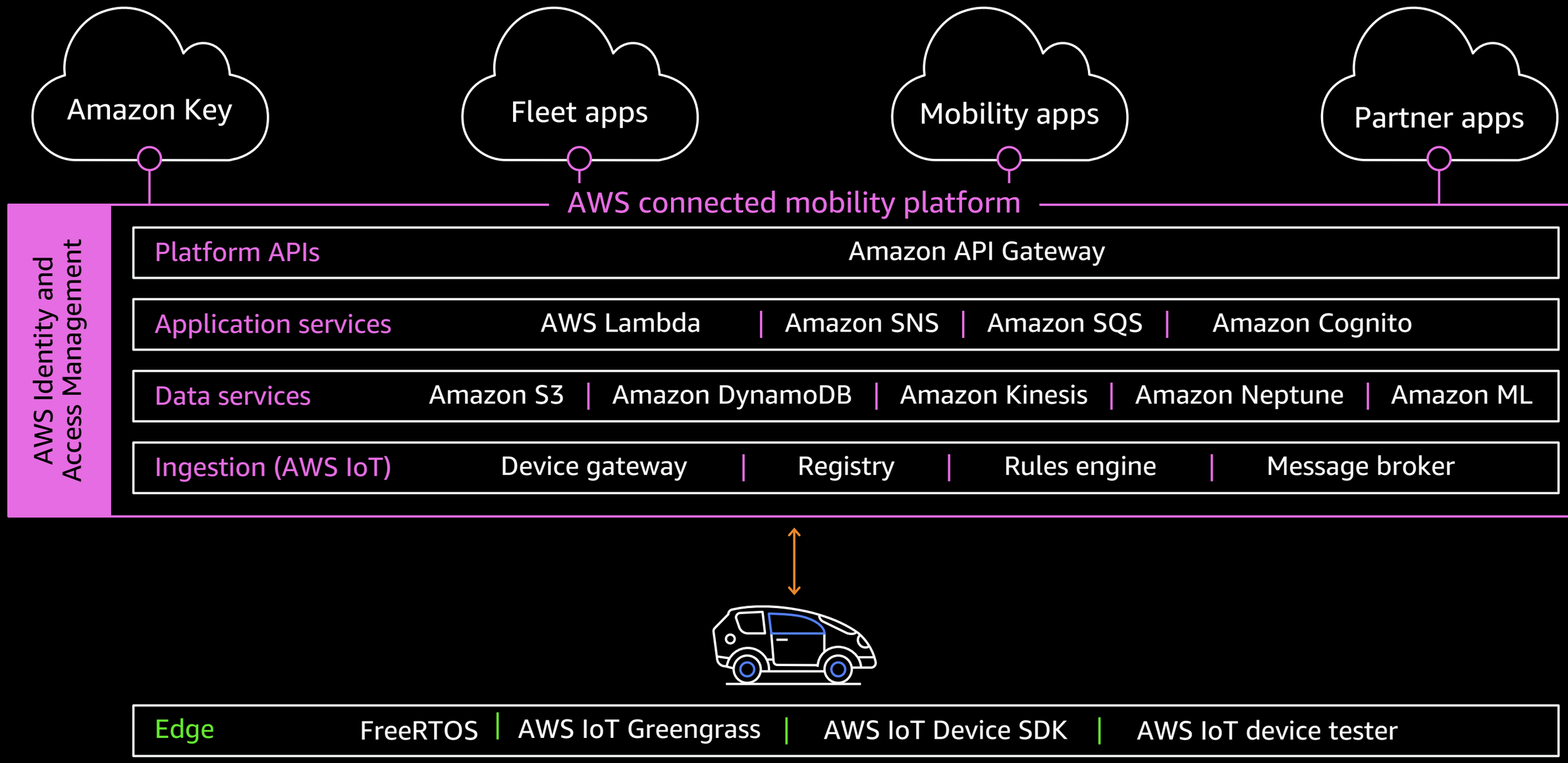
OTA upgrade

## Fleet telematics

Telemetry

Events

# Introducing AWS Connected Mobility Solution





Vehicle

## Fleet provisioning

Registration

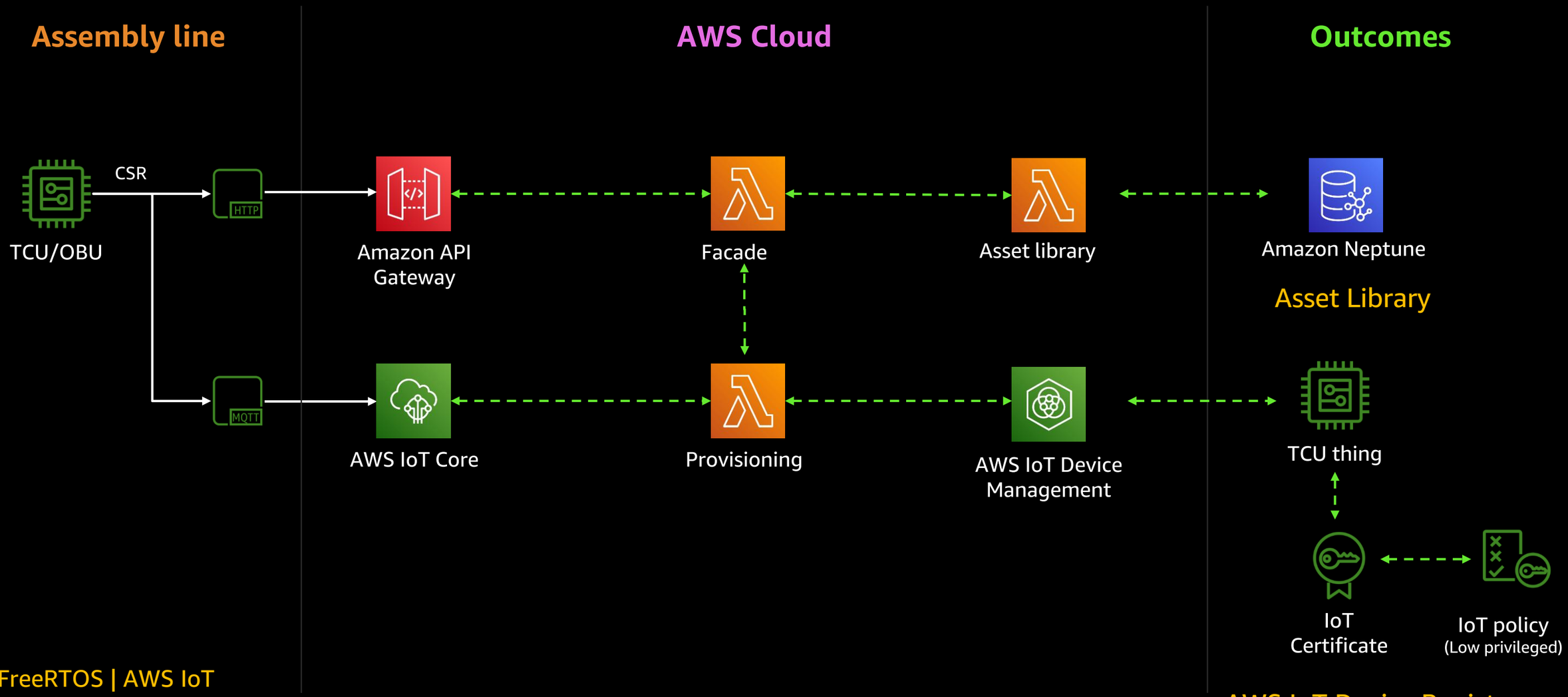
Activation

Ownership

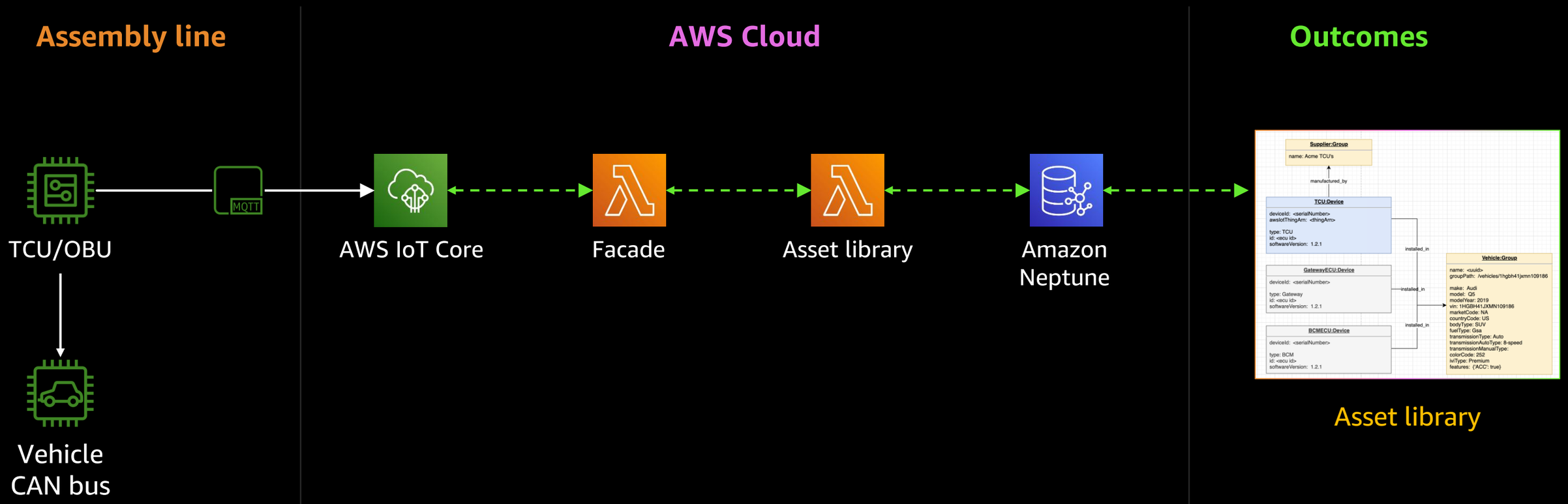


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# Registration



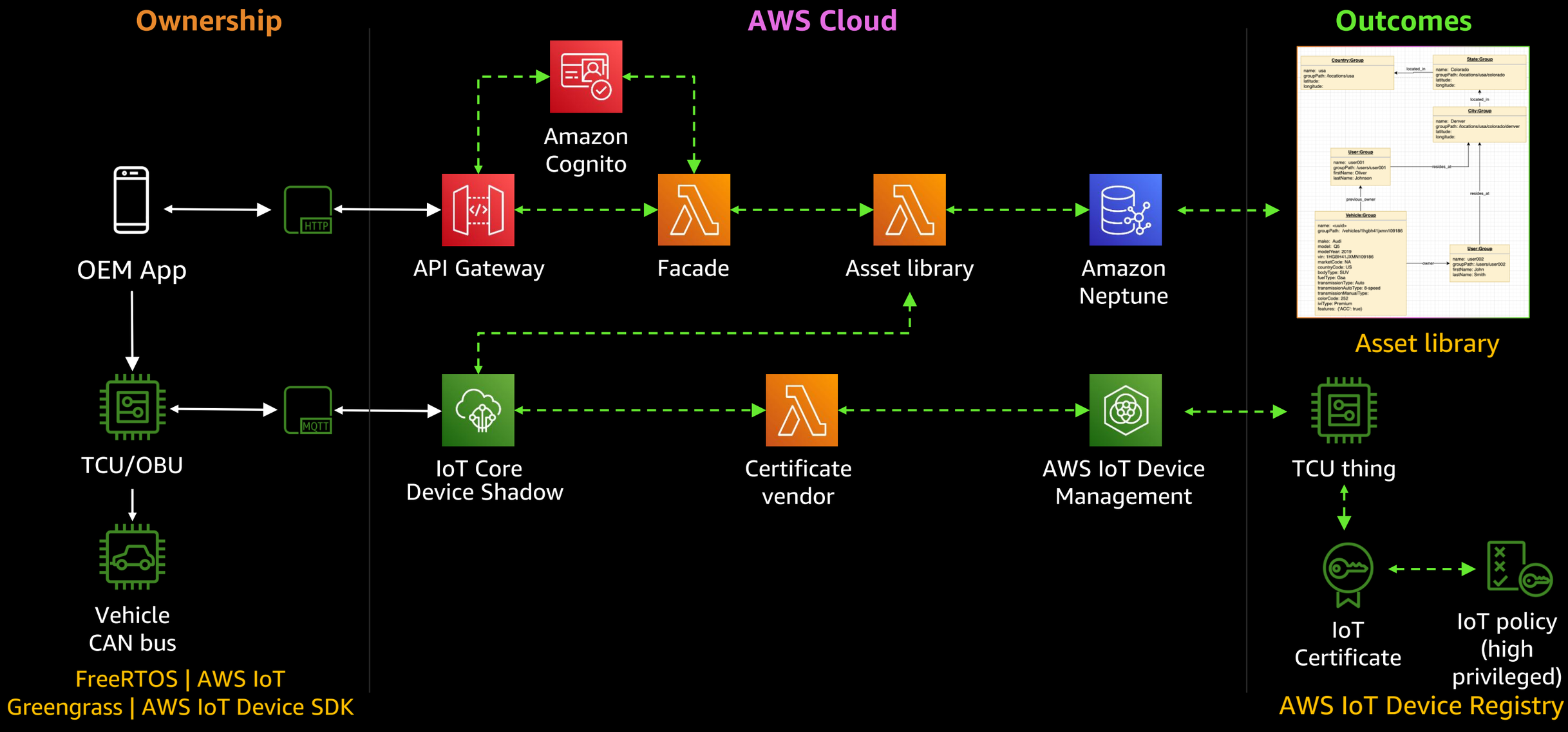
# Activation




Asset library

FreeRTOS | AWS IoT Greengrass | AWS IoT Device SDK

# Ownership


Ownership
AWS Cloud
Outcomes
Amazon Cognito
OEM App
HTTP
API Gateway
Facade
Asset library
Amazon Neptune
Asset library
TCU/OBU
MQTT
IoT Core Device Shadow
Certificate vendor
AWS IoT Device Management
TCU thing
Vehicle CAN bus
IoT Certificate
IoT policy (high privileged)
FreeRTOS | AWS IoT Greengrass | AWS IoT Device SDK
AWS IoT Device Registry



Data

# Fleet telematics

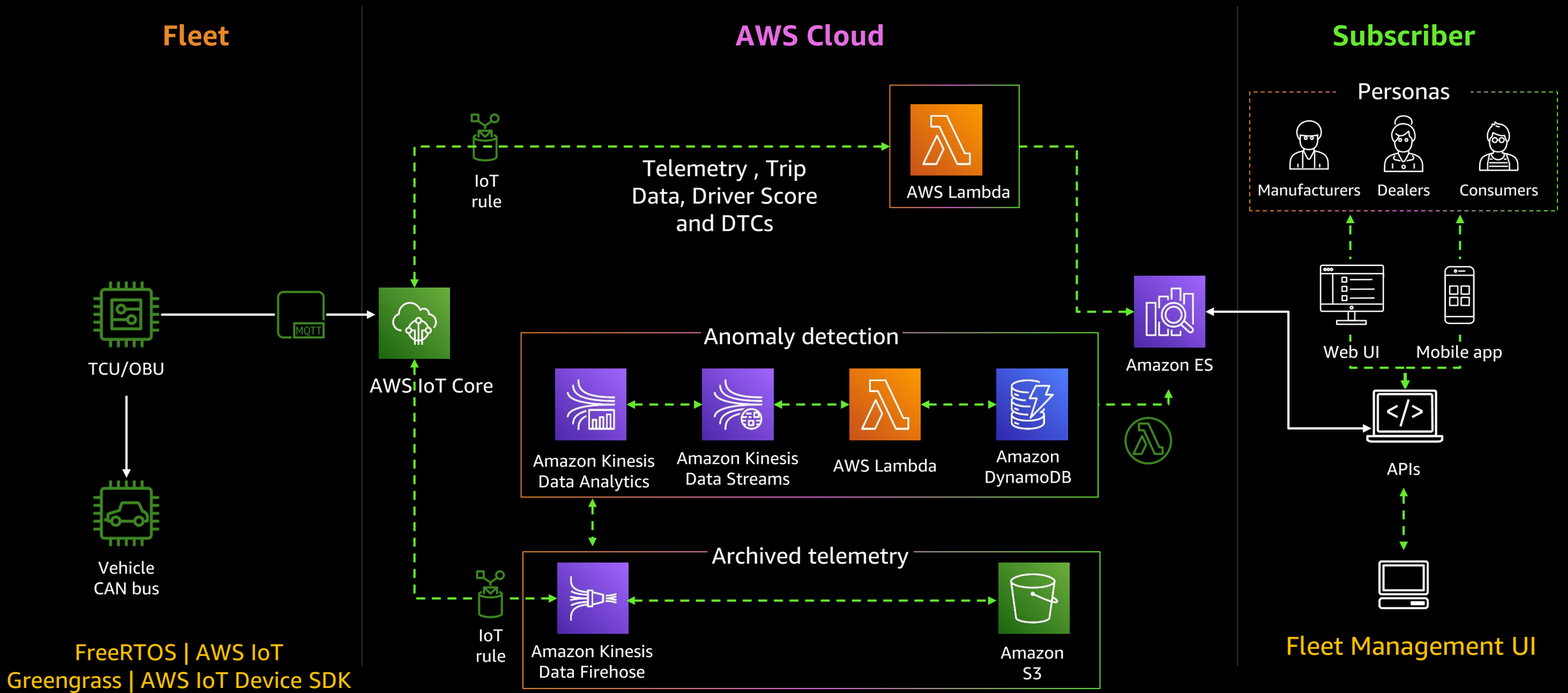
Telemetry

Events

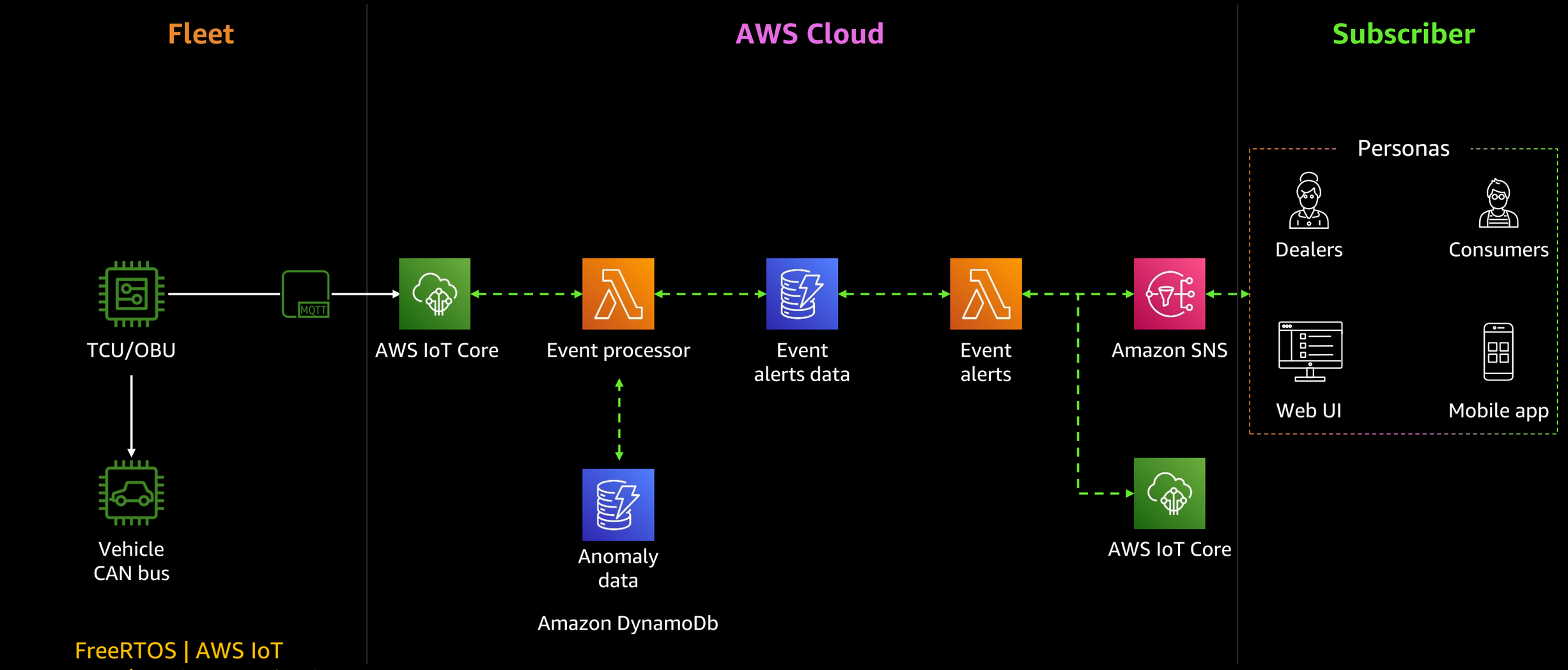


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# Telemetry ingestion and archiving



# Events

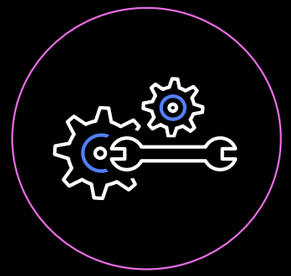

Fleet
AWS Cloud
Subscriber
Personas
Dealers
Consumers
Web UI
Mobile app
TCU/OBU
MQTT
AWS IoT Core
Event processor
Event alerts data
Event alerts
Amazon SNS
Vehicle CAN bus
Anomaly data
Amazon DynamoDb
AWS IoT Core
FreeRTOS | AWS IoT Greengrass | AWS IoT Device SDK

## Fleet management

Maintenance

Configuration

OTA Upgrade



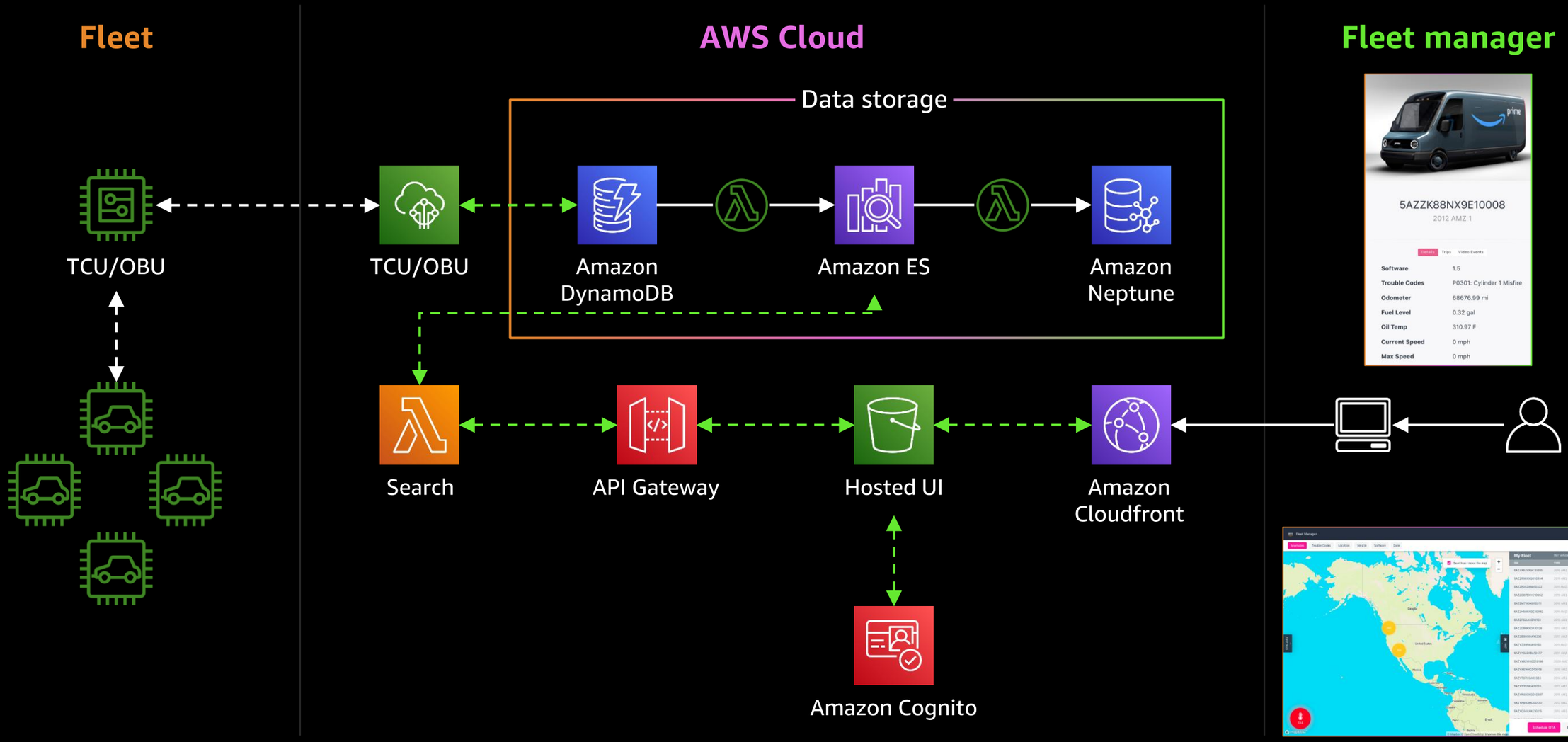
Control



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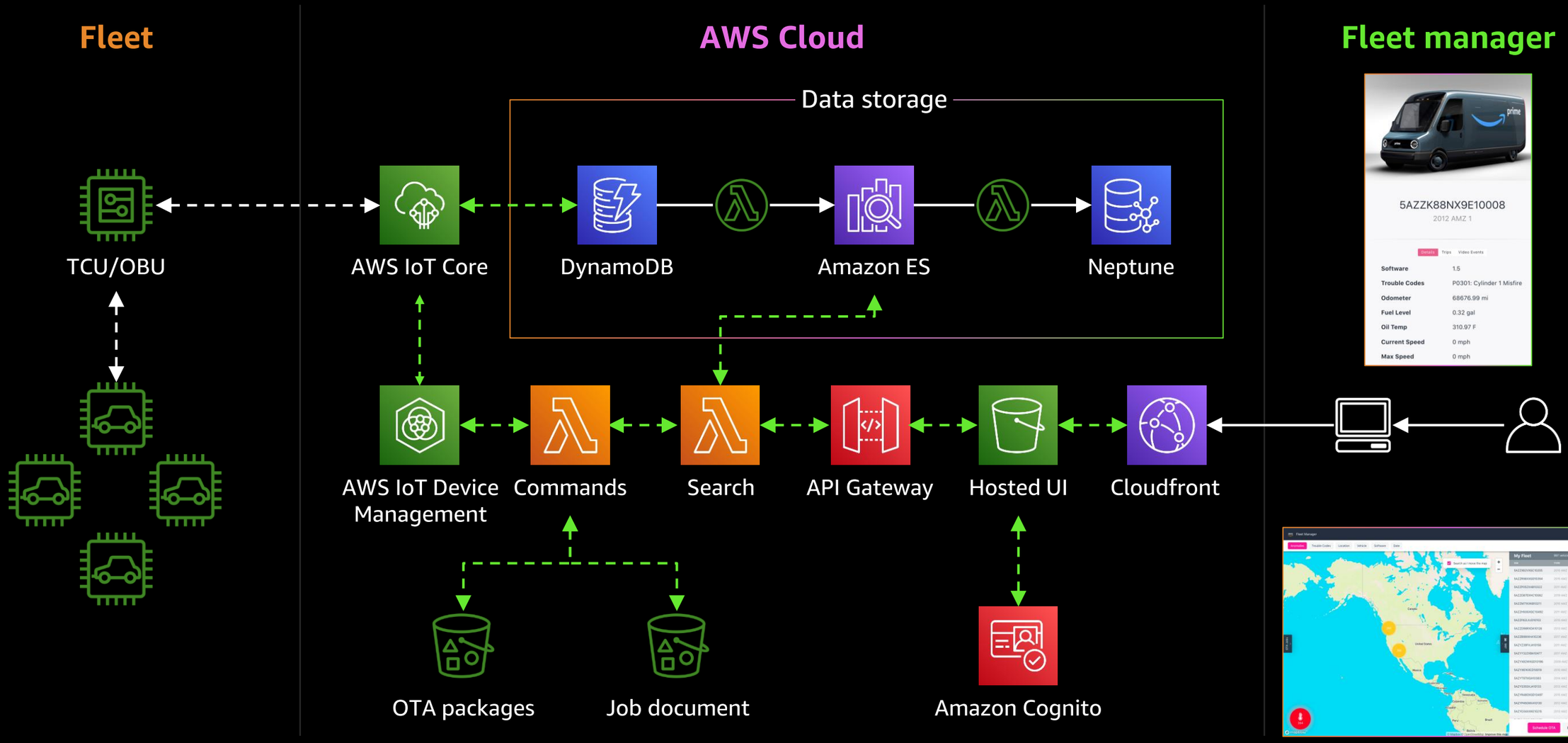
# Fleet management

MAINTENANCE



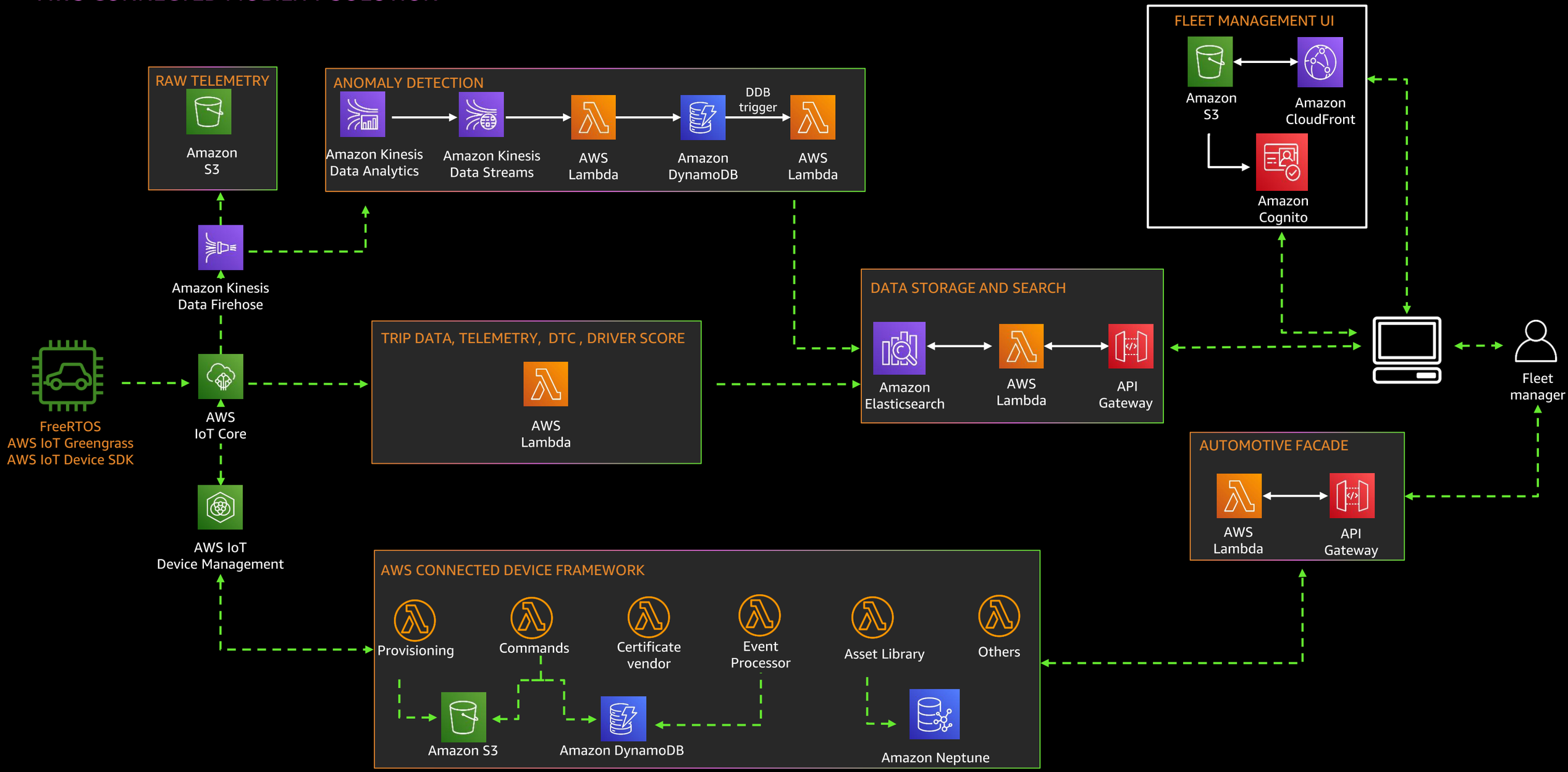
# Fleet management

CONFIGURATION AND OTA



# Bringing them together

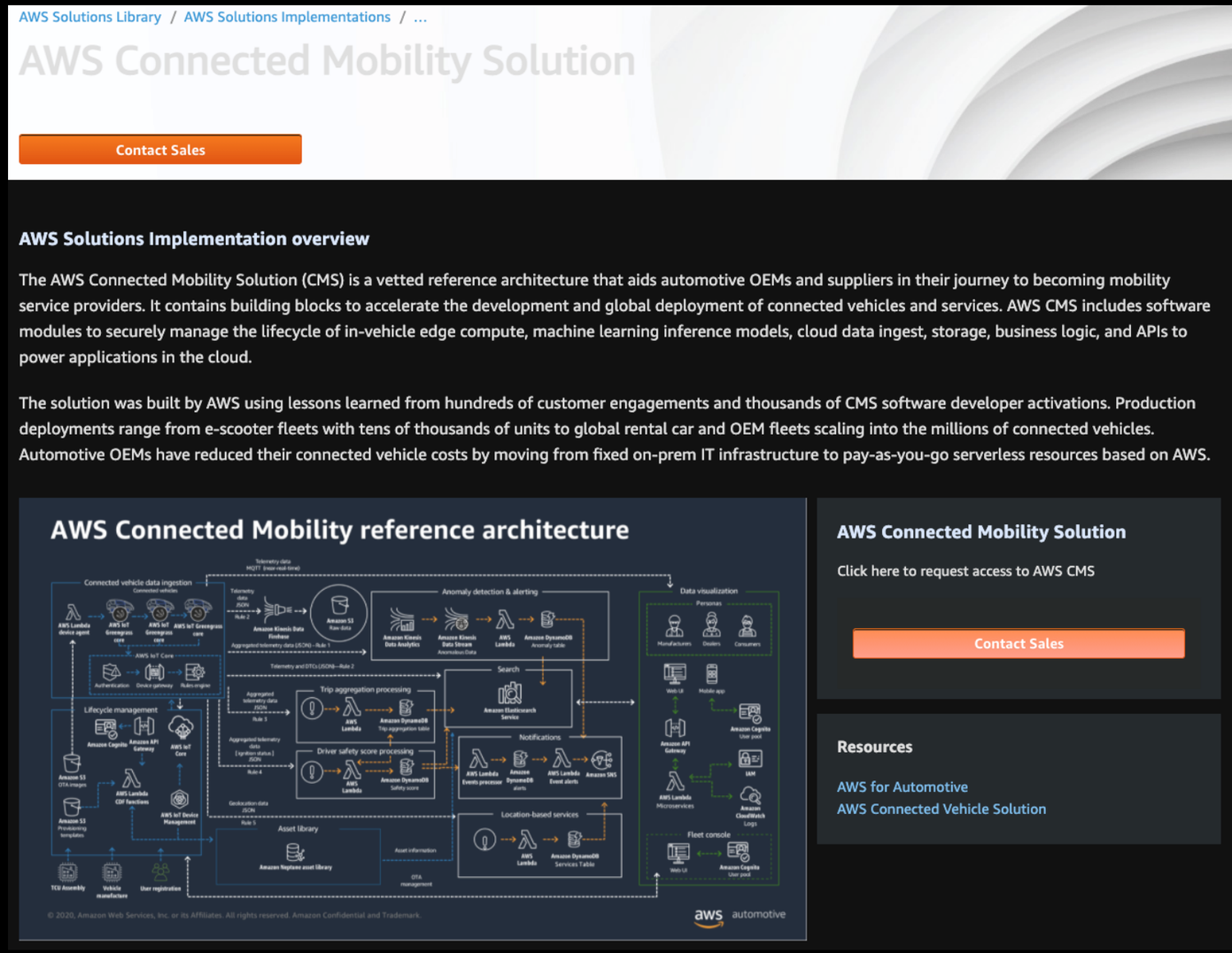
AWS CONNECTED MOBILITY SOLUTION



# How do you get started?

https://aws.amazon.com/solutions/implementations/connected-mobility-solution/

- Start prototyping with a “well-architected” architecture in minutes using the AWS connected vehicle quick start
- Deploy into your own AWS account
- Customize use cases or develop your own
- Remove or add other AWS and partner services
- Easily connect your own data or your own devices
- Source code



# DENSO—Mobility IoT Solution

Shazaan Bahrainwala

Senior Manager, Seattle Innovation Lab

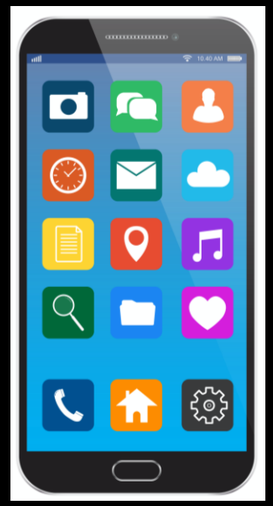
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# Future of connected vehicles

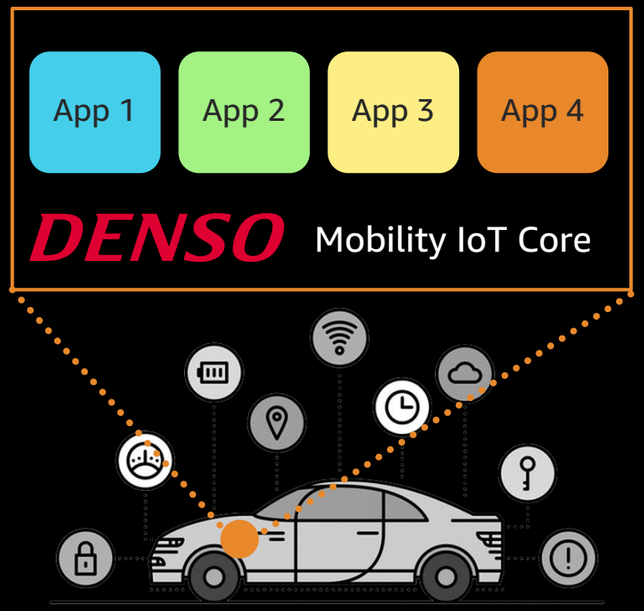


- Single Function
- Not updatable
- No compute capability
- Slow innovation



- Multi function
- Updatable
- CPU/GPU compute available directly to developers
- Rapid innovation





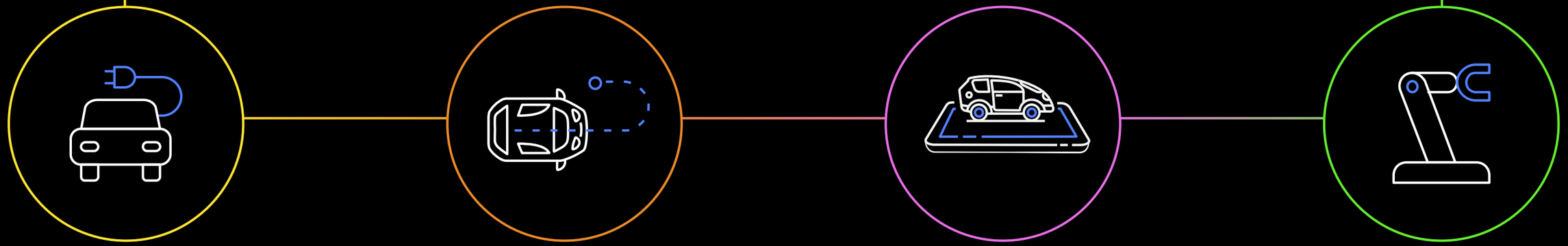
# About DENSO

- Established 1949
- 2nd largest global automotive parts company
- Thermal, powertrain, mobility, electrification, electronic systems
- $47.6 billion net sales
- 170,000 people, 35 global regions

# DENSO's future direction

## 4 core technologies

to create new value
and influence the future of mobility



Electrification

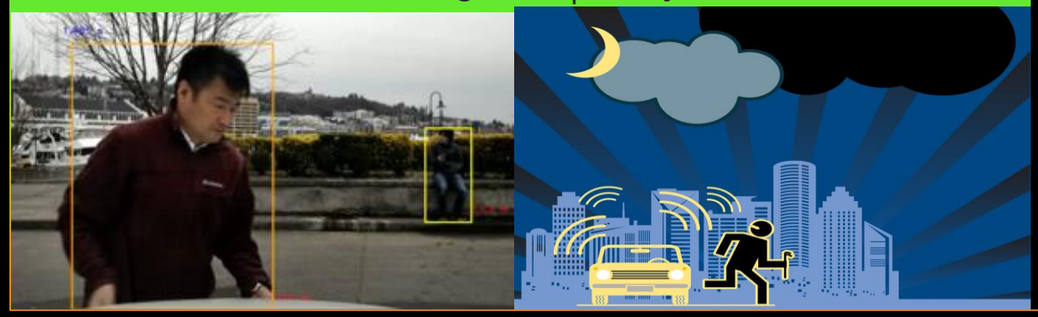
Automated driving

Connected vehicles

Factory automation and AgTech

# Edge computing—real world use cases

Video Recognition | Always-on



## Car security

- Continuously detect dangerous events inside and outside the vehicle using vehicle camera systems
- Proactively alert users
- Capture video proof of security events

Endpoint AI | Video Capture and Streaming

MOTER




## Usage-based insurance for car sharing

- Insurance based on real-time driver behavior, location, usage, and vehicle telemetry
- More precise risk measurement in real time
- Better insurance pricing for customers

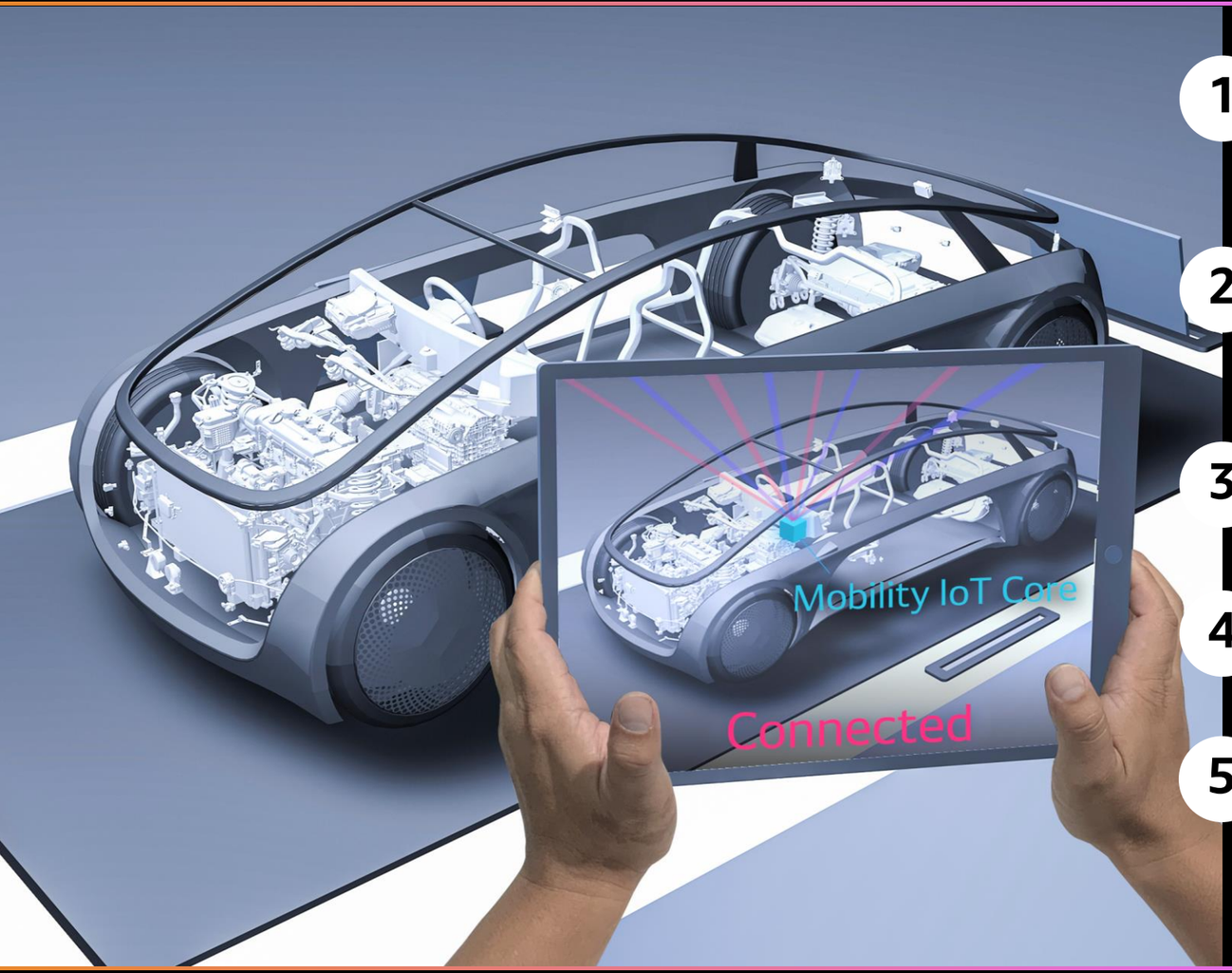
Security | Key Management



## Location-based services

- Real time mapping
- Ad targeting
- Logistics and last mile delivery services

# Vehicle edge computing with DENSO mobility IoT solution




1. **Speed and resiliency**
   Very low latency applications; doesn't require constant connectivity
2. **Cost effective**
   Doesn't require transfer of large amounts of data to the cloud for storage and processing
3. **Privacy focused**
   Private data never needs to leave the vehicle
4. **Updatable**
   Applications can be updated and modified
5. **Unlock business innovation**
   Allows developers and operators to build and grow new mobility business models

# DENSO Mobility IoT core + AWS CMS

App 1 | App 2 | App 3 | App 4

docker | AWS IoT SDK | WebRTC | MQTT

gstreamer | AWS GreenGrass | SQLite | AWS IoT Shadow

**DENSO Edge Application Framework**

DENSO System Management

Linux Operating System

Hardware Accelerators

DENSO Mobility IoT Core

Vehicle Cameras | Vehicle CANBUS



**DENSO UI**

Anomaly Detection | Video on Demand | Fleet Management

Trip Aggregation | Vehicle Data Ingestion | Vehicle Control

**DENSO Mobility Services Library**

**DENSO Service Access APIs**
**DENSO Digital Twin**
**DENSO Mobility Gateway**

AWS Identity and Access Management

Platform API's | Application Services

Data Services | Data Ingestion (AWS IoT)

**AWS CMS**

DENSO Mobility Services Core

aws

Insurance company

Fleet operators

OEM

**Automotive Grade Mobility Solution**

# DENSO Mobility IoT core hardware platform









**DENSO**
Crafting the Core

DENSO Hardware Reference Design

- Extensible Hardware platform
- Modifiable based on customer requirements
- Available as aftermarket OEM product
- Integrated into new or existing vehicle ECUs

Vehicle camera

Vehicle CANBUS

CPU

GPU

Machine Learning

Updatable apps

# Demo:

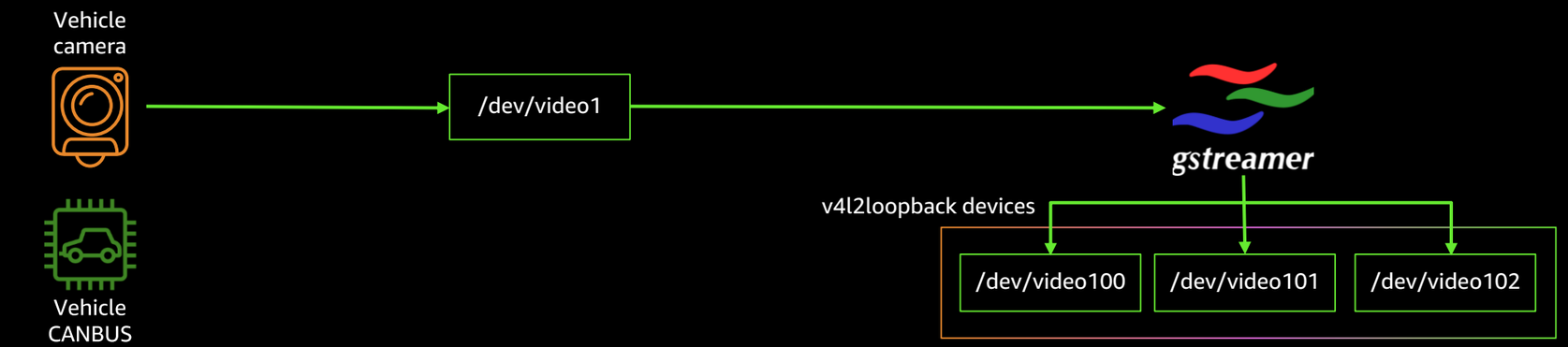
# Vehicle security camera



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# 1. Building a video pipeline at the edge

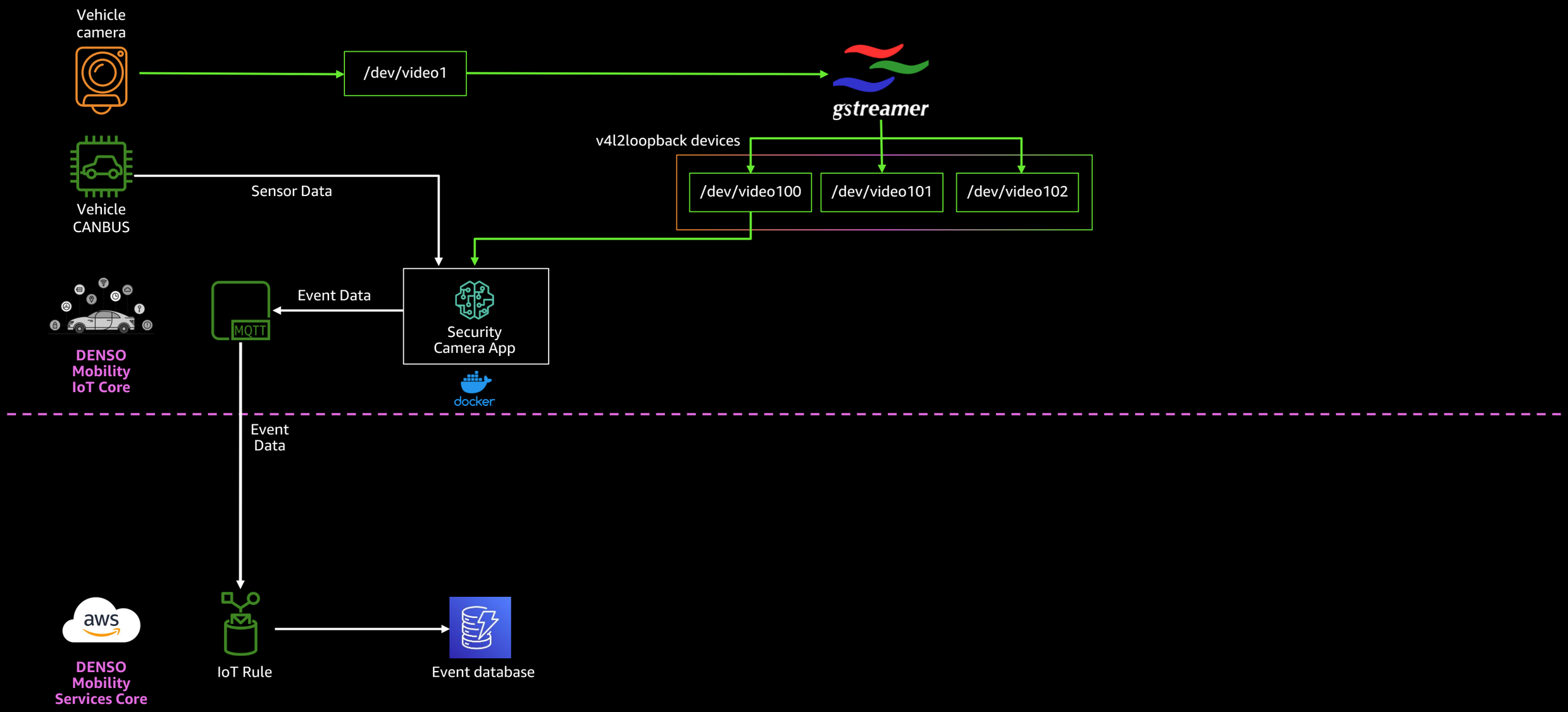




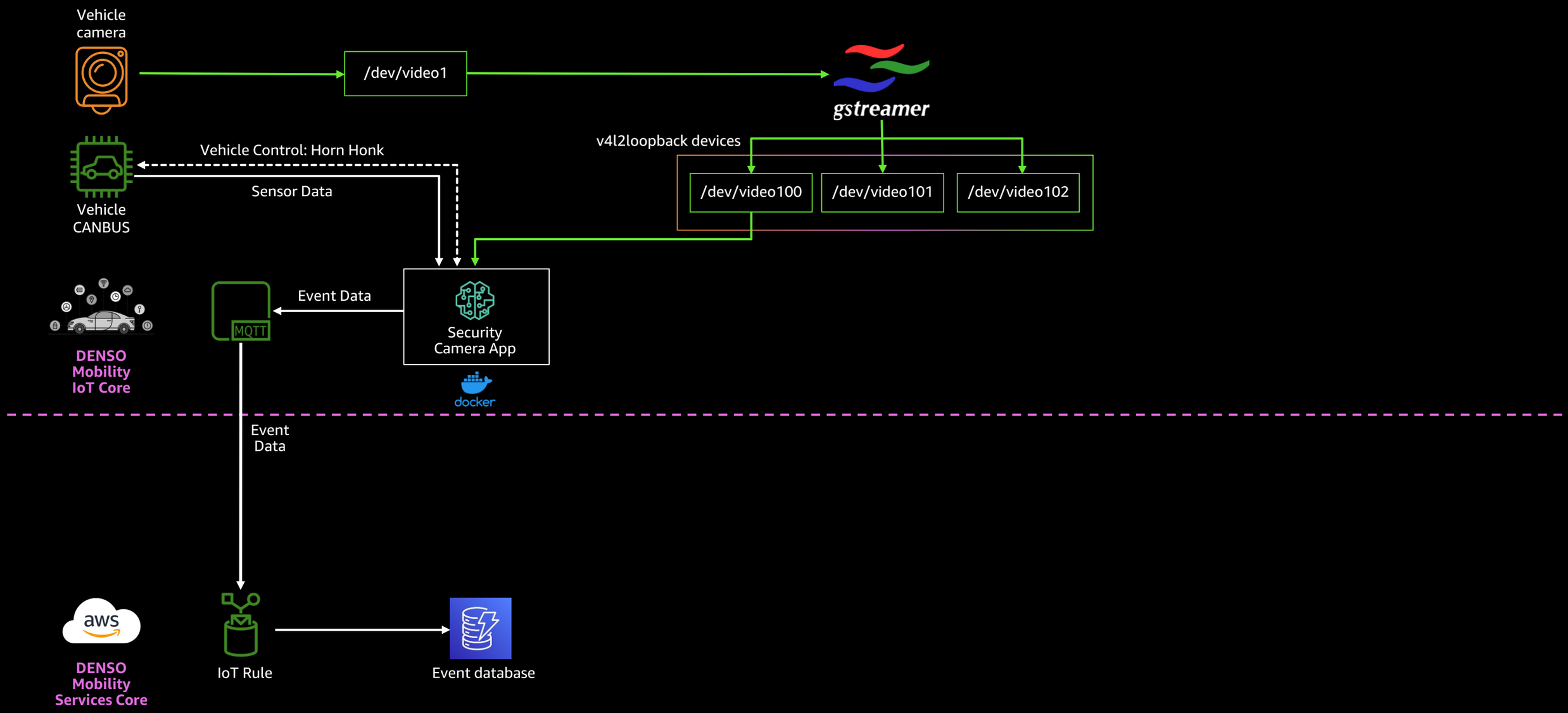

DENSO Mobility IoT Core

DENSO Mobility Services Core

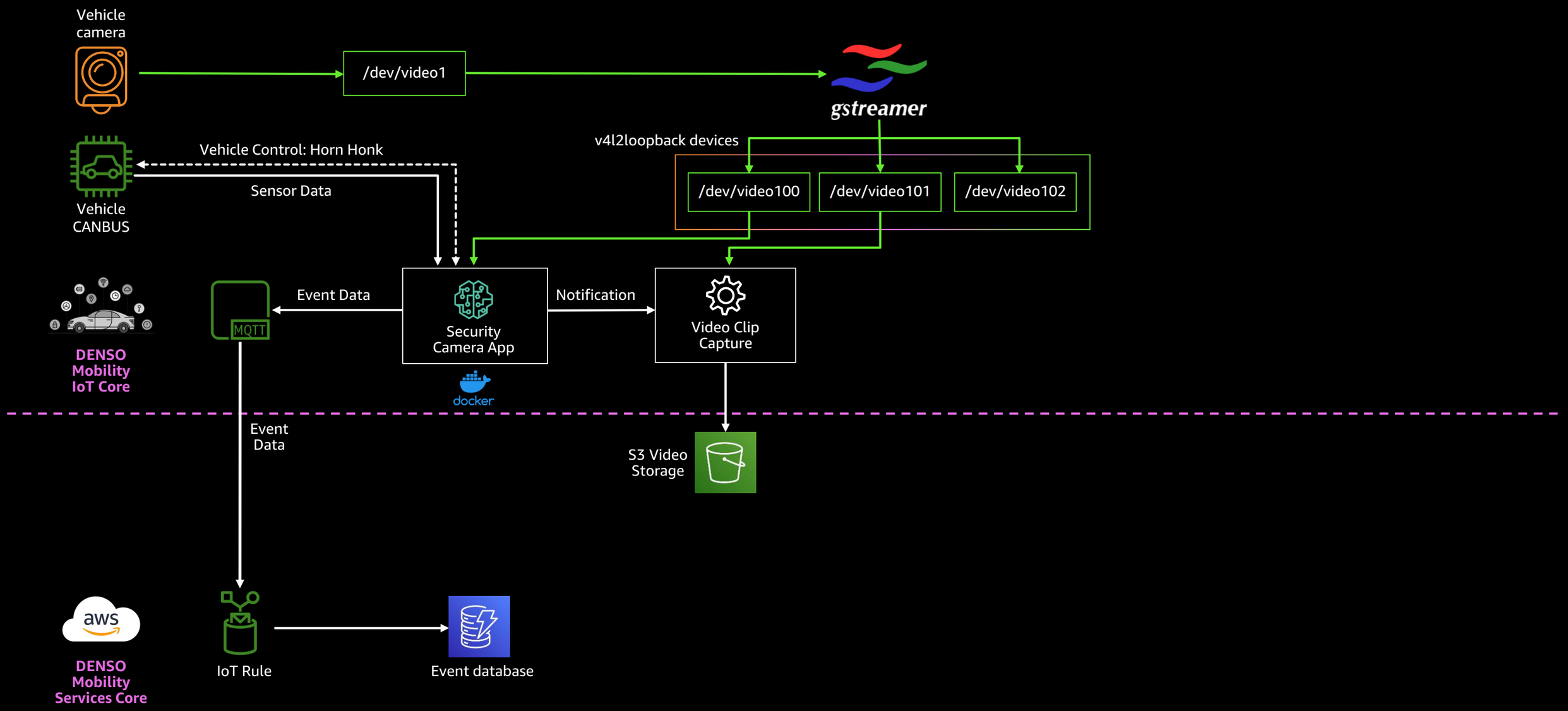
# 2. Detect and store security camera events



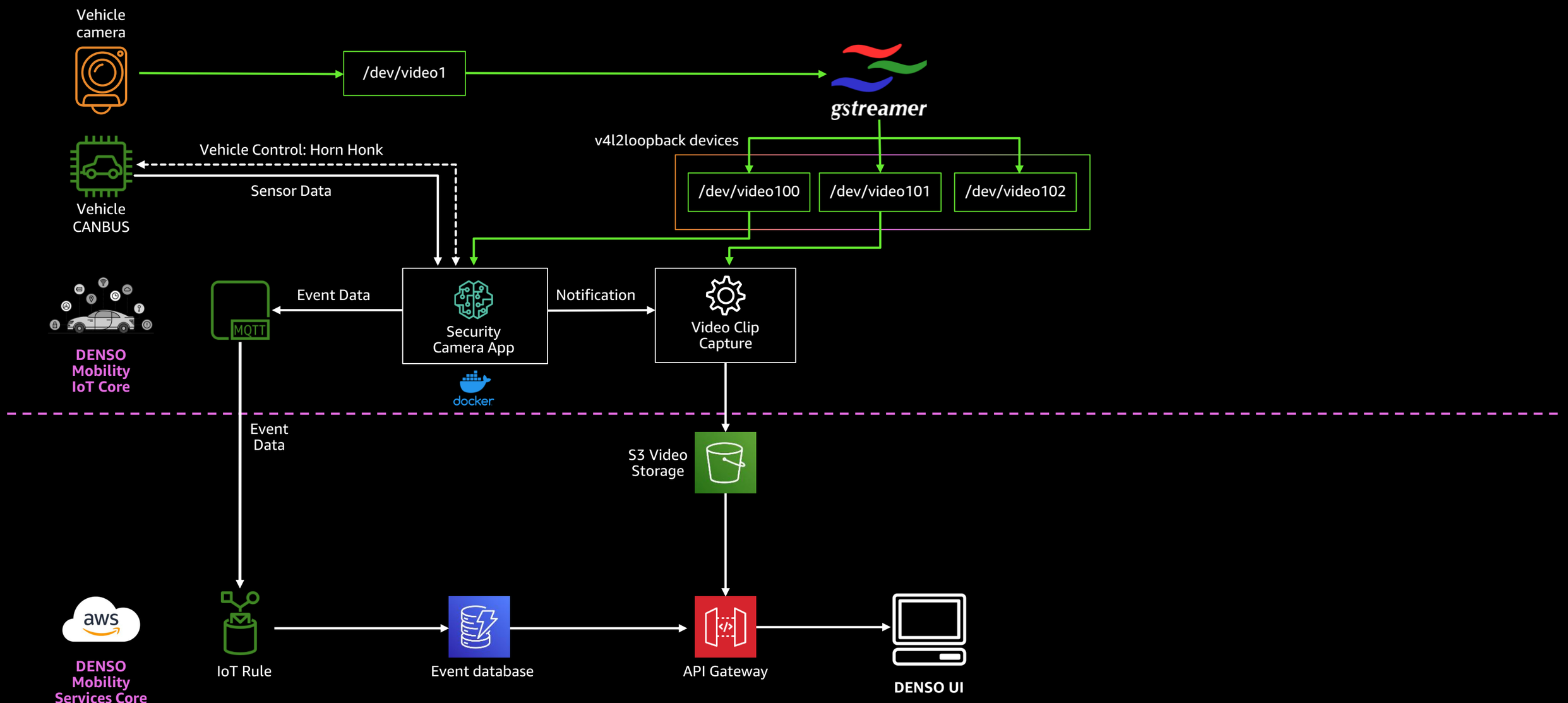
# 3. Activate the vehicle horn



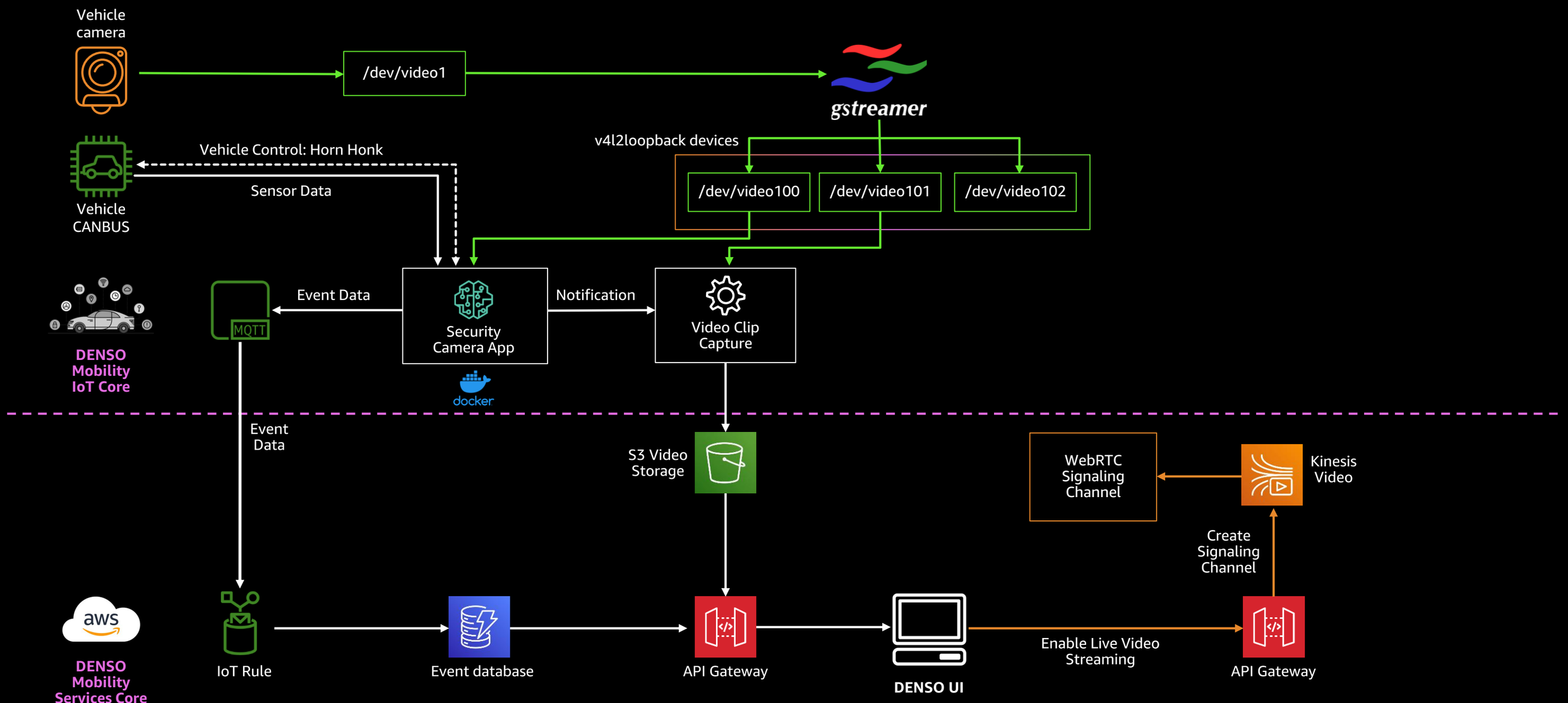
# 4. Capture and store event video clips



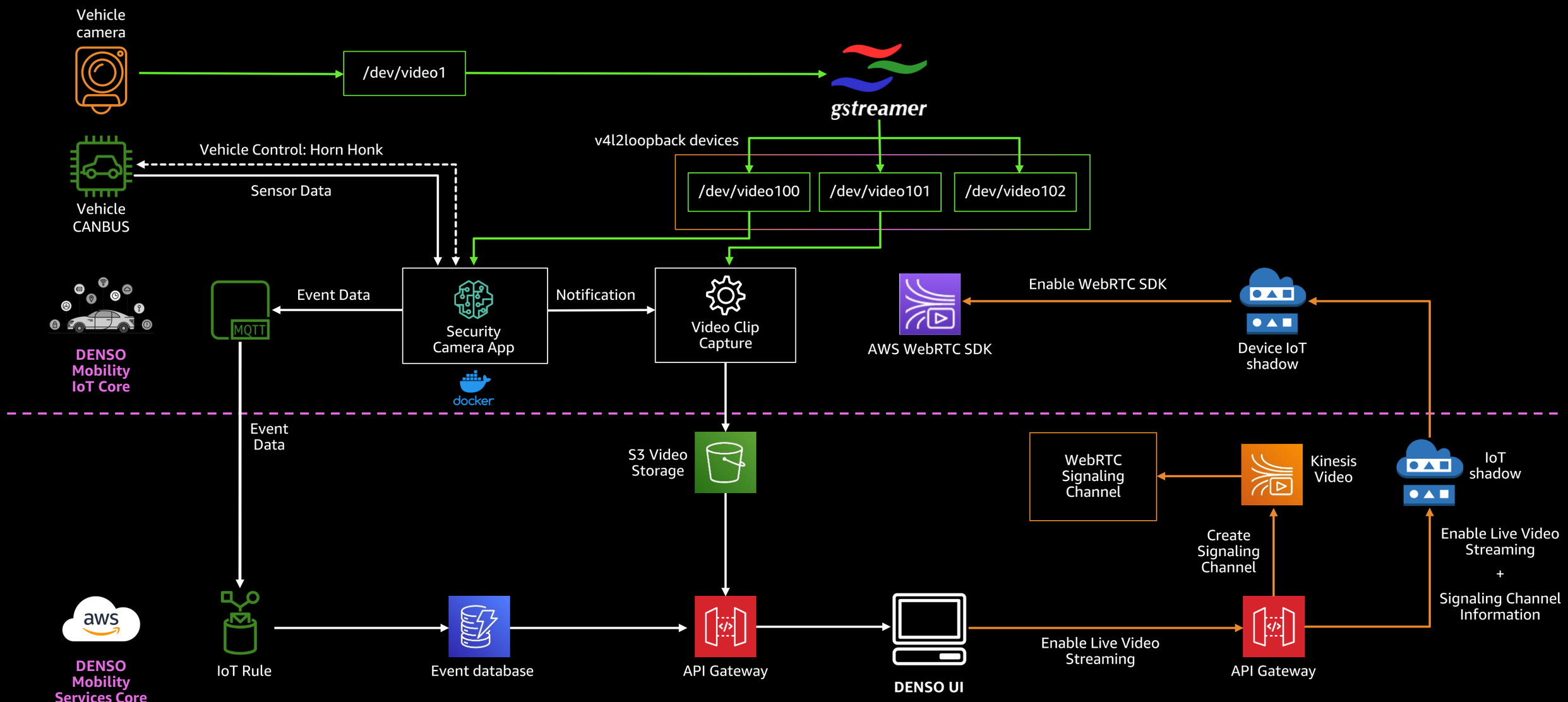
# 5. View security events in the cloud



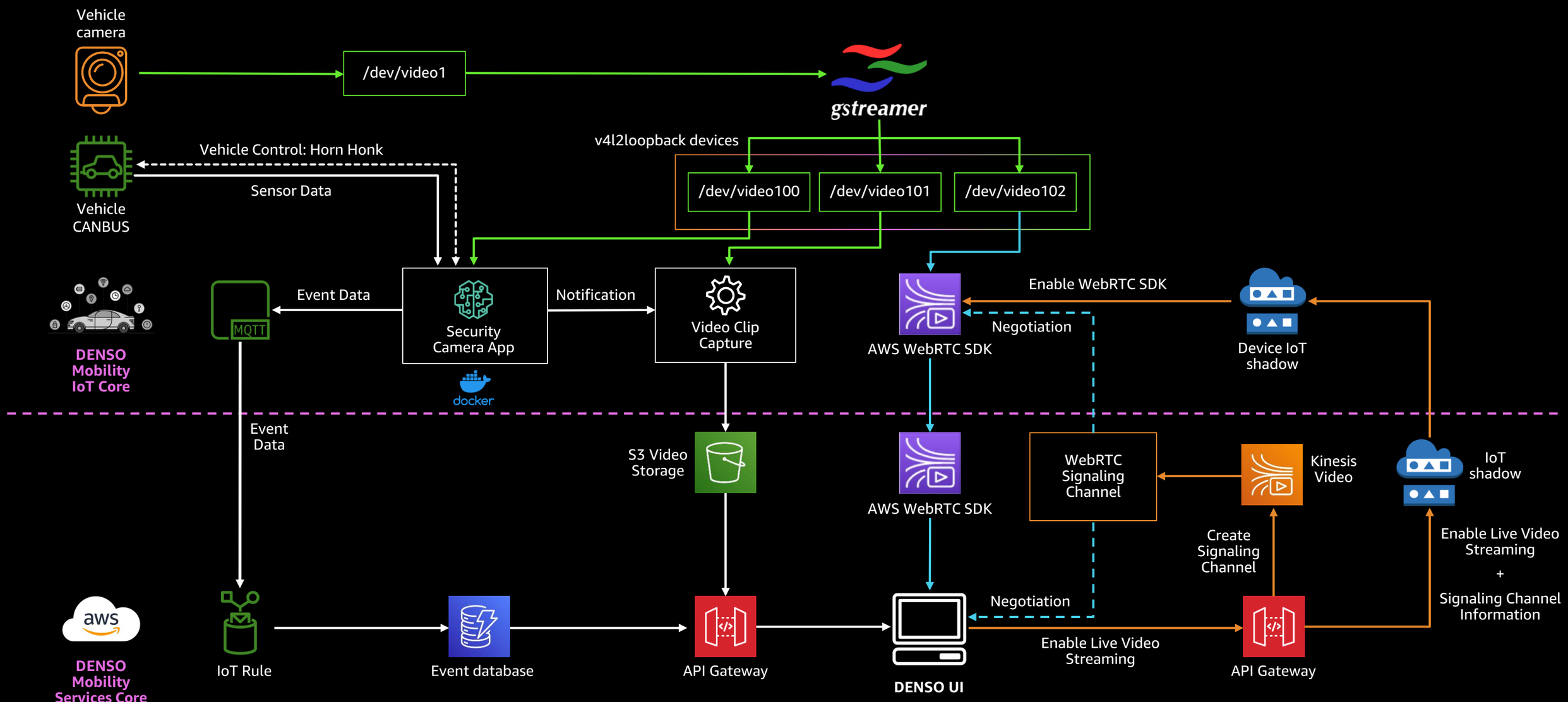
# 6. Create a WebRTC signaling channel



# 7. Enabling live video streaming on the edge



# 8. View live video streamed from the vehicle



# Lesson learned



## Speed to first prototype

Utilizing the CMS reference architecture significantly accelerated development time



## Learn by building

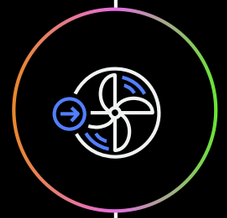
AWS allows for easy trial and experimentation



## Collaboration with AWS

Quick problem solving, help to build new solutions

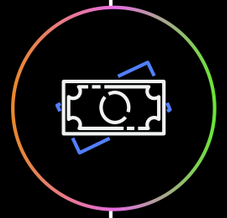
# Summary



AWS Mobility Flywheel



AWS Connected Mobility Solution



Pay as you go



Open Source & Modular




Mobility IoT Core Platform

# Learn more

AUT301 – Alexa, charge my car! Test drive the Accenture EV roaming platform

AUT302 – Paving the way toward automated driving with BMW Group

AUT303 – Reimaging mobility with Toyota Connected

AUT201 – Transforming the automotive industry with the Industrial Cloud

# Thank you!

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