
AWS
re:Invent
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IOT302-R

# Connected vehicle design patterns with AWS IoT and MQTT

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# Agenda

AWS for Automotive

Connected vehicle platforms with AWS

Evolution of connected vehicle platforms

Challenges of connected vehicles

Building a connected vehicle platform on AWS

Considerations – AWS IoT Core for connected vehicle

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# Connected vehicle on AWS

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# AWS for Automotive solution areas

## Software-defined vehicle

The vehicle is evolving into a software-defined digital platform and empowering the design and development teams to deliver on changing consumer value expectations

## Connected mobility

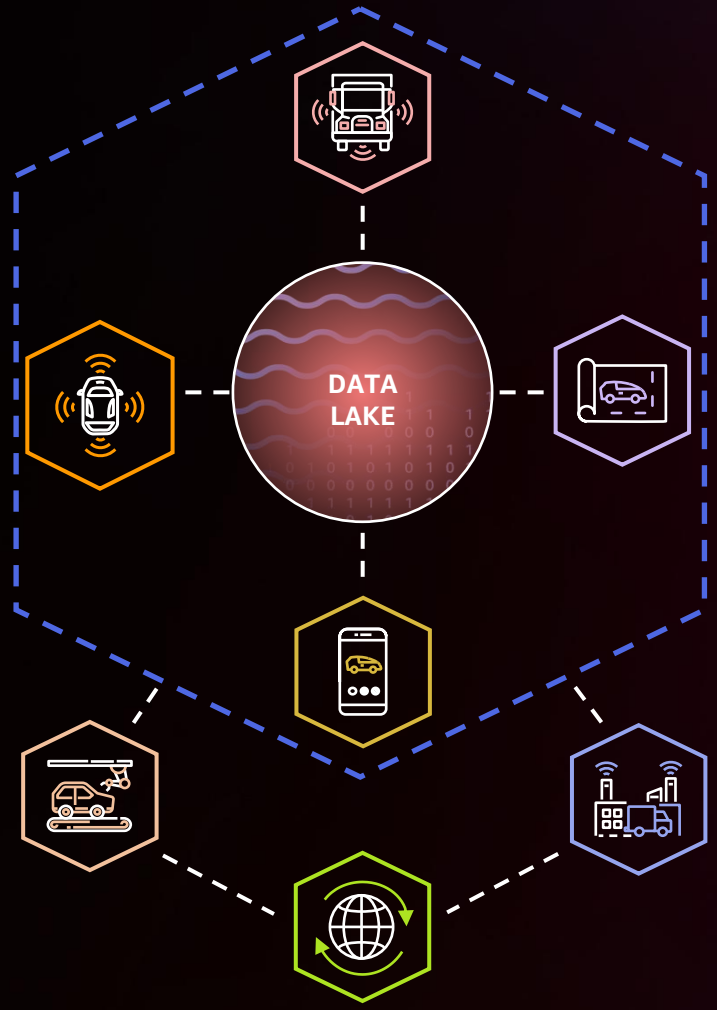
In a software-driven era, technology unlocks the power of your data to build intelligent, personalized features and revenue-generating mobility services

## Digital customer engagement

Increase customer engagement with relevant marketing content, personalized digital experiences, and real-time data analysis

## Manufacturing

Realize improved manufacturing operations and overall equipment effectiveness by enabling data-driven real-time decisions leveraging existing shop floor data and innovative technologies




## Autonomous vehicle development

Amazon's 20 years of experience with autonomous systems, robotics, and ML taught us how to accelerate our customers' AV development with purpose-built AWS solutions

## Product engineering

Customers can use AWS and partner-enabled solutions to develop new and innovative products at a faster pace by collaborating with multiple suppliers and OEMs across a single platform

## Supply chain

Gain end-to-end real-time visibility and insights beyond immediate suppliers to build a resilient, intelligent, and cost-effective supply chain with unprecedented efficiency

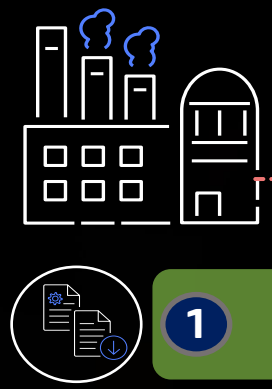
## Sustainability

Enablement tools for battery asset monitoring, track and trace capabilities, and sustainability reporting from vehicle to enterprise scale

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# Elements of a connected vehicle platform





AWS IoT Core

1 Secure onboarding

AWS IoT Device Management

Fleet Hub for AWS IoT Device Management

4 Operations



3 Data abstraction layer

AWS IoT FleetWise



Connected vehicle data lake

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2 Connectivity and control

AWS IoT Core



5 Applications

Amazon SageMaker

Amazon QuickSight

Amazon Managed Grafana



6 End-to-end security and privacy

AWS IoT Device Defender

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# Connected vehicle architectural layers

**Cybersecurity** protection

**Applications layer**
Business use cases, differentiation

**Operations layer**
Monitoring, customer support, deployment

**Software abstraction layer**
Containers, CI/CD

**Data abstraction layer**
Model, select, collect

**Connectivity layer**
Secure connection from vehicle to cloud (MQTT, HTTPS)

**Device layer**
**H**ardware abstraction, OS, device onboarding and management




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# Evolution of connected vehicle platforms

- First connected vehicle platform ~25 years ago, CDMA and GPS
- Hardware-based, outsourced to telematics service providers (TSPs)
- On-premises infrastructure, scaled for peak demand
- OEMs, in-house development, 10-year support model
- Cloud migration for ingest and data lakes
- Platform migration/modernization, managed message broker, intelligent data collection

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# Challenges with connected vehicle platforms

- Automating onboarding and provisioning
- Scalability and elasticity
- High latency and unreliable networks
- Instantaneous bidirectional communication
- Vehicle modeling and uniformity
- Autonomous vehicle data streams
- Platform security and data privacy

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WirelessCar

## WirelessCar connects millions of vehicles to the cloud using AWS IoT Core

WirelessCar is a provider of digital vehicle services headquartered in Sweden. Founded in 1999, the company has connected more than nine million vehicles in over 100 countries.

### CHALLENGE

To support a global fleet of connected vehicles, which rely on IoT technology, WirelessCar needed to manually manage and configure several backend services. The company needed an automated solution to manage these processes.

### SOLUTION

By adopting AWS IoT Core, WirelessCar is managing its vehicle fleets at scale without having to manage infrastructure. Using this fully managed solution, the company has reduced manual labor and improved its speed to market.

### IMPACT

- Connects millions of vehicles to the cloud
- Supports high availability
- Reduces manual labor with fully managed services

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“Using AWS IoT Core, we can save time and reduce the number of resources needed to deliver a solution.”

**Henrik Strömberg, solutions architect, WirelessCar**




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# Building a connected vehicle platform on AWS

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# Building a connected vehicle platform



## 1. Secure vehicle onboarding

- How to establish mutual trust between the vehicle and cloud?
- How to securely deploy secret credentials to the vehicle?



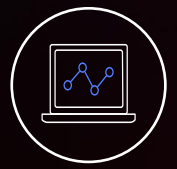
## 2. Connectivity and control

- How to securely ingest vehicle data into your AWS environment?
- How to securely send commands to vehicles, even with intermittent connectivity?



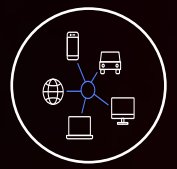
## 3. Software and data abstraction

- How to extract data from proprietary ECU data formats and networks (e.g., CAN)?
- How to model vehicle data for data analytics, dashboards, and applications?



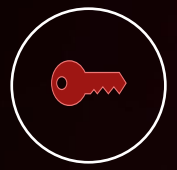
## 4. Operations

- How to monitor and respond quickly to individual or fleet-wide issues?
- How to safely deploy updates to the platform (OTAs)?



## 5. Applications

- How to discover problems before a customer does?
- How to develop personalized customer experiences?



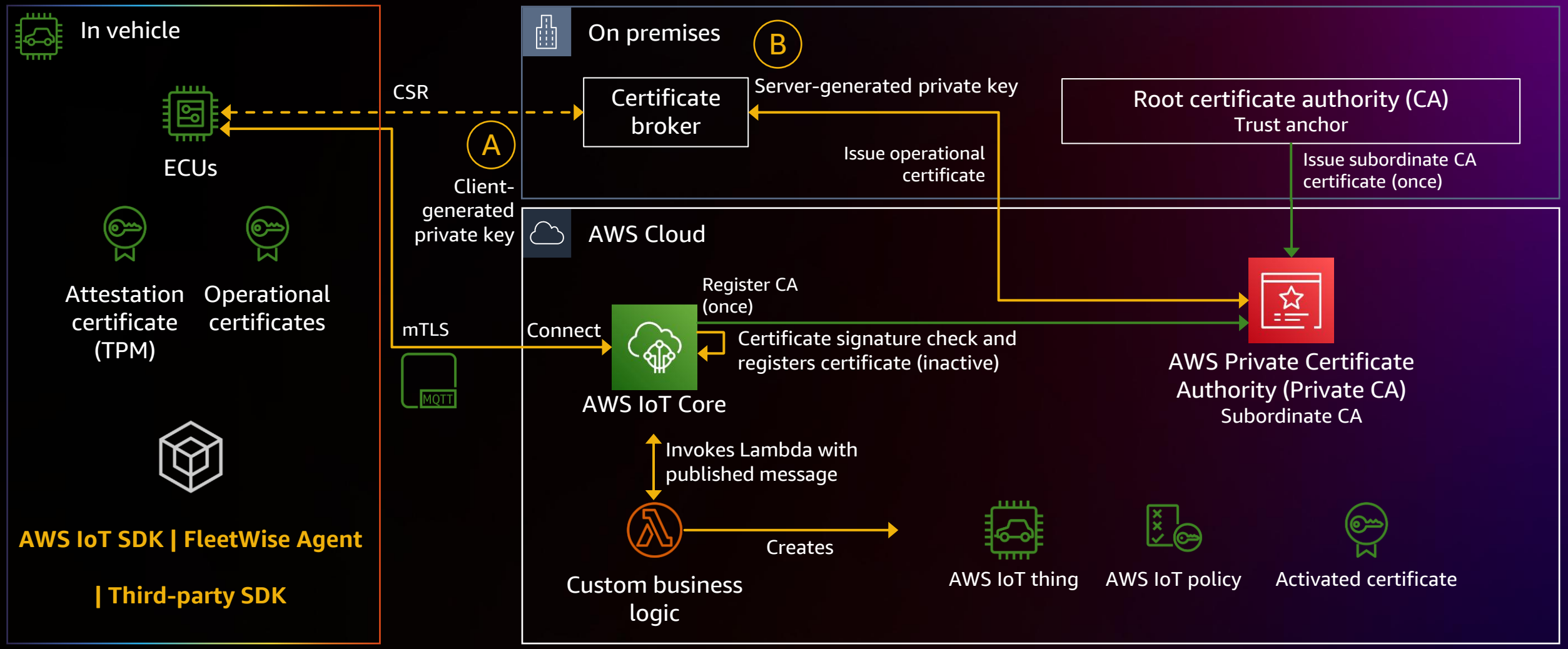
## 6. End-to-end security and privacy

- How to ensure the whole solution is secure on the vehicle and in the cloud?
- How to comply with data privacy requirements like GDPR (EU) or PIPEDA (Canada)?

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# Securing ECU communication to AWS IoT Core




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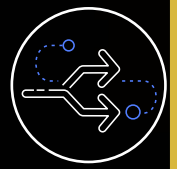
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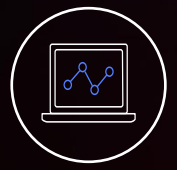
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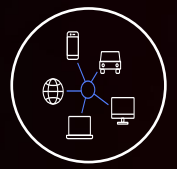
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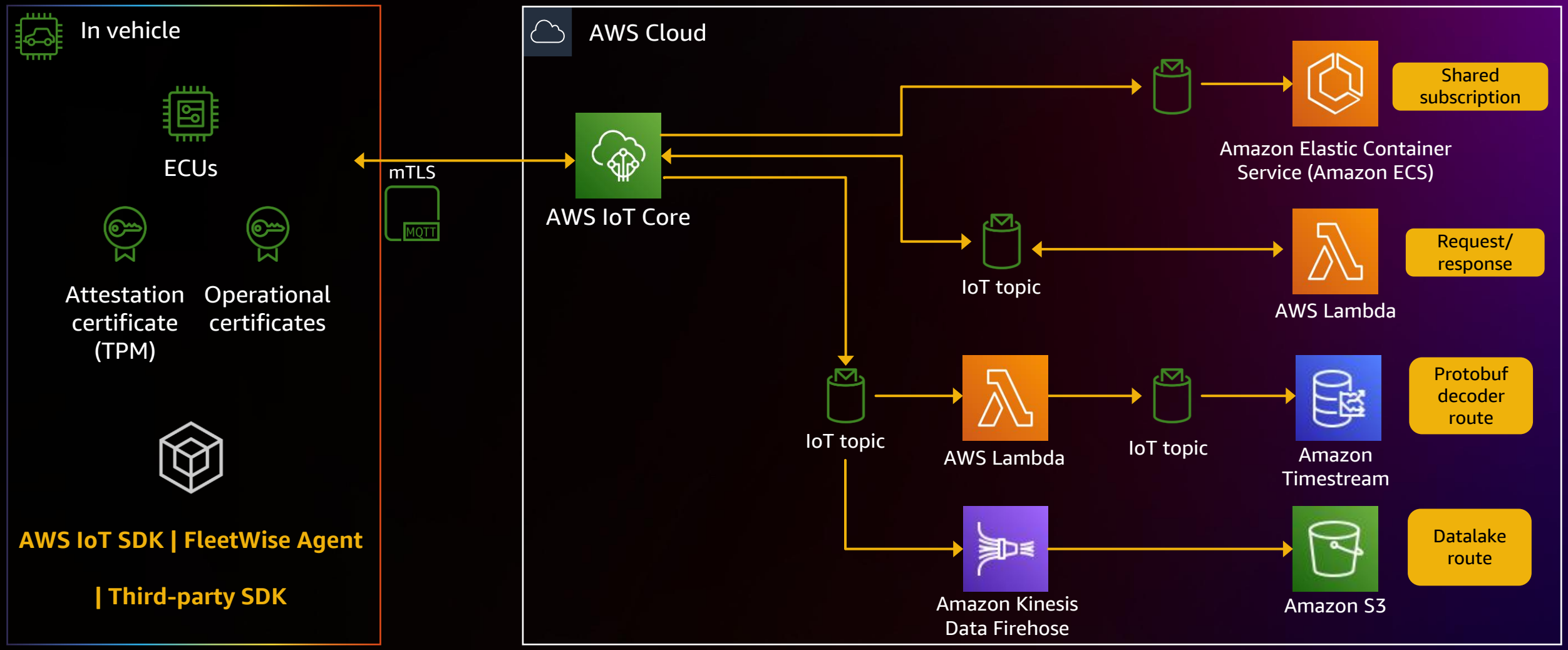


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# AWS IoT Core enables large-scale connected vehicle workloads




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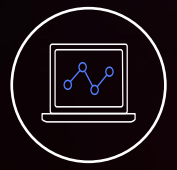
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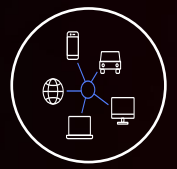
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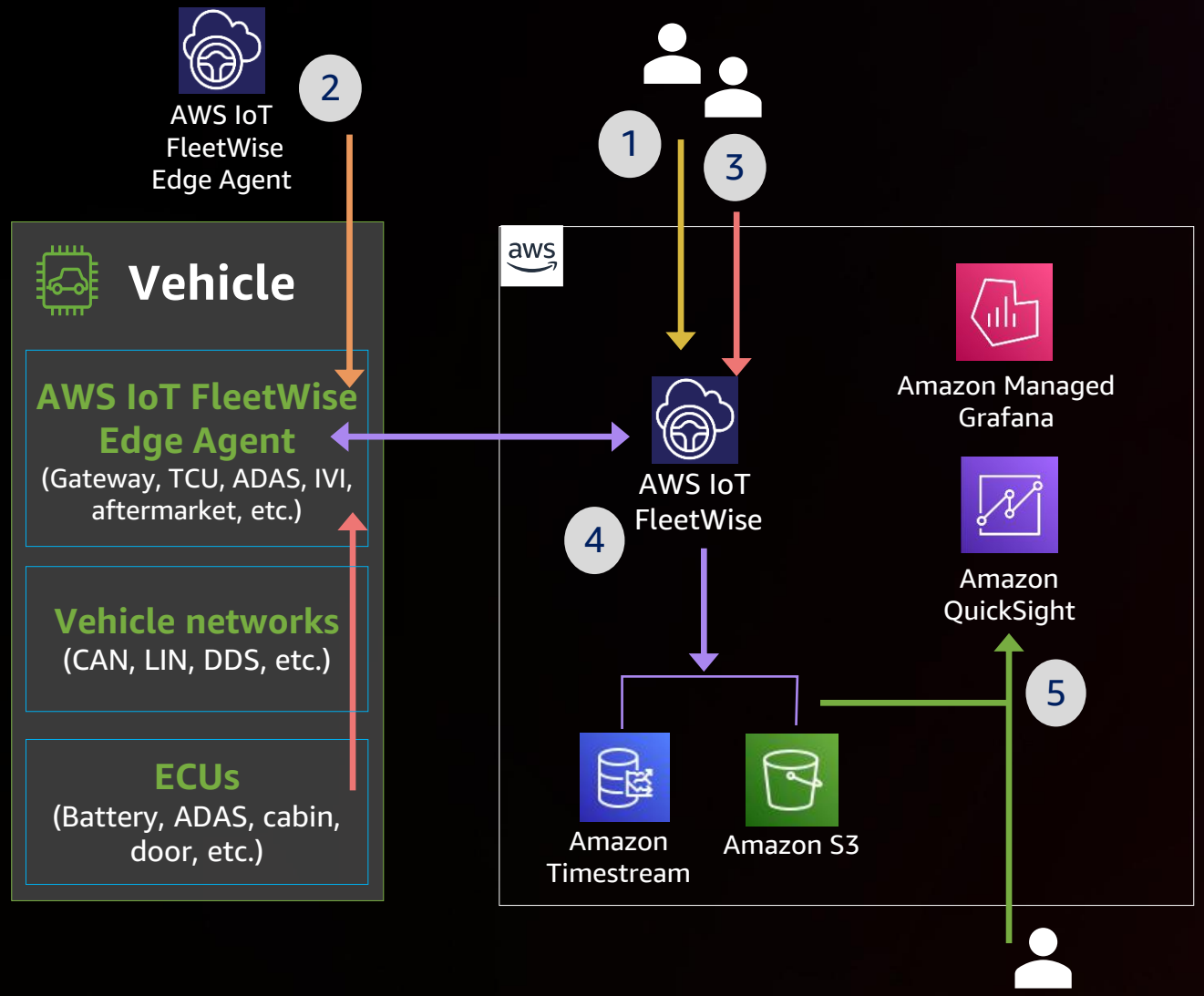


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# Deploying AWS IoT FleetWise




AWS IoT FleetWise

1 **Model**

- Model vehicle sensors and ECUs in the signal catalog using FleetWise designer

2 **Deploy and connect**

- Build and deploy the FleetWise Edge Agent to target hardware in the vehicle
- Connect the FleetWise agent to the cloud

3 **Select data**

- Create and manage data collection campaigns based on time or events/conditions

4 **Collect and transfer data**

- Activate the data collection campaigns
- FleetWise collects, transfers, and stores the data

Customer

5 **Analytics and applications**

- Build insights, dashboards, analytics, AI/ML pipelines, and applications based on the data

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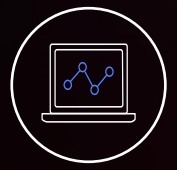
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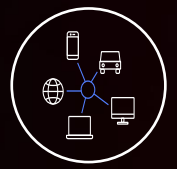
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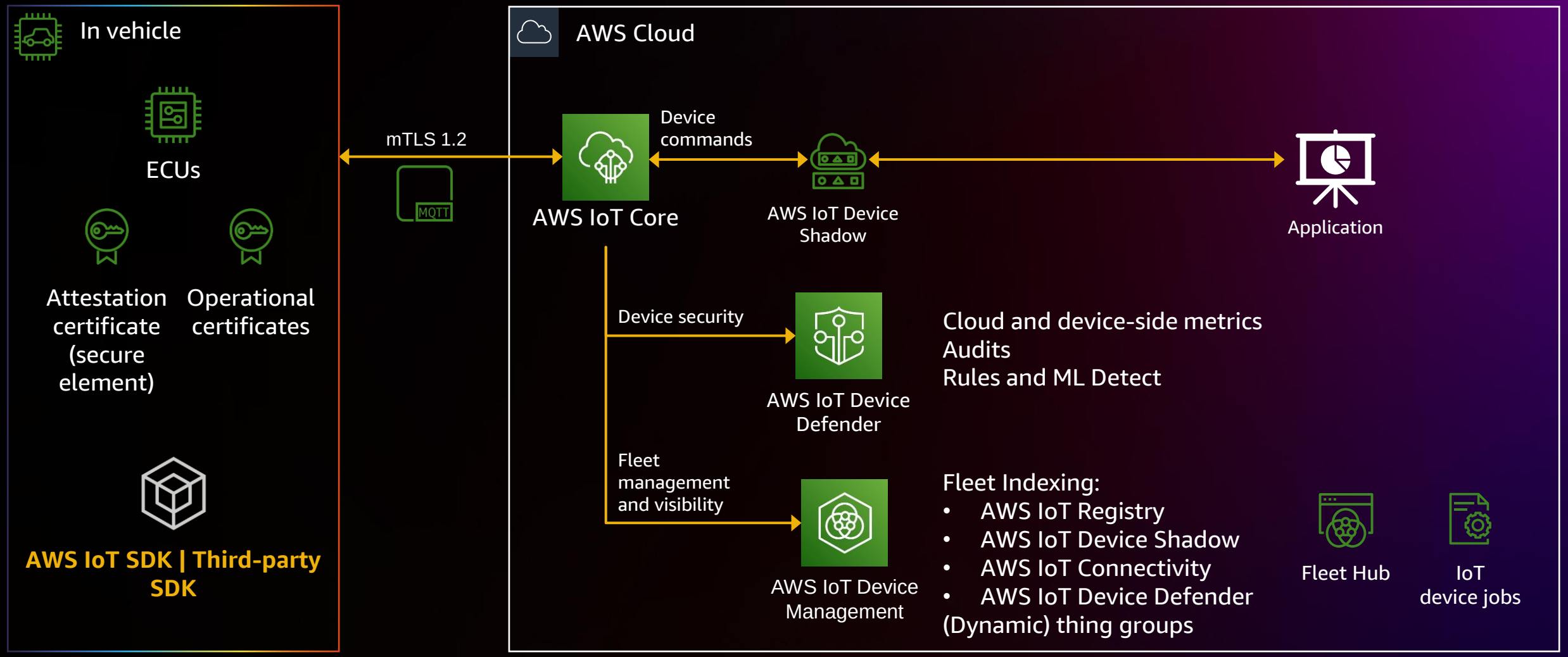


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# AWS IoT Core vehicle operations




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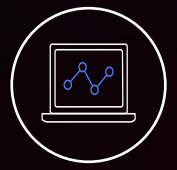
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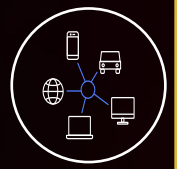
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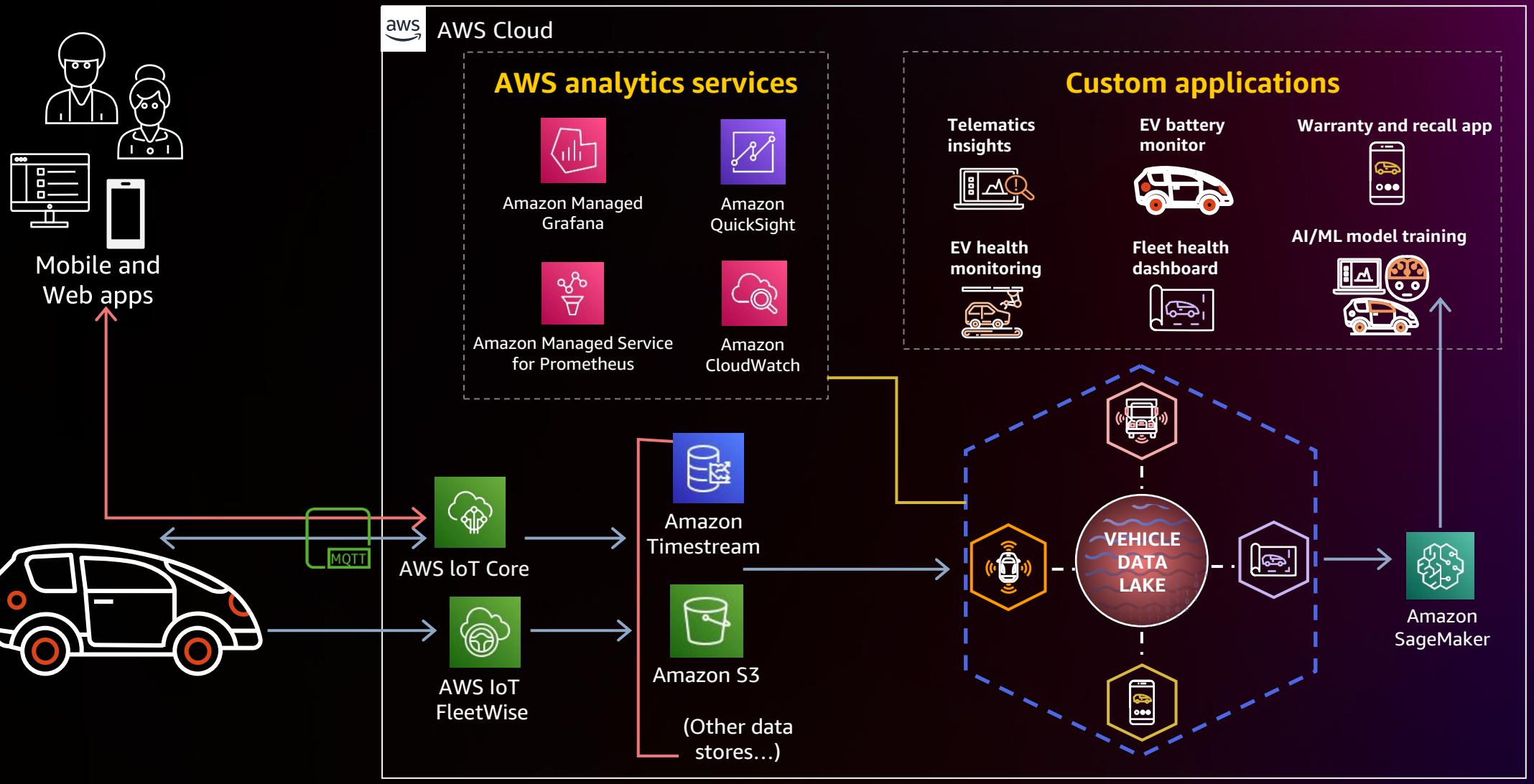


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# Applications with connected vehicle telematics




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# Data visualization in Grafana




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# AWS IoT for Automotive

- AWS IoT Core: Platform as a service – pay for what you use
- Provisioning devices – secure communication
- Downstream communication
- Telemetry and streaming ingest – AWS IoT Core Message Broker
- Operations – device management
- Predictive models and edge inference

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