

Capgemini 

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Accelerate towards connected mobility with Capgemini's Trusted Vehicle, an AWS Connected Mobility Solution

Capgemini and Amazon Web Services make new driver, passenger, and fleet-management experiences a reality with connected and software-defined vehicles

As OEMs embrace CASE (Connected, Autonomous, Shared and Electrification) trends, they must also create new driver, passenger, and fleet-management experiences that span many new B2B relationships – without sacrificing trust. Trusted Vehicle, based on the AWS Connected Mobility Solution, accelerates time to market with a secure, scalable platform of next-generation driver and fleet-management experiences.

The companies which succeed will be those which bring frictionless innovation into the vehicle with the latest technology. Amazon Web Services (AWS), the world's leading cloud platform, helps thousands of automotive customers innovate by equipping them with the essential tools for business agility, efficiency, and innovation.

AWS for Automotive helps OEMs, mobility providers, parts suppliers, automotive software companies, and dealerships navigate AWS,



AWS for Automotive helps OEMs, mobility providers, parts suppliers, automotive software companies, and dealerships navigate AWS, [empowering them with custom-fit solutions and capabilities](#) in multiple areas. These include: :



Autonomous driving – Accelerate development of ADAS and AV solutions with edge compute, data ingestion, HPC, and machine learning



Connected mobility – Leverage the power of vehicle data to build intelligent systems and mobility services to generate revenue and redefine the driver experience



Digital customer engagement – Boost consumer engagement with real-time data analysis and personalized marketing campaigns



Software-defined vehicle – Deliver new vehicle capabilities updatable over the air, blending proven software development techniques with deep automotive engineering, without sacrificing safety and risk



Manufacturing – Increase manufacturing efficiency and automation by capturing and interpreting shop-floor data that implement new operational technology improvements



Supply chain – End-to-end and real-time visibility of the supply chain and distribution network



Product engineering – Equip developers with tools to engineer new solutions to complex problems and deliver innovative designs to market with speed.



Sustainability – Sustainability solutions on AWS allow OEMs to manage indirect emissions in the supply chain and extend the longevity of vehicles through swappable batteries and updatable software-defined functions which add new capabilities during a vehicle's lifespan.

Having partnered with AWS for over a decade, Capgemini has the expertise to deliver AWS for Automotive solutions tailored to unique business requirements. Our global teams comprise 6,500 certified AWS professionals and 30,000 trained on AWS who guide both start-ups and global enterprises through evolving challenges surrounding cloud, digital, and platforms.

One of the connected-mobility challenges OEMs must face is developing B2B links with external organizations they do not have relationships with today; these organizations include quick-serve restaurants and retailers, hospitality companies, toll road and bridge operators, EV charging network providers – essentially any organization that provides

a product or service that adds value to the driver experience. This is the Capgemini differentiation – we make sense of the huge volumes of vehicle data and integrate vehicles with OEMs and external enterprises to create seamless and innovative experiences.

Capgemini worked with AWS as a launch partner for the AWS Connected Mobility Solution (CMS) platform. We developed repeatable and customizable modules for OEMs and mobility companies to accelerate their connected mobility journey. Some examples include:

- Managing overage fees with a fleet telematics system as an incentive to avoid overcharging electric vehicles and wasting energy
- Using APIs and vehicle keyless features to quickly locate a car in large parking lots, increase safety, and protect vehicles from theft
- Accessing a greater range of useful information in electric vehicles like coolant level, state of charge, and battery health, so helpful suggestions can be made to the driver
- Detecting anomalies before they become a problem by analyzing vehicle data and making proactive interventions before the vehicle breaks down
- Interpreting diagnostic trouble codes and fixing them with new software to save on repairs and prevent costly or dangerous malfunctions.

Capgemini has partnered with Amazon Web Services to bring innovative mobility solutions to companies committed to a better and more sustainable automotive future. We can apply our AWS partnership and CMS expertise to successfully implement Trusted Vehicle in your organization. We can also quickly add new capabilities to the solution that are unique to your business, and give you market differentiation. The following pages describe the repeatable modules we have already developed, so you can get started more quickly.

Build your brand experiences for drivers, passengers, and fleet managers on Capgemini's Trusted Vehicle – then build the cars your consumers want to drive. Let's redefine the world of mobility together.



BOLSTER SAFETY AND EFFICIENCY WITH BETTER FLEET MAINTENANCE

Diagnostics trouble-code tracker identifies issues before they become bigger problems

A car dashboard is a wealth of information. Many drivers rely on their dashboard to provide an early warning of maintenance issues or concerns. If a light flashes on, drivers pay attention.

But for fleet managers, relying on drivers to relay dashboard information and warnings is unreliable. And having to check every vehicle for a warning light is not efficient. A new way to monitor large numbers of vehicles and predict issues before they happen is required.

Automotive OEMs need a connected fleet-management solution with the ability to identify diagnostics trouble codes (DTC) quickly and easily.



The approach

By using FreeRTOS or installing AWS IoT Greengrass at the edge to connect a vehicle to AWS IoT cloud, fleets can securely transmit telemetry data over MQTT protocol. DTC warnings are published via the AWS IoT Core's MQTT client and trigger the appropriate AWS Lambda function.

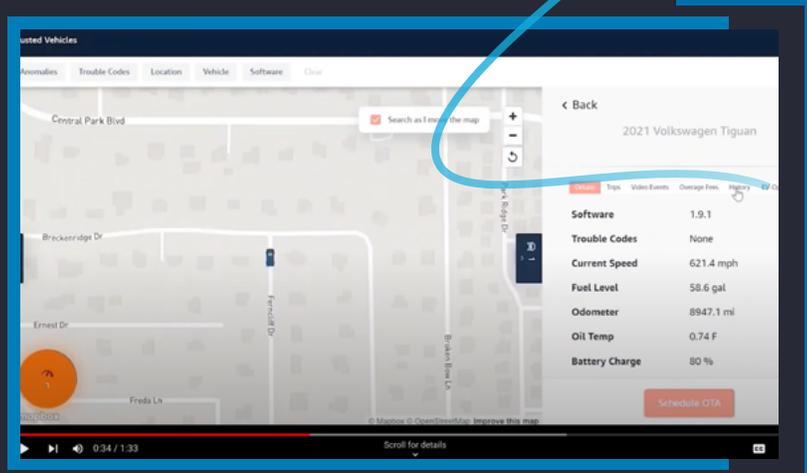
AWS Lambda then sends the data to Amazon OpenSearch to facilitate storing and retrieving data from the CMS web-based application user interface. DTC codes are centralized and problems identified more easily.

By proactively finding patterns of fault codes across a fleet of thousands of vehicles, DTC codes provide the early alarm signals to quickly fix problems. Receiving the codes in

real-time boosts safety and efficiency and keeps the fleet running with fewer disruptions.

Even identifying small issues or glitches early can save on repairs and maintenance. A dashboard light can be helpful but onboard diagnostics can pinpoint the problem and, in some cases, the driver can make the adjustment rather than returning for maintenance. The system will also proactively send a message to the driver via phone or SMS to schedule a repair or software update.

Compared to a traditional GPS system, onboard diagnostics reduce maintenance costs and drive savings and efficiencies over the long term.



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The transformation

Diagnosing problems before they happen transforms the driving experience. Preventing sudden malfunctions increases safety and potentially save lives.

Onboard diagnostics can also inform drivers of issues that need immediate attention, and prevent more costly secondary malfunctions. The system also keeps track of warranties and which parts are covered.

As cars become more connected, well-designed fleet-management software can bring everything together to keep vehicles running smoothly. This is especially valuable as industry research has shown at least half of fleet vehicles leave mechanic's shops with at least one unresolved issue.

A reliable telematics system takes the burden off drivers to notify maintenance of DTCs and ensures nothing is missed. Capgemini's Connected Mobility platform in collaboration with AWS CMS allows fleet managers to easily and securely connect vehicles and build innovative solutions to support the fleet.

Stop guessing about maintenance issues and start saving money and driving efficiencies. Learn how Capgemini can help you get the fleet future you want.

CONVENIENCE AND SECURITY WITH KEYLESS VEHICLE REMOTE CONTROL

Get more out of fleet-management software

Manufacturing reliable cars that deliver value is a proven strategy for automotive companies, but value is increasingly defined by a new set of standards as cars adopt emerging technologies and features. One of these differentiators is convenience.

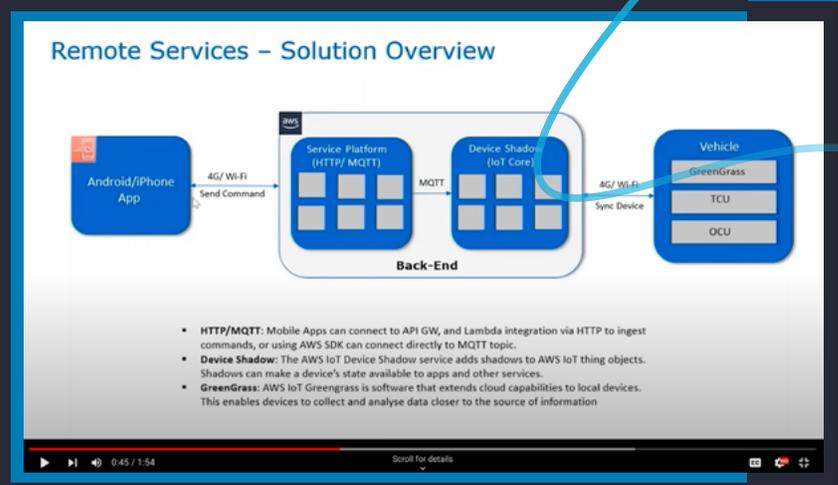
Cars have used mechanical keys to switch on and unlock doors for nearly all their history, making drivers face a number of inconveniences. Everyone occasionally struggles to locate their vehicle in a large parking lot, and drivers in cold climates often need an extra trip to their car to switch on and warm up before commuting to work.



Fleet-level convenience

Fleet management software and mobile apps easily solve these issues. APIs allow remote honking and ignition features to locate and operate cars from a distance, and can also control car alarms.

Here is how the latest APIs work. The user input is registered on the key fob or Android/iOS application, using the API gateway backed by a Lambda function. The API gateway endpoint is invoked by setting the appropriate name and the value for the car property (e.g., car alarm) which will update the status in the IoT device shadow, and the current state is synced over AWS IoT Greengrass installed at the edge, giving further control over functions such as starting the vehicle or activating the horn.



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The world of keyless mobility

Mobile apps, APIs, and the keyless features they provide will be commonplace in modern vehicles. Young drivers today may not ever face the inconvenience of having to physically twist a key to unlock their vehicle or waste time searching through a parking lot.

But the benefits of these digital tools are not limited to easy accessibility and remote features: security is also greater with keyless functions. Drivers can quickly get into their cars and lock them from the inside for safety in places without light and precarious situations. Key fob devices also protect from theft, as only the code within them can successfully switch on the vehicle.

Capgemini has a deep understanding of the automotive industry, with a long history of working with its major players across the globe. We can apply our Amazon Web Services partnership and expertise to successfully implement AWS IoT Greengrass, IoT device shadows, and API solutions for your vehicles. Together, we can explore the potential of keyless features to deliver further convenience to drivers and redefine the world of mobility.

PREDICTIVE MAINTENANCE FOR CONNECTED VEHICLES

Anomaly detection determines root causes early, to ensure proactive interventions can be made and a smooth road ahead

Connected vehicles can generate vast amounts of data. These large volumes of information require quick and accurate anomaly detection for smooth business operations and positive customer experiences. This process has to scale to identify root causes so businesses can make decisions based on accurate information.

For example, tire pressure or oil temperature are typically alerted as warning lights in the cockpit. In a connected vehicle, this data will also be sent to the fleet manager, mobility provider, or OEM, as well as the driver. Proactive intervention can then be initiated before the vehicle breaks down.



AWS ecosystem

AWS IoT Greengrass connects the vehicle to the cloud and securely transmits telemetry data over the MQTT protocol. This data is loaded into AWS Kinesis Data Analytics to perform near real-time analytics before being passed to Kinesis Data Streams for processing.

An AWS Lambda function is triggered by an anomaly condition. The data is stored in a DynamoDB table in Amazon OpenSearch to facilitate the storing and retrieval of the data from the CMS web-based application's user interface.

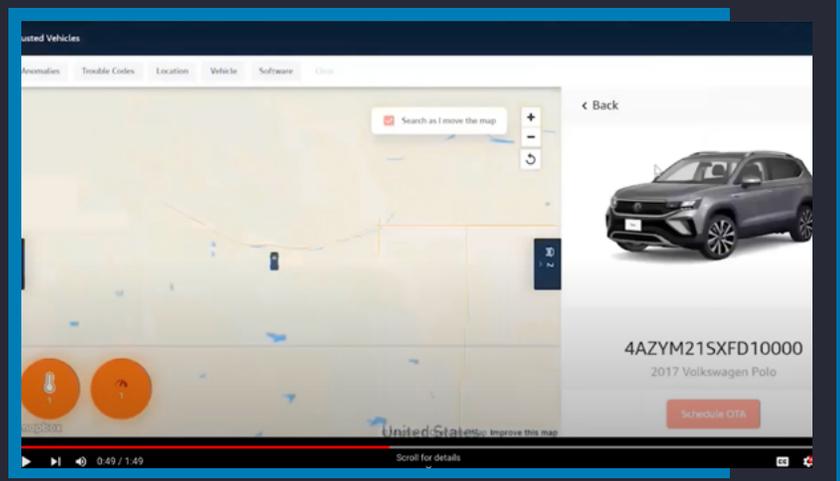
One potential application of this is oil-temperature alerts. Typically, the driver is notified in the cockpit when the oil temperature reaches a threshold, but also capturing the oil temperature in time intervals establishes if the problem is gradual or sudden, and by correlating temperature with other diagnostic information a more helpful intervention can be made. The vehicle data can also be compared with other similar vehicles to find patterns that suggest known problems. If a vehicle repair is required, the appointment can be automated based on service-level agreements, location, availability, urgency, and inventory levels.



Building new mobility tools

Connected cars are going to change driving forever. And while the vehicles will be a source of invaluable data for OEMs, it is imperative to have a well-designed anomaly-detection system to uncover issues before they impact the driver or cause significant damage.

Capgemini's Trusted Vehicle allows OEMs and fleet managers to easily and securely connect to vehicles and build innovative solutions such as anomaly detection systems, running at the edge and in the cloud at global scale. By leveraging Capgemini's solution blueprint, OEMs can accelerate development to get new mobility tools to market faster with security and scalability built in.



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SHIFTING TO AN EV OPERATIONS MINDSET

Fleet operators can plug into vital battery details

The move to EVs will necessitate a new kind of cockpit, with vehicle range replacing the gas gauge as the critical factor. Other essential information includes coolant level, tire pressure, state of charge (SOC), state of health (SOH), charging current, and HVAC status.

Battery information is more than just measuring range. SOH also tells the driver if the battery needs attention. Understanding battery risk and health ensures you don't run out of charge.

On a fleet level, managers need to monitor a number of batteries and related systems and share information with drivers, to improve drive range, save energy, choose the most efficient route, and factor in third-party charging infrastructures.



Fleet-wide charge monitoring

AWS IoT Greengrass installed in vehicle sensors connects to the cloud and can securely transmit telemetry data over MQTT protocol. To monitor EV operations, the data will be published via the AWS IoT Core's MQTT client, which involves the appropriate lambda function

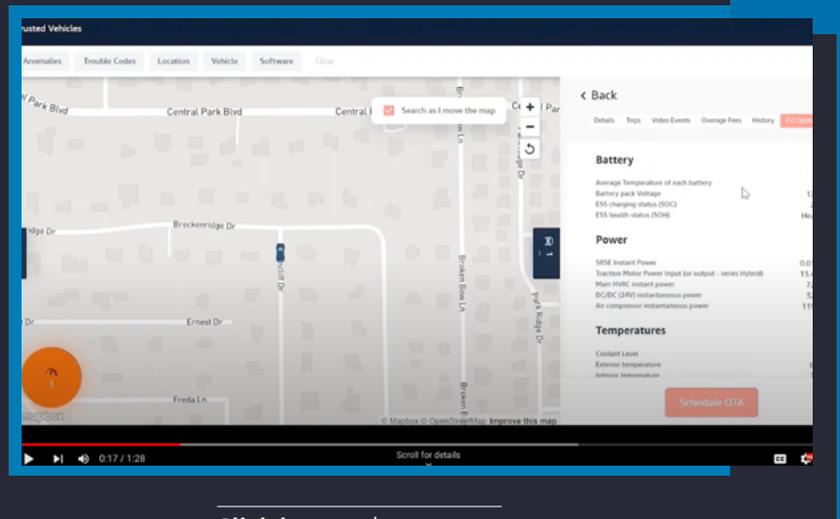
AWS Lambda then performs computations on the data and determines the state of various measures, including SOH, the charger type in use, voltage, and current. This data is then shared with AWS Elasticsearch to facilitate storage and retrieval from the CMS web-based application's use interface.

This makes tracking charging details efficient across the fleet.

The other important measurement is driving-to-empty (DTE) calculations. This can also be integrated into fleet management to determine how far a vehicle can last until the battery charge is depleted. Waiting until a vehicle reaches zero means an expensive tow to a charging station. DTE predicts future performance based on how long the vehicle has driven on a single charge, the current state of the charge, and driving conditions.

Fleet operators can also make adjustments to drive efficiencies. For example, knowing the battery charge and the temperature of the vehicle, fleets could add a heat pump to support AC use while also extending the average range of the vehicle.

EV fleet operations can also monitor other details such as selected gear, ignition signal state, and ignition key on to provide insight into potential problems.



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Streamline EV operations

Performing real-time condition monitoring for fleet vehicles is vital. Having insight into temperature, charge state, power, and SOH and SOC is essential to maintain an intelligent, multi-purpose, and user-friendly system.

Capgemini's Trusted Vehicle solution in collaboration with AWS CMS allows fleet operators to easily and securely connect vehicles and build innovative solutions to streamline EV operations at scale. By leveraging Capgemini's solution blueprint, companies can accelerate development and get to the new mobility market faster with security and scalability for the future they want.

REDUCE WASTED ENERGY WHEN CHARGING ELECTRIC VEHICLES

Charging stations use overage fees as an incentive to avoid overcharging

Drivers charging their electric vehicles through public charging networks occasionally forget to unplug or simply leave their vehicles unattended, denying use of the station to other drivers. Just as importantly, this overutilizes and wastes energy. All energy is precious, and we cannot afford to waste it if we are to create a more sustainable future. The EV market will continue to grow and expand, and there is still time to stop this problem before it escalates.

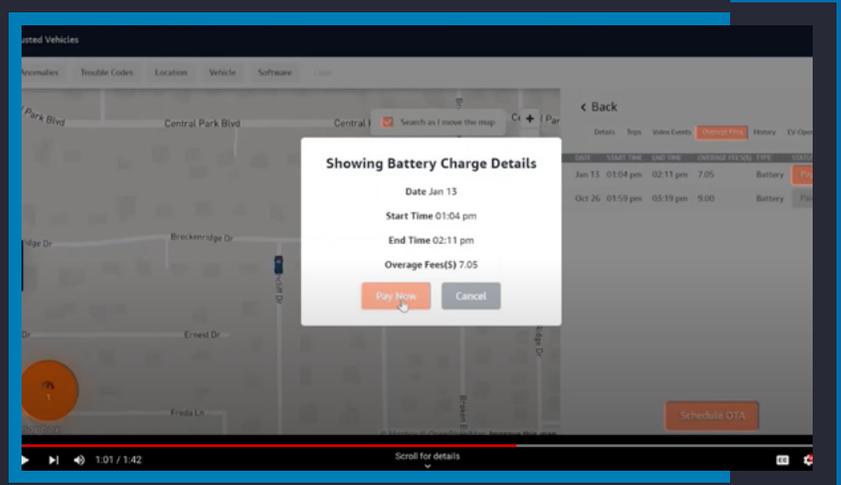
This also matters to fleet managers, as a well-designed solution will help drivers only use enough energy to complete their journey, use electric power more efficiently, and save everyone's time.



Incentives for good

Capgemini has partnered with Amazon Web Services to deliver an AWS IoT Greengrass-based edge solution. It connects vehicles to the AWS IoT cloud to securely transmit telemetry data over MQTT protocol. The corresponding payload is measured within the system and invokes the appropriate Lambda function to calculate overage fees. These are presented to the driver on a fleet-management dashboard for transparency and delivered when the vehicle is charged for longer than necessary or its allotted time.

People generally do not want to make others wait needlessly and many, especially EV owners, want to contribute to sustainability and be more efficient with resources. But, without a doubt, nobody wants to pay extra fees. Therefore, the clear presence of a cost for overcharging acts as an incentive for drivers to be more aware when charging their cars.



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Proven results

Trusted Vehicle provides a reliable fleet telematics system that informs drivers of the cost they will incur should they forget or neglect to unplug the vehicle.

It can also calculate the required charge to complete a journey. The car's navigation system can provide route information to determine the required charge, so drivers can use more economical home charging.

The introduction of these systems in fleet-management software has led to people more frequently unplugging vehicles as soon as their batteries are charged, saving power, time, and cost.

Capgemini is committed to improving and redefining the world of mobility. Our company is equipped to implement AWS IoT Greengrass easily and safely for your vehicles. We apply our Amazon Web Services partnership and expertise to deliver innovative tools and solutions for tangible business value.



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About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of over 340,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2021 global revenues of €18 billion (about \$21 billion USD at 2021 average rate).

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