



# Battery health and safety:

monitoring technology for electric vehicles

Brett Stein

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## STATE OF THE INDUSTRY

Electrification of transportation brings new challenges in terms of safety, performance and lifetime

### Safety



- **Battery fires are common:** Thousands of fires every year, from cars to commercial vehicles
- **Insurance premiums are high:** damages are not fully covered and costs balloon after incidents

### Performance



- **Revenues are inconsistent:** Over 40% of annual revenues in the top 30 days of a year<sup>2</sup>
- Downtime and underperformance (e.g., SOC errors) result in **major financial losses**

### Lifetime



- **Increasing warranty requirements** like in California put pressure on OEM
- **Warranty management and compliance** across vendors becomes increasingly complex for OEM

## DATA-CENTRIC APPROACH

Cloud analytics improve safety and operational efficiency using readily available Battery Management System data



### Safety

- Early safety risk detection
- Automated alerts and logging
- Improved warranty conditions

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> 50 incidents prevented in 2022



### Performance

- Underperformance and downtime
- Predictive maintenance
- Track and improve SOC accuracy

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Numerous successful warranty claims



### Lifetime

- Degradation & SOH insights
- Warranty claims management and compliance

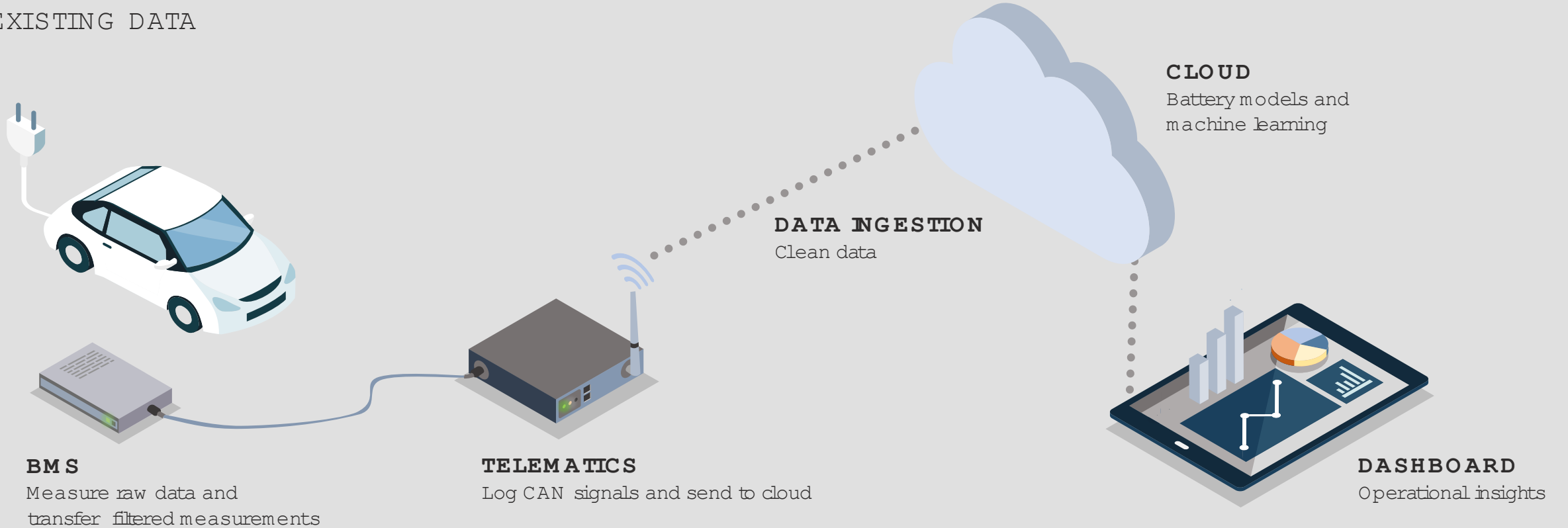
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> 25% lifetime increase

# CLOUD COMPUTING

## Predict the safety, performance, and lifetime of EV batteries

### EXISTING DATA



Readily available BMS data is underused today.

# SAFETY

## Real-world example: Detect battery issues before they become critical.

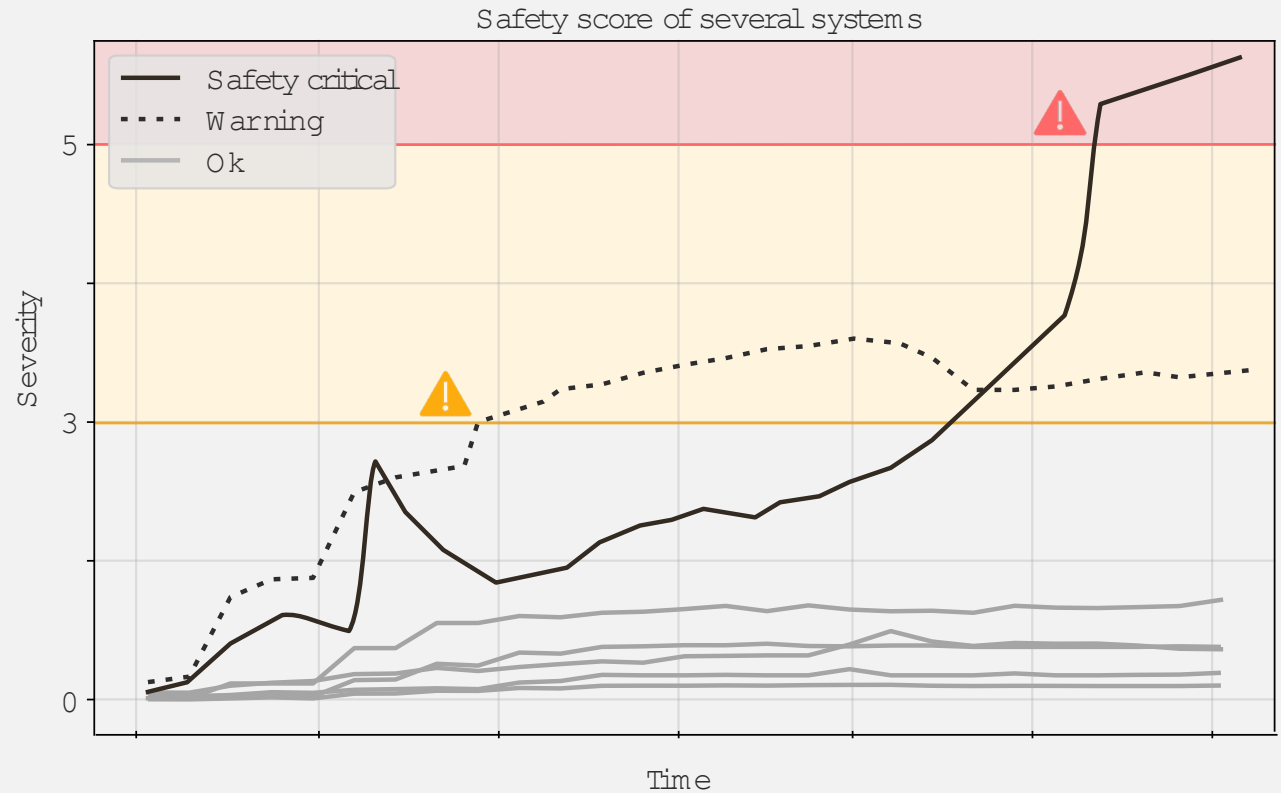
### Safety-first approach to asset management

**What:** A Lithium-Ion battery failure can result in gassing and burning, potentially harming people and property. Critical battery incidents include cell openings that release toxic gasses, such as hydrofluoric acid, as well as internal short circuits and fires.

**How:** By tracking long-term indicators which are often missed by the BMS, we can:

- Detect safety-relevant patterns and anomalies and
- Identify sudden failure events

This allows for a proactive asset management strategy rather than a reactive one.



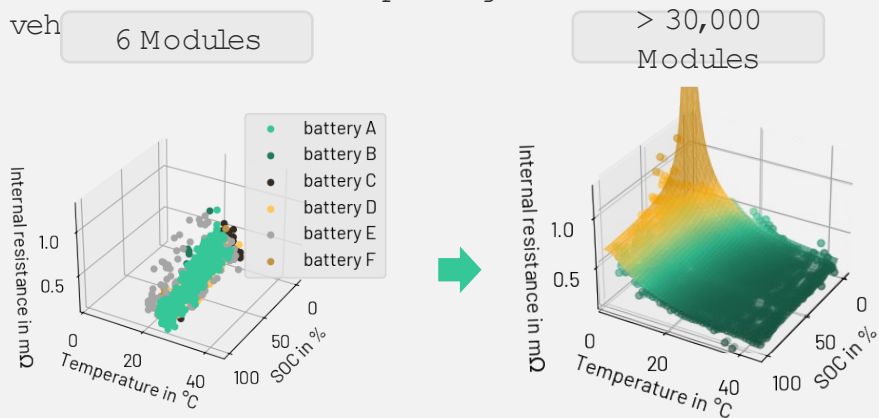
# PERFORMANCE

## Real-world example: Using cloud computing to predict battery failures related to performance and fast-charging capabilities

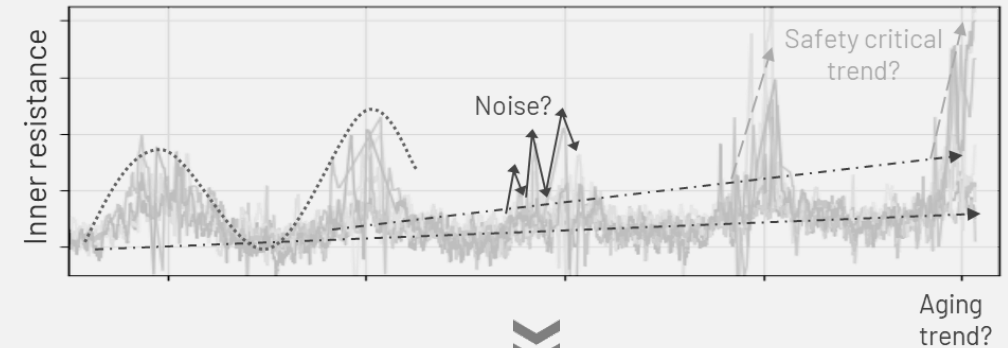
### Predictive capabilities

**What:** A rapid increase of the internal resistance limits vehicle performance and fast-charging and leads to battery failures. This can be predicted by big data algorithms.

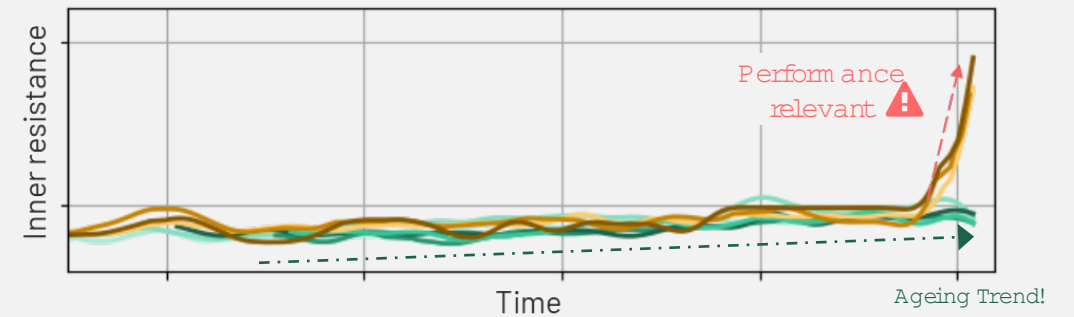
- How:**
- The internal resistance of EV batteries strongly depends on internal and external factors, including ageing, temperature and state of charge.
  - ACCURE's analytical framework allows to track and predict the internal resistance for all operating conditions based on the overall vehicle



### Cloud-based capabilities manage noisy data

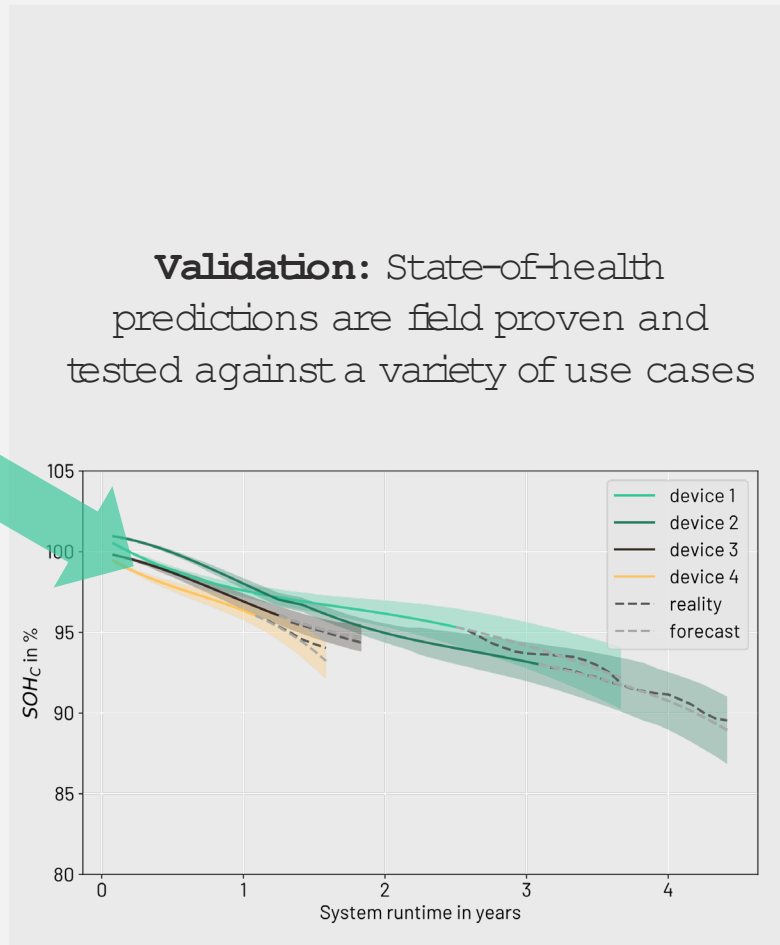
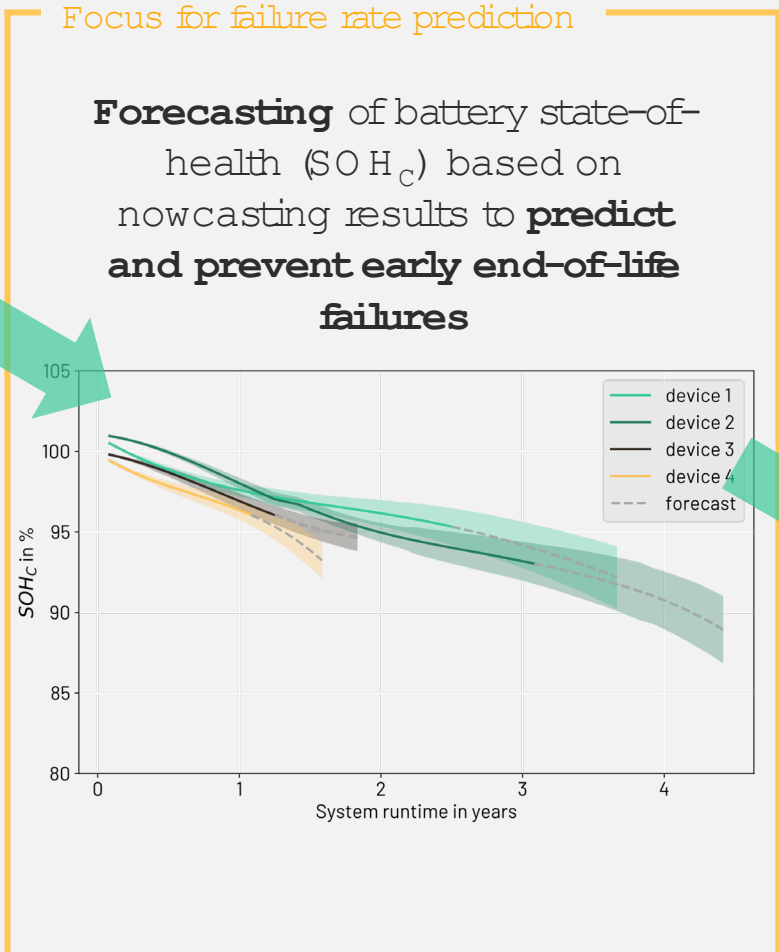
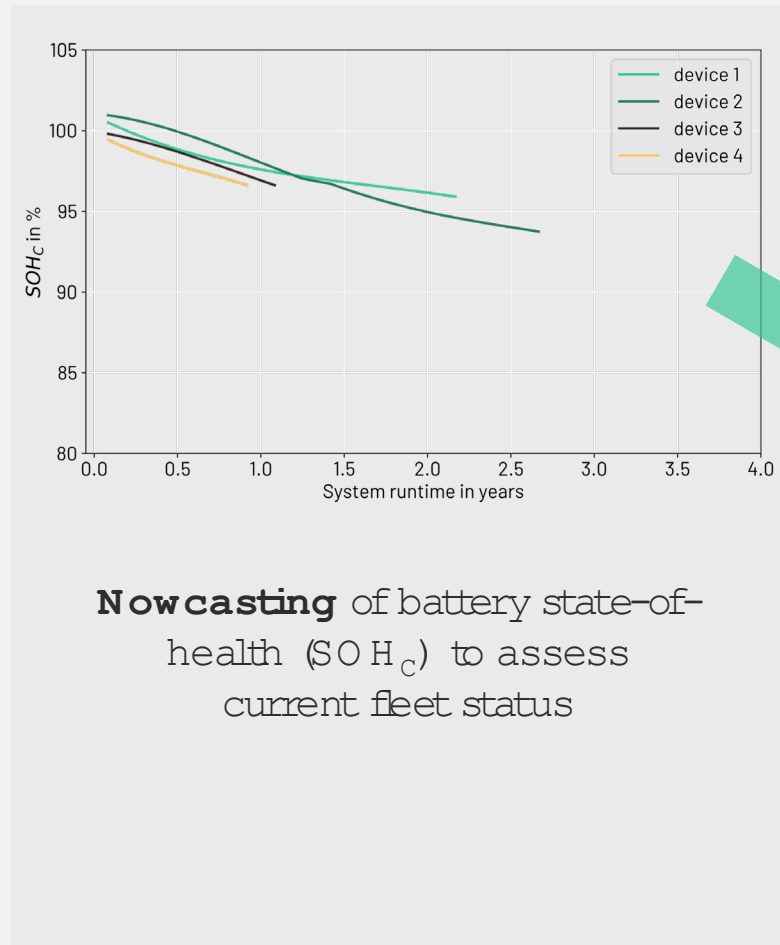


Cloud monitoring to clean, and filter irrelevant outliers to only receive what matters.



# LIFETIME

Real-world example: High accuracy state-of-health prediction to predict failure rates due to accelerated ageing behavior



## CASE STUDY: BERLIN TRANSIT AUTHORITY

We detected a critical safety issue preventing a potentially dangerous situation.

*BVG, one of the largest transit operators in the world, was managing a large and very complex electrification project.*

### Background

- Partnered with ACCURE to actively monitor 15 electric buses.
- We identified a critical safety issue and alerted BVG. On the same day, BVG removed the bus from operation.

### Solution

- In a post-mortem review, the battery problem was proven to be a critical failure situation.
- The BMS did not identify the problem.
- BVG requested ACCURE's continuous monitoring.





## CASE STUDY: NEW YORK CITY TRANSIT

We remotely detected previously unknown battery resistance issues.

*New York City Transit is North America's largest and busiest transit system and is transitioning to a zero-emissions bus fleet.*

### Background

- ACCURE was selected from hundreds of applicants to participate in the highly competitive Transit Tech Lab pilot program
- We would use readily available BMS data from 15 electric buses and provide NYCT with insights into fleet safety and performance.

### Solution

- ACCURE found four buses with battery capacitance/resistance issues, which has resulted in operational underperformance.
- NYCT is taking a proactive approach to battery asset management which will extend the useful life of its bus fleet.
- ACCURE and the NYCT have successfully completed the Transit Tech Lab program and are exploring the next steps.



Leverage battery data for safe, efficient electrification.

**2.6+ GWh**  
managed

**>100m Cells**  
actively monitored

**100+ Battery**  
**types**  
chemistries, models

**1 Petabyte**  
data handled

**35+ Battery**  
**Experts**  
partnering with you