Digital Transformation in the Automotive Industry

Digitale Transformation in der Automobilindustrie

Dr. Michael Nolting

Lecture 9

Tutorials

- Homework will be reading the book from Gene Kim „The Phoenix Project“

The homeworks are optional and not relevant for the exam

Lecture Overview

1. Introduction: Why Digital & Data Transformation	**7. Culture & Organization**
Homework 1: Reading 60 mins the Phoenix Project	Homework 7: Reading 60 mins the Phoenix Project
2. The World is Changing: ACES & VUCA	**8. Examples of Digitalization Projects I**
Homework 2: Reading 60 mins the Phoenix Project	Homework 8: Reading 60 mins the Phoenix Project
3. The Technological Disruption	**9. Examples of Digitalization Projects II**
Homework 3: Reading 60 mins the Phoenix Project	Homework 9: Reading 60 mins the Phoenix Project
4. Challenges for the Transformation - Innovation	**10. TESLA as THE Digital Player**
Homework 4: Reading 60 mins the Phoenix Project	Homework 10: Reading 60 mins the Phoenix Project
5. Challenges for the Transformation - Legacy	**11. Q & A – Exam**
Homework 5: Reading 60 mins the Phoenix Project	
6. How to Transform Into a Techgiant	
Homework 6: Reading 60 mins the Phoenix Project	

Agenda

01 Data Squads

02 Autonomous Driving

03 Industrial Cloud

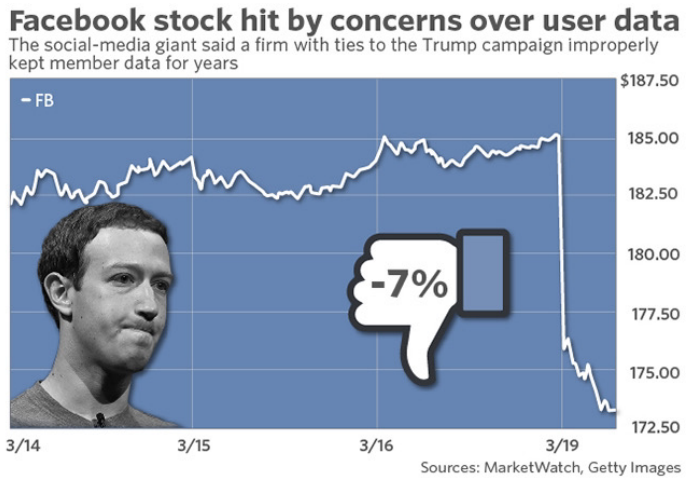
04 Summary

Data Analytics is Key to Success, if Compliance is given

Tech Players

Quelle: The Visual Capitalist

Damage due to Non-compliance



Data products are developed in cross-functional Squads

VWCV DATA SQUADS

01 MOBILITY

Digital Services and products for VWCV customers:

- 100% Uptime
- TCO Analytics
- …

02 CUSTOMER

360° Customer View:

- Upselling Recommender
- Next-best vehicle to buy
- Driving Profile Analysis

03 VEHICLE

Data-driven vehicle development:

- Optimization Vehicle dimensioning
- Automation for Analytics WBs

04 SMART FACTORY

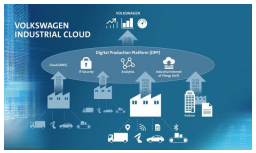
Efficient production and logistics:

- Support Data lake for DPP@VWN
- Predictive Maintenance

05 OPEX

Digital company and processes:

- Adoption Group Digital- and API-Strategy
- Data Warehousing & BI MS Azure
- …



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01 Data Squads

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Data-driven Research & Development

Analytics

- Usage profiles
- Driving profiles

Data Logging

- Own test fleet
- Pilot customers

Results

- Better vehicles
- Better services

Vehicle Analytics

ID BUZZ AD

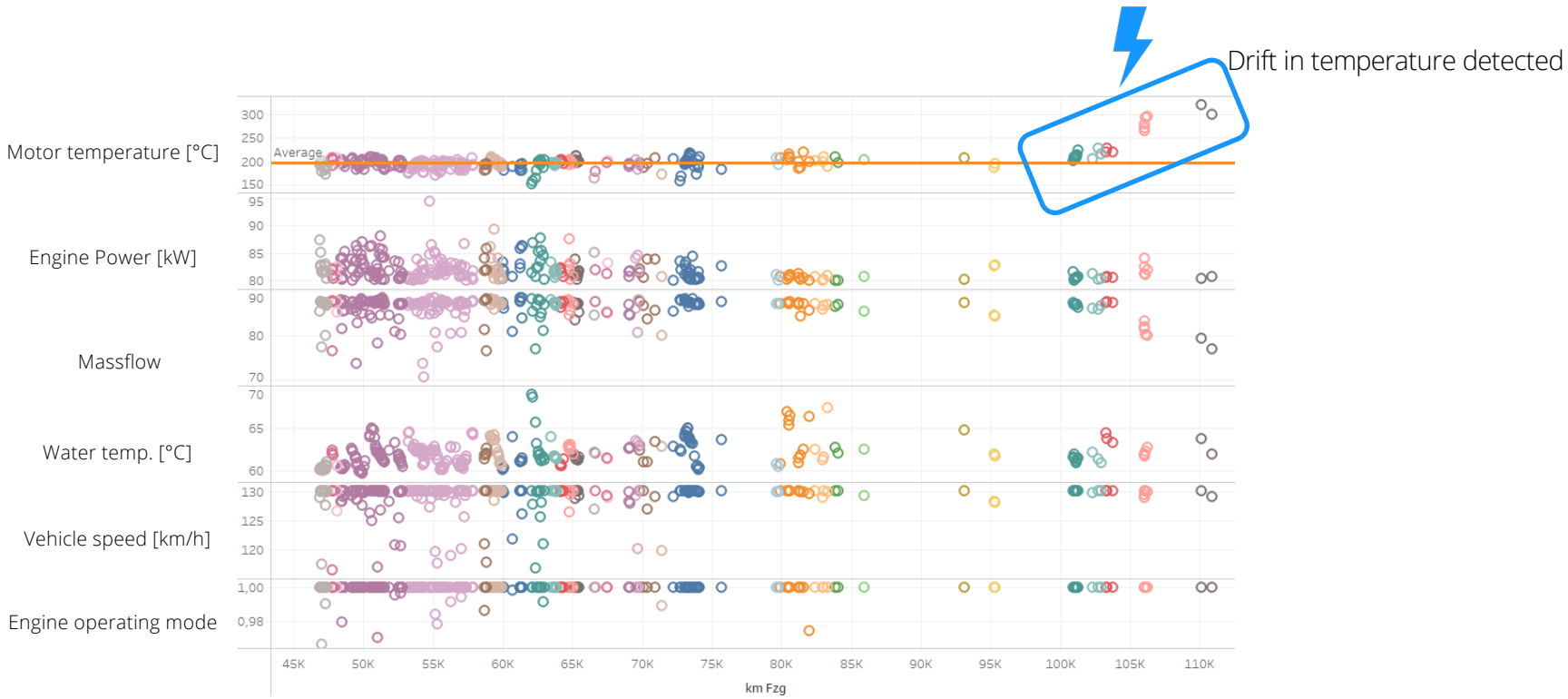
ID BUZZ

T7

Amarok

Caddy

Detecting potential damages in advance



- Potential engine damage was detected during endurance testing, because of broken divider plate near motor
- Data analysis shows rapid drift in motor temperature 30.000 km before the damage occured
- Damage and reason of damage are known before SOP

The ID. BUZZ AD for MaaS & TaaS

- The ID. BUZZ AD is pointing the way to the future of mobility
- First fully autonomous vehicle in the Volkswagen Group
- SDS development in tandem with partners
- Test in Germany already started in 2021
- First offer for internal customers like MOIA

Data-driven Research & Development

Analytics

- Usage profiles
- Driving profiles

Data Logging

- Own test fleet
- Pilot customers

→ 10.000.000's km

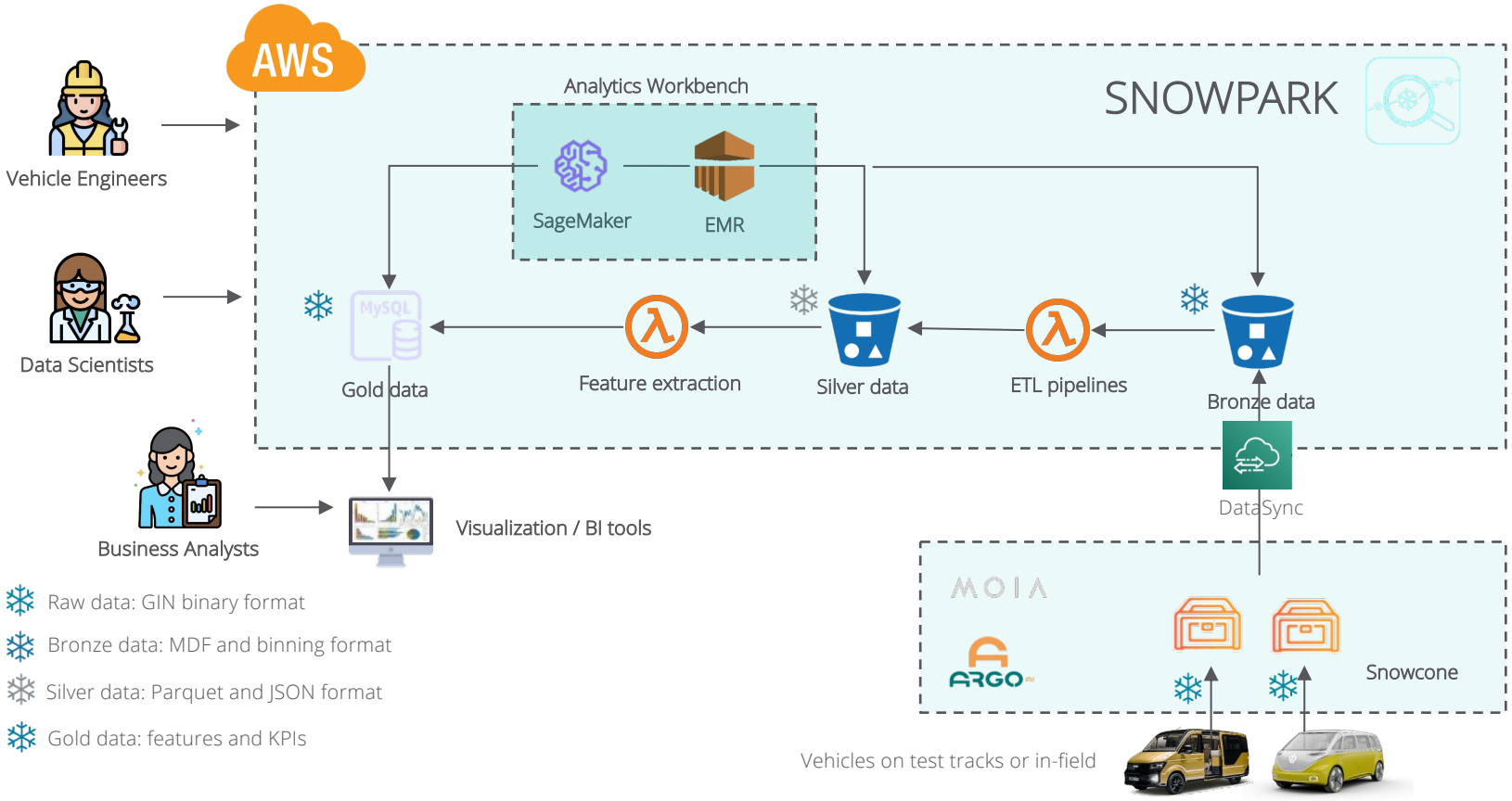
Our key challenge for autonomous driving development:

Process very high data volume & provide insights on **all** decision levels

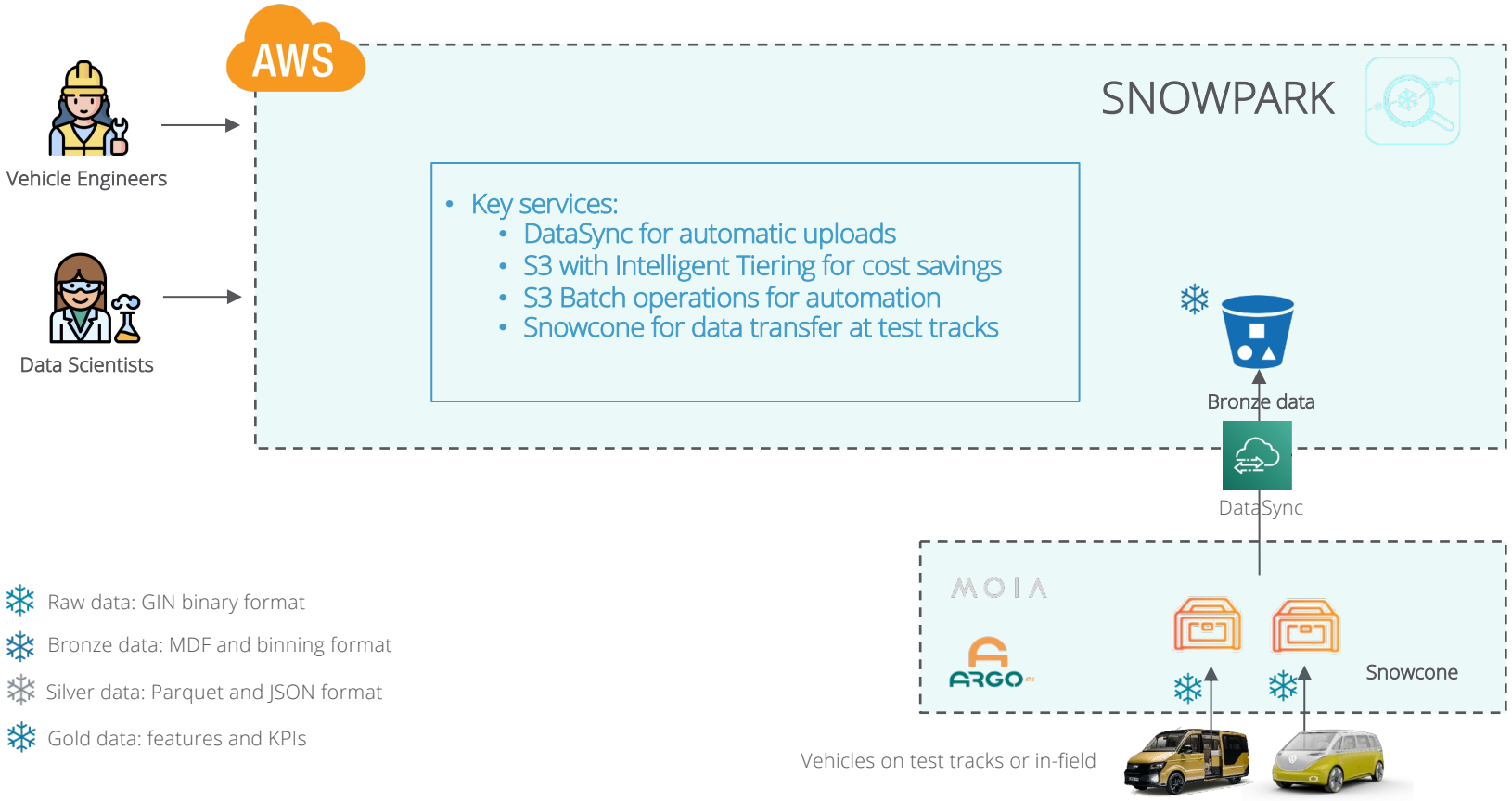
Results

- Better vehicles
- Better services

SNOWPARK for Data-Driven Development

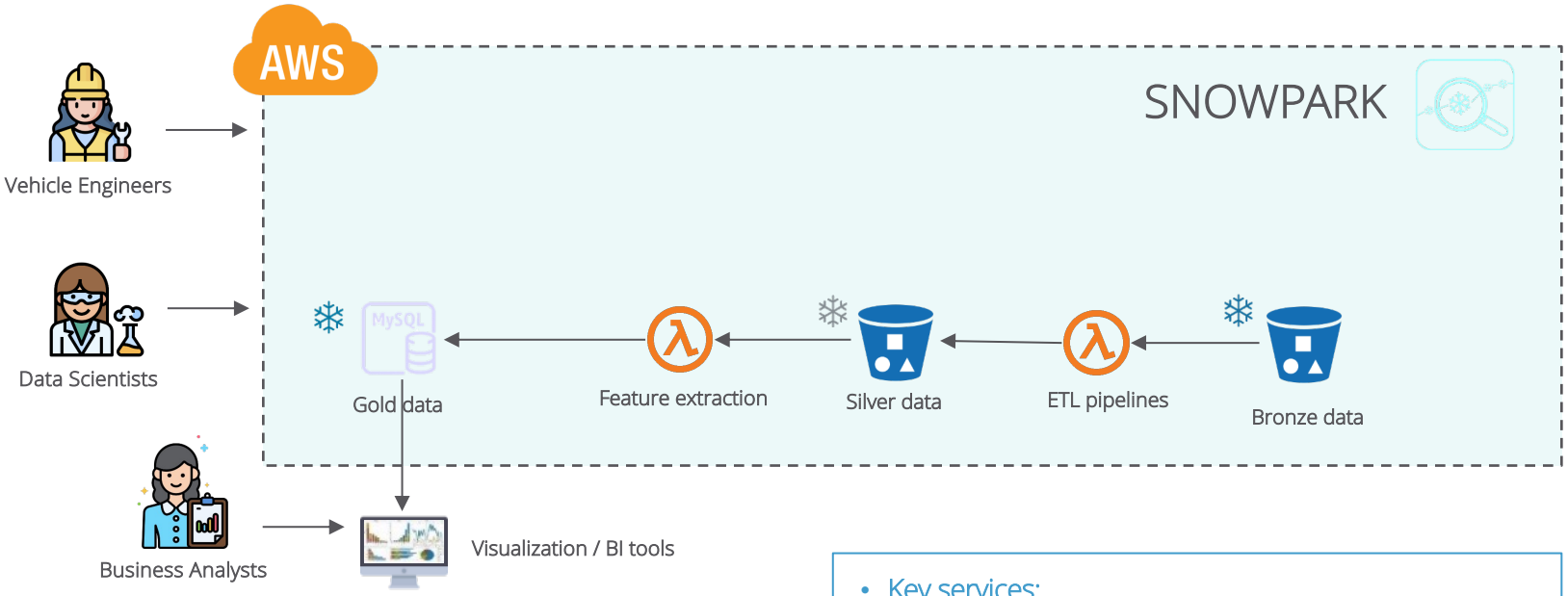


SNOWPARK for Data-Driven Development



- Raw data: GIN binary format
- Bronze data: MDF and binning format
- Silver data: Parquet and JSON format
- Gold data: features and KPIs

SNOWPARK for Data-Driven Development



- Raw data: GIN binary format
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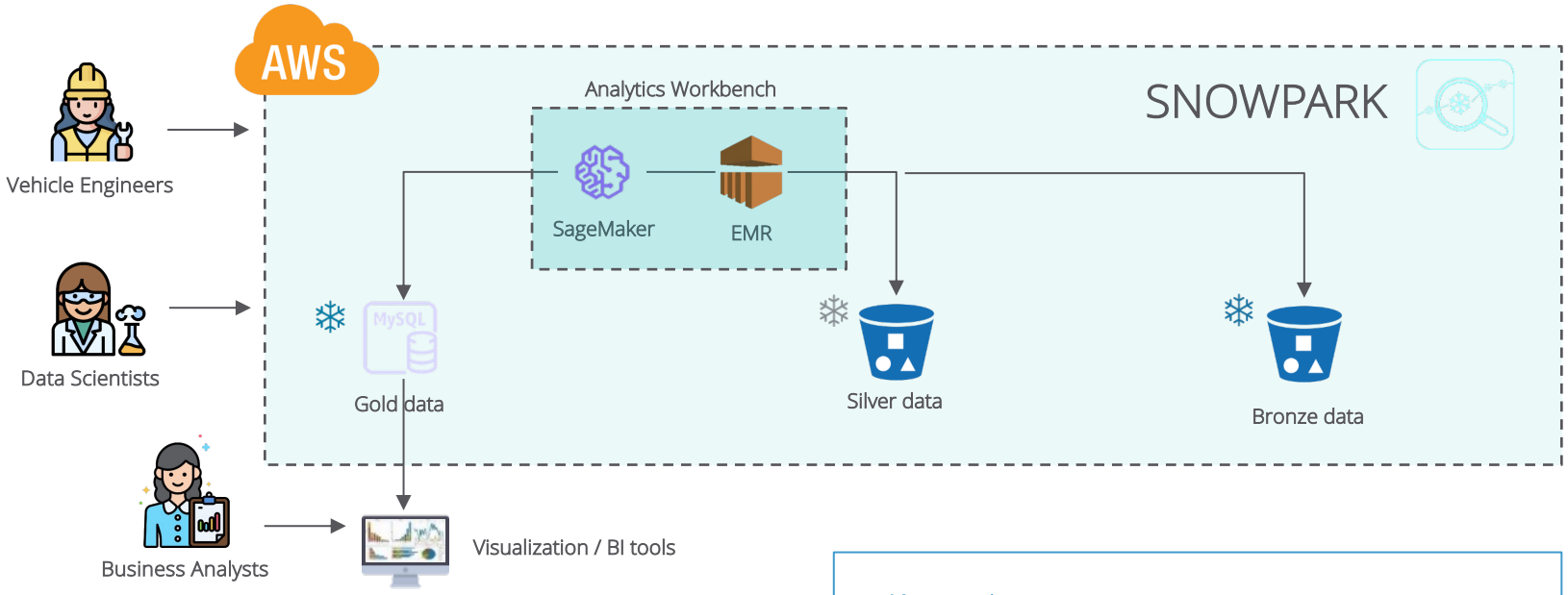
- Gold data: features and KPIs

- Key services:
  - Automatic data processing pipelines
  - Serverless components for faster development
  - Lambda Functions and SQS as building blocks
  - Cloudwatch for monitoring and alerting

SNOWPARK for Data-Driven Development



- Raw data: GIN binary format
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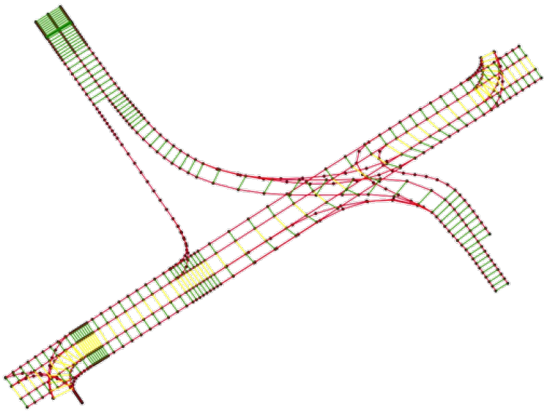
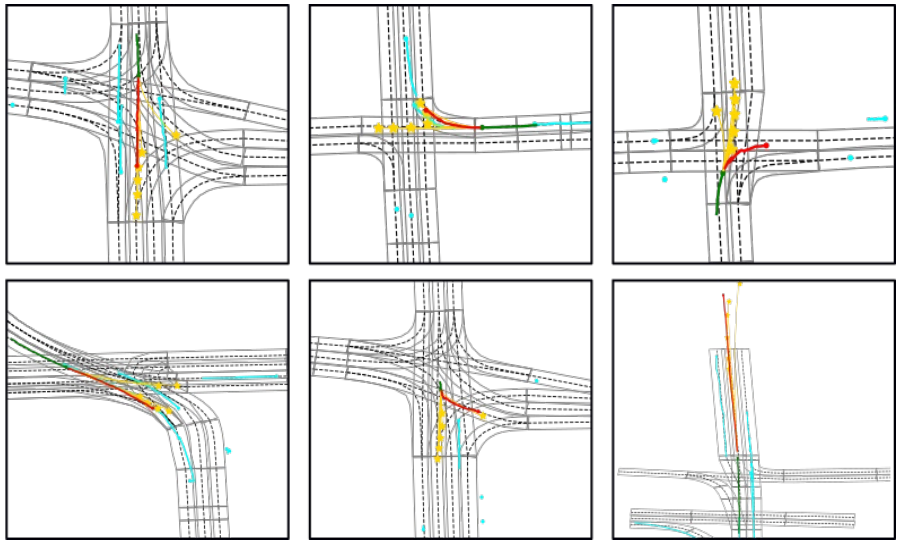
- Gold data: features and KPIs

- Key services:
  - Analytics Workbench for data scientists
  - SageMaker for ML tasks
  - EMR for scalable analytics

Example: Motion Prediction using Graphormers



Graph representation of road networks

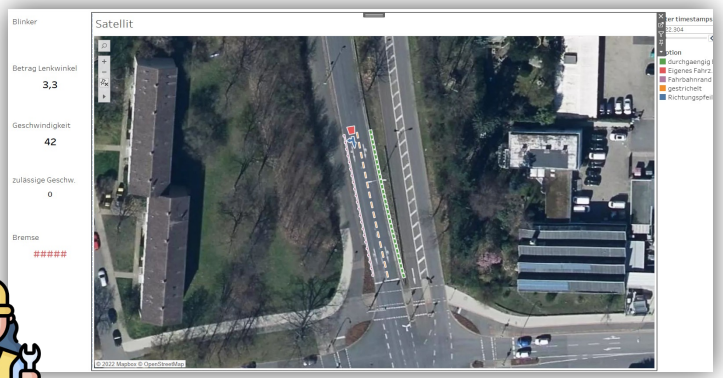


Evaluation of motion prediction models

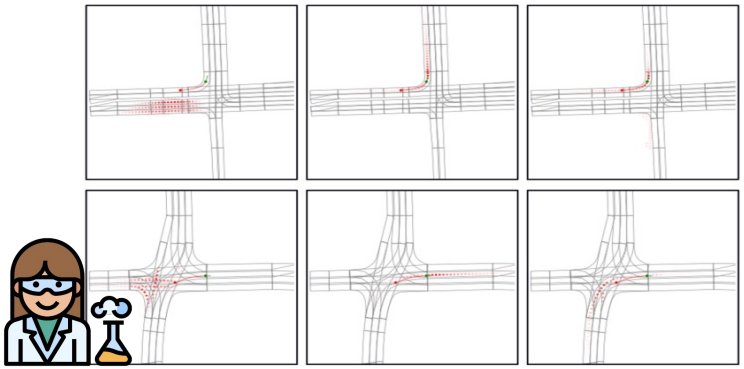
Shimon Wonsak, Mohammad Al-Rifai, Michael Nolting and Wolfgang Nejdl, "*Multi-Modal Motion Prediction with Graphormers*", Published at the IEEE International Conference on Intelligent Transportation Systems, 2022

Data democratization in data-driven enterprise

Business intelligence - management decision level



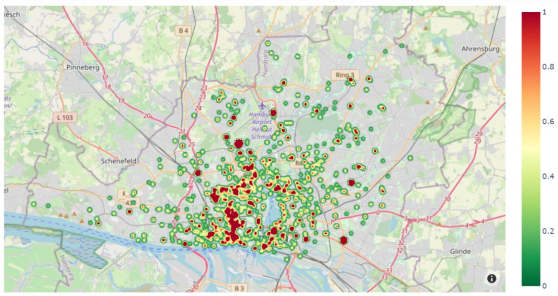
Technical features - the engineering perspective

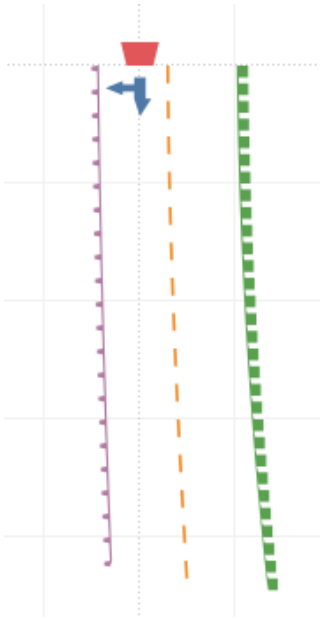


Data Science – the algorithmic perspective

Example: MOIA & ID-BUZZ AD

Use of GPS data from datalogger antenna





Analytics on non AD sensor data (e.g.: front/back Radar, multifunction camera, etc.)

Use cases:

- Detect error situations
- Dashboarding of critical situations
- Detection if car follows traffic rules
- Statistic of traffic and driving events, pick-up locations etc.

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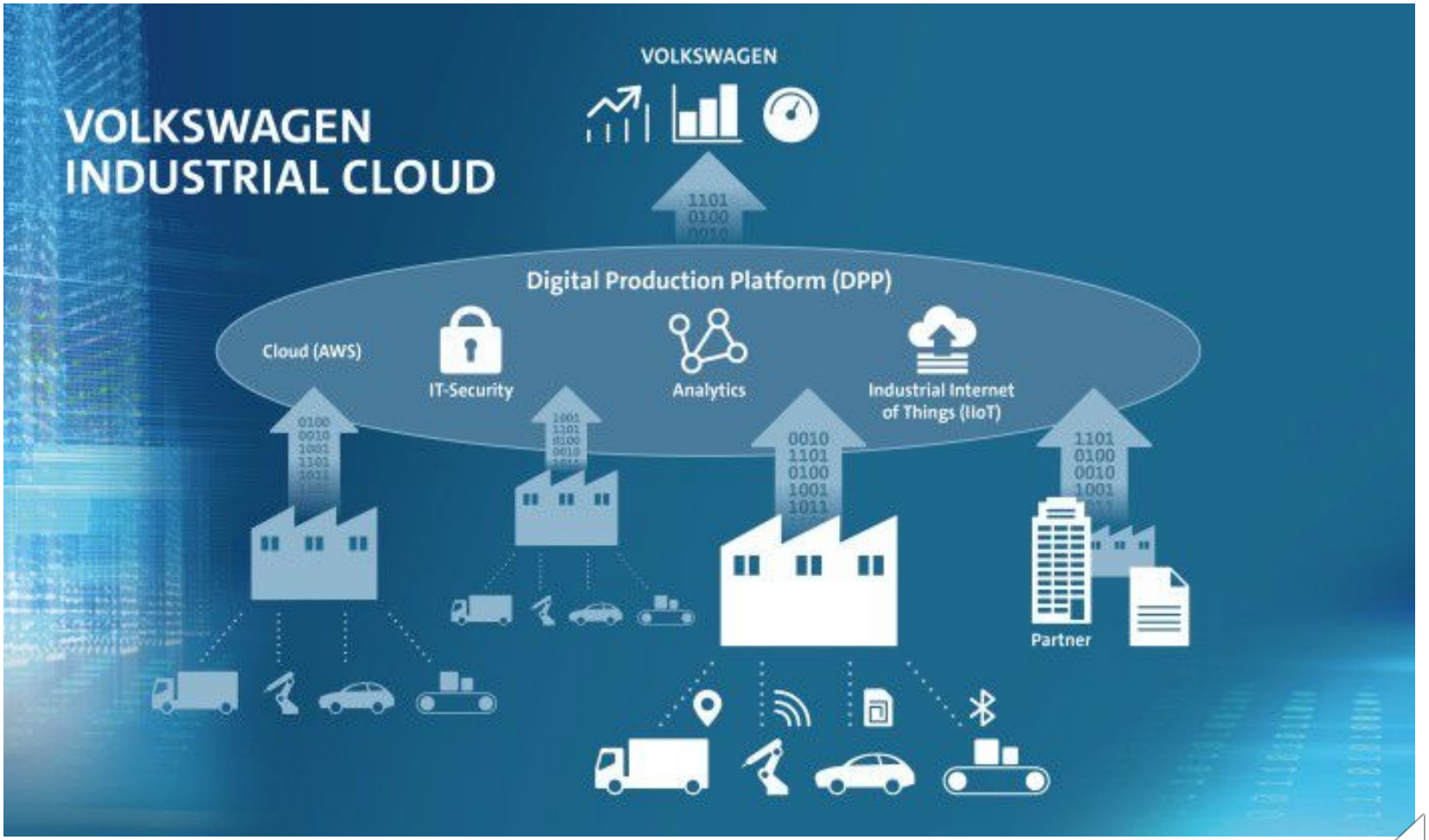
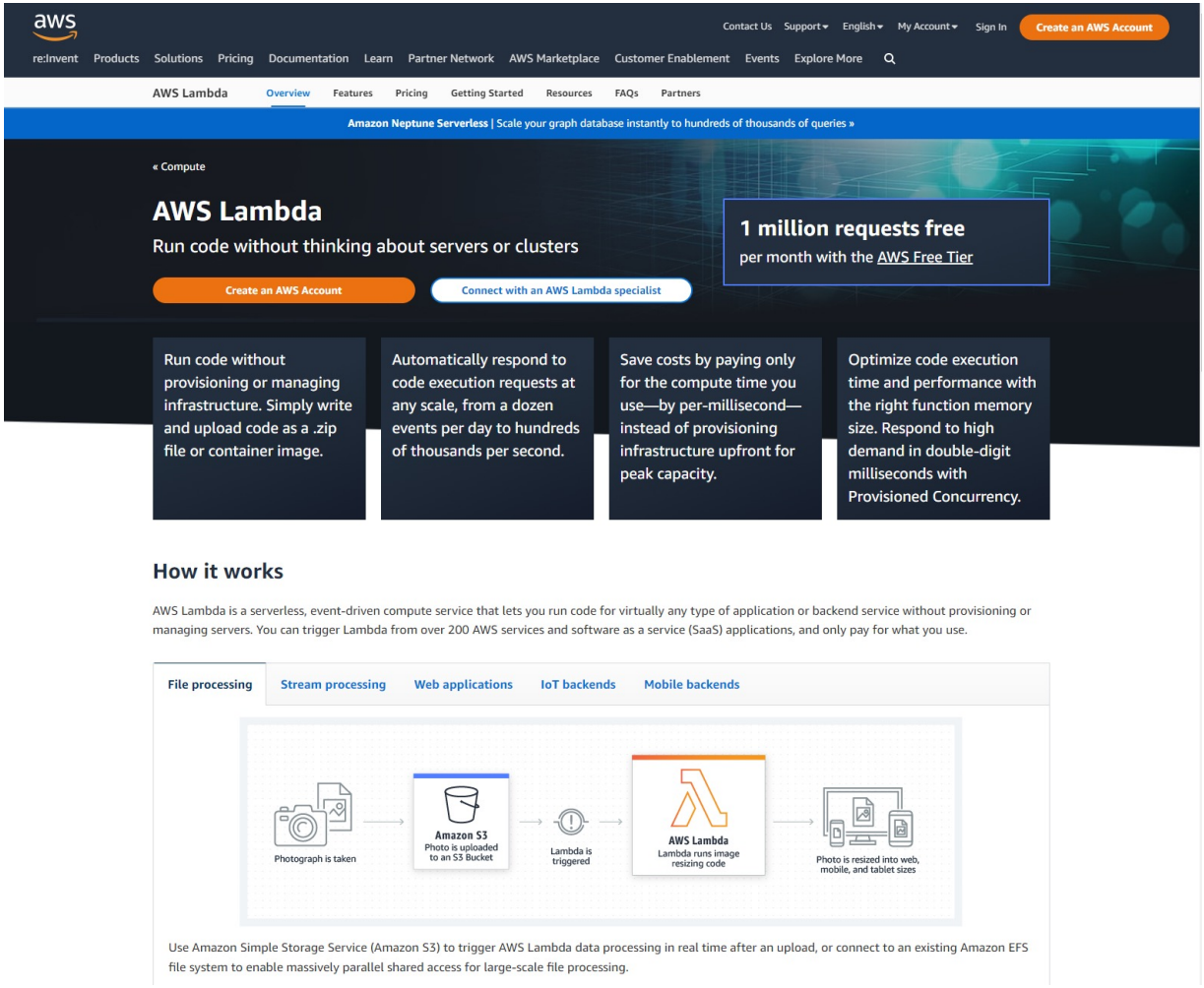
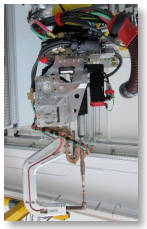
Industrial cloud



Why Industrial Cloud? Scalability!



Predictive Maintenance



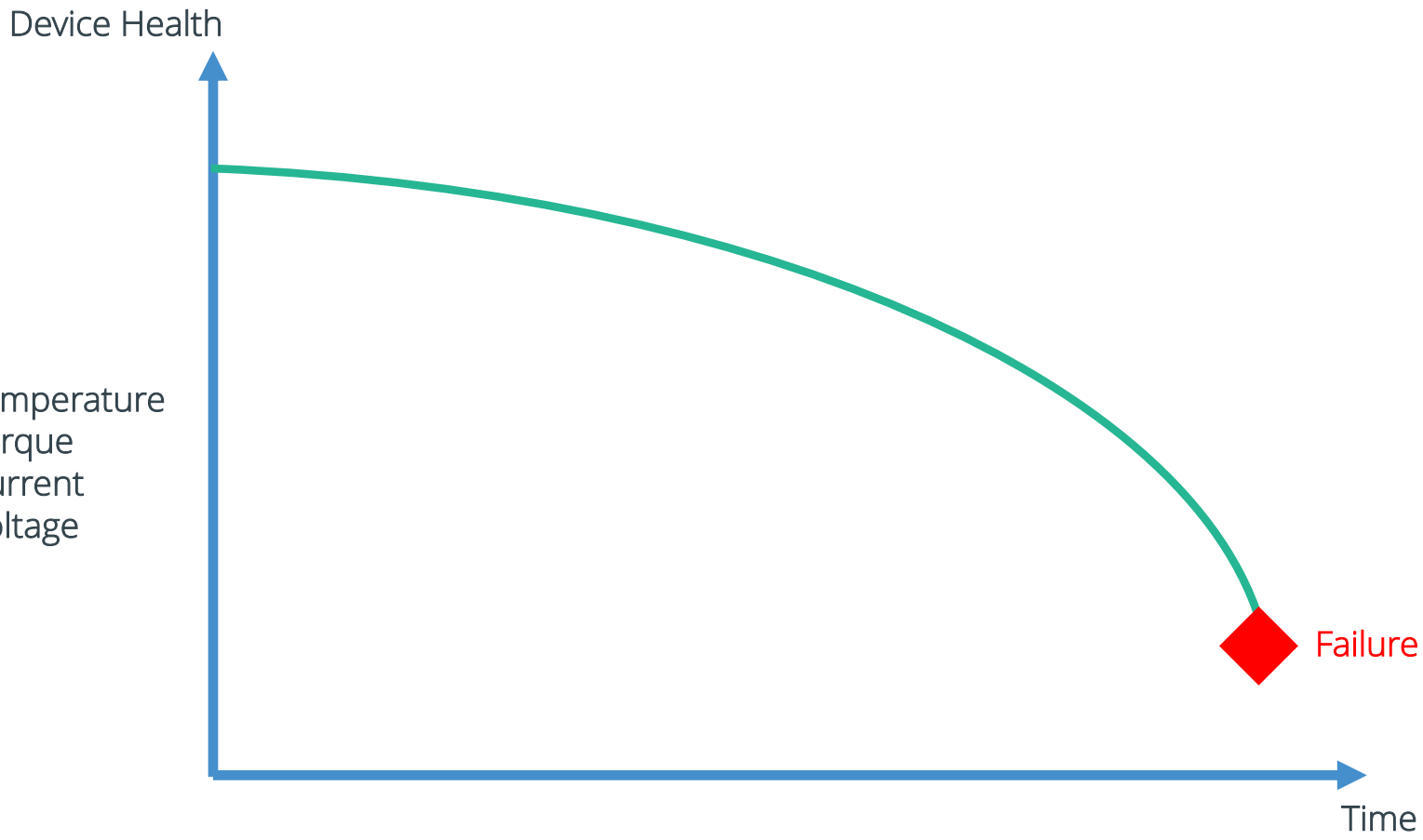
Device Health

- Temperature
- Torque
- Current
- Voltage
- ...

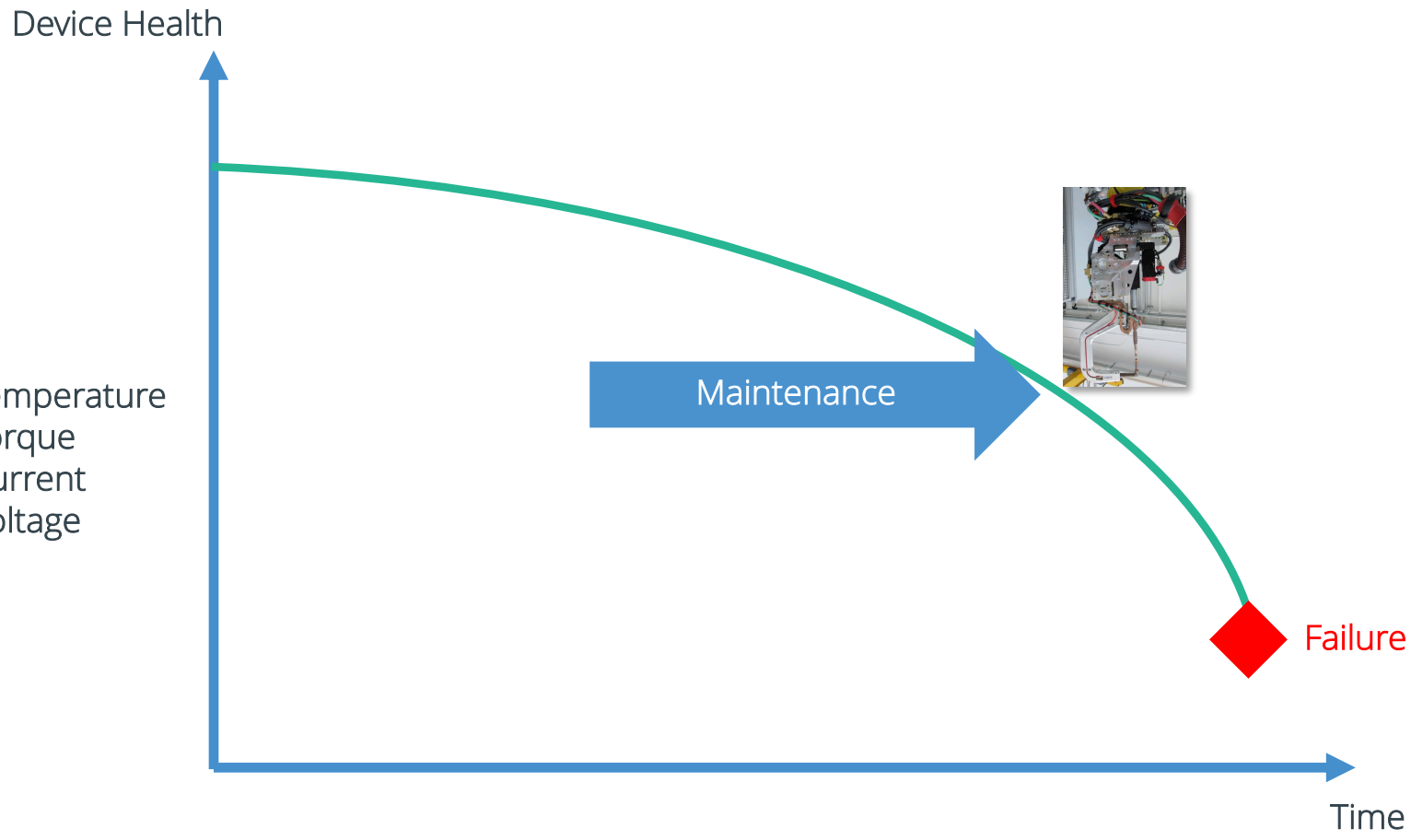
Failure

Time

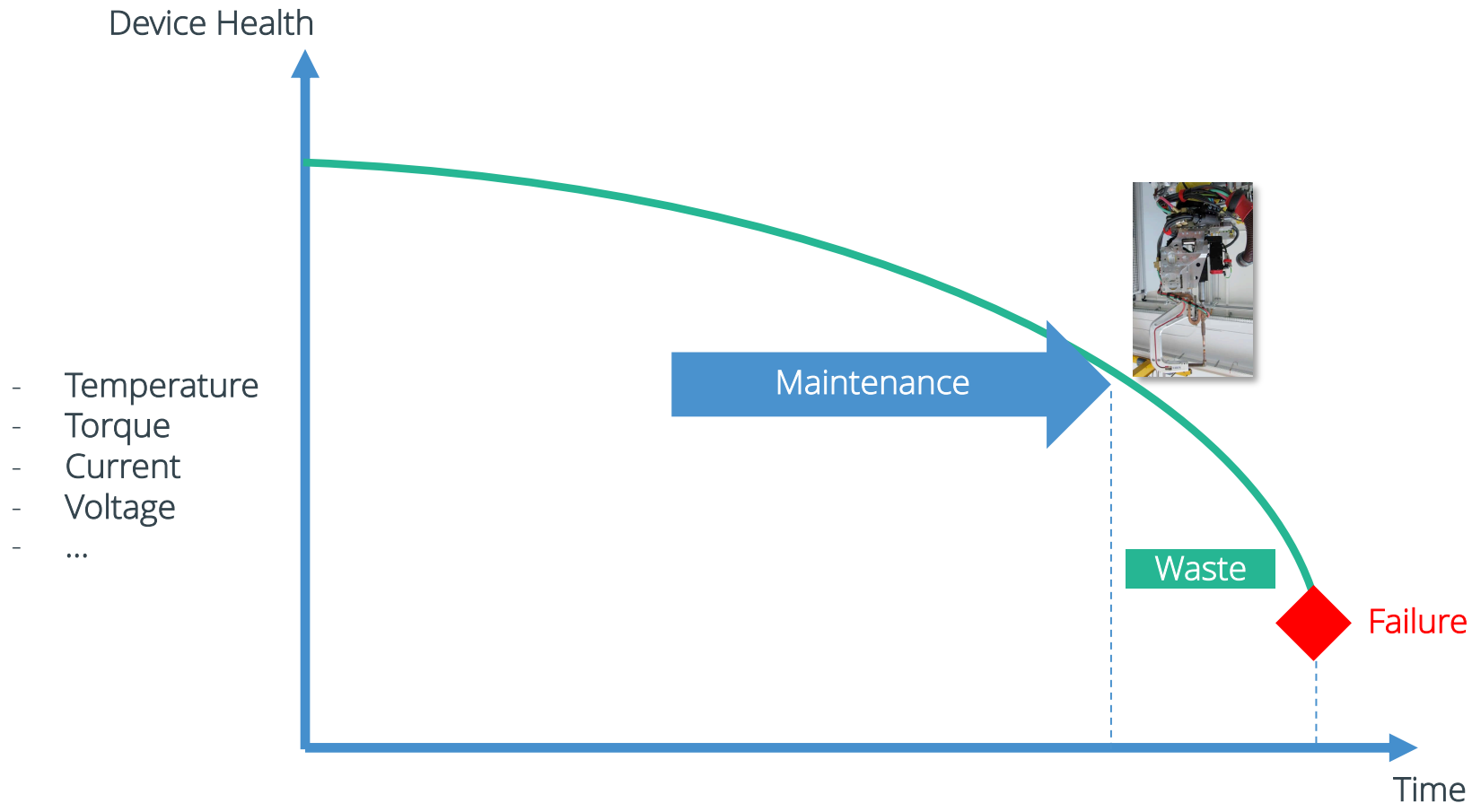
Reactive Maintenance



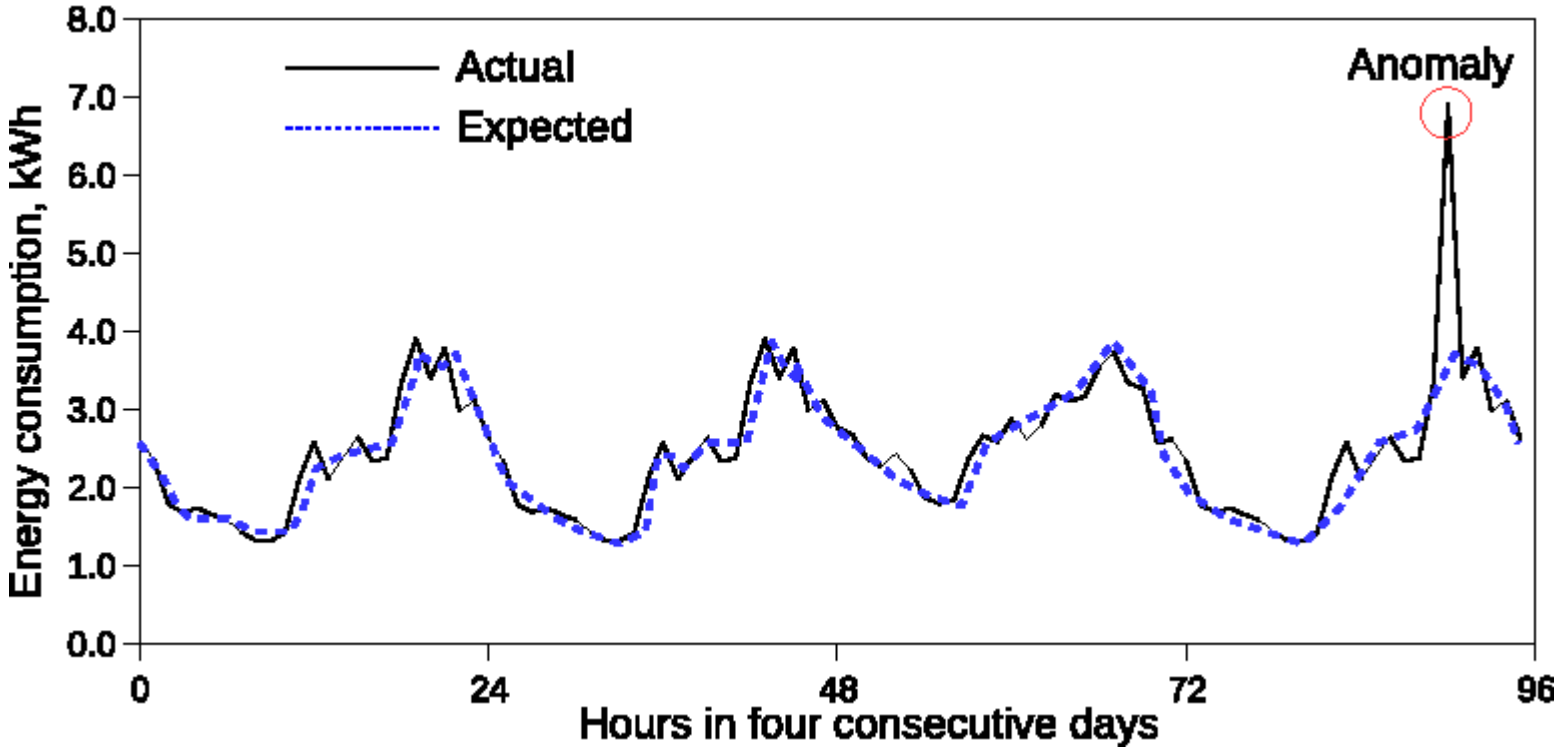
Preventive Maintenance



Predictive Maintenance



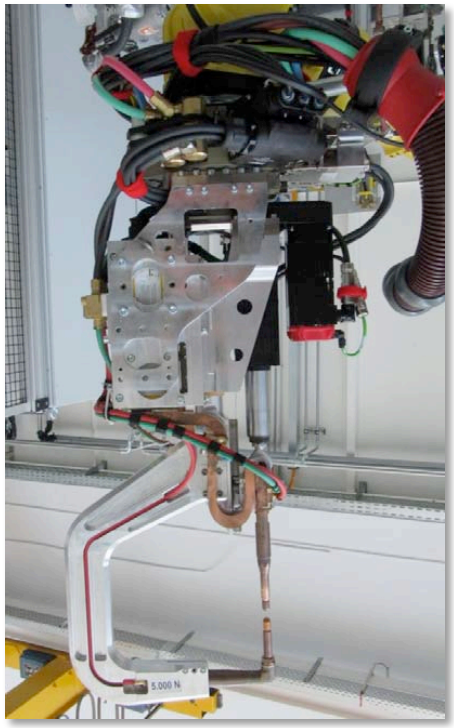
Detection of anomalies



Two methods to leverage predictive maintenance

- Off-the-shelf sensors
  - Vibration
  - Temperature

- Internal machine data



AWS Monitron

amazon | Liefern nach Deutschland | Amazon Geräte | DE | Hallo, anmelden Konto und Listen | Warenrücksendungen und Bestellungen | Einkaufswagen

Alle | Angebote des Tages | Kundenservice | Wunschlisten | Geschenkkarten | Verkaufen bei Amazon | Fang an zu jubeln – jetzt Geschenke einkaufen

Amazon-Geräte | Echo & Alexa | Fire-Tablets | Fire TV | Kindle eReader | Dash Button | Sicherheitssysteme | Geräte-Angebote | Zubehör | Zertifiziert generalüberholt | Geräte-Support | Ihre Inhalte und Geräte verwalten

Für größere Ansicht Maus über das Bild ziehen

Amazon Monitron Starter Kit, an end-to-end system for equipment monitoring

Marke: Amazon Web Services

4,1 von 5 Sternen | 15 Sternebewertungen | 6 beantwortete Fragen

Derzeit nicht verfügbar.

Ob und wann dieser Artikel wieder vorrätig sein wird, ist unbekannt.

Stil: **Amazon Monitron Starter Kit**

Amazon Monitron 5-pack Sensor	Amazon Monitron Gateway (Ethernet)	Amazon Monitron Gateway (Wi-Fi)
1 Option von 575,00 $	1 Option von 180,00 $	1 Option von 140,00 $

Amazon Monitron Starter Kit
1 Option von 715,00 $

- Amazon Monitron is an end-to-end system that automatically detects abnormal behavior in industrial machinery, enabling you to take proactive action on potential failures and reduce unplanned downtime. It includes sensors to capture vibration and temperature data, a gateway to securely transfer data to the AWS, a service that analyzes the data for abnormal machine patterns using machine learning, and a companion mobile app to set up the devices and track potential failures in your machinery.
- The Monitron Starter Kit enables you to begin monitoring the condition of rotating equipment in minutes.
- Includes 5 Amazon Monitron Sensors and 1 Amazon Monitron Gateway (Wi-Fi) which can be set up using the Amazon Monitron App (Free app on Google Play).
- Amazon Monitron works right out of the box. It is quick to install, and no development work or machine learning experience is required.
- Amazon Monitron sends notifications when it detects potential failures.
- Amazon Monitron Sensors are wireless with an estimated 5-year battery life. They measure 3-directional vibration and temperature data, and can be mounted on equipment using epoxy.
- Fully secure and smart. Amazon Monitron Sensors and Gateways are remotely updated over-the-air (OTA), providing system improvements over the life of your installation.

We want you to know

Visit the AWS Website to learn more about Amazon Monitron.

Derzeit nicht verfügbar.
Ob und wann dieser Artikel wieder vorrätig sein wird, ist unbekannt.

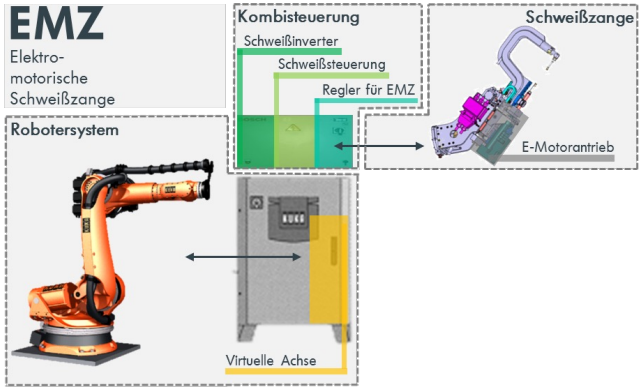
Siehe ähnliche Artikel

Liefern nach Deutschland

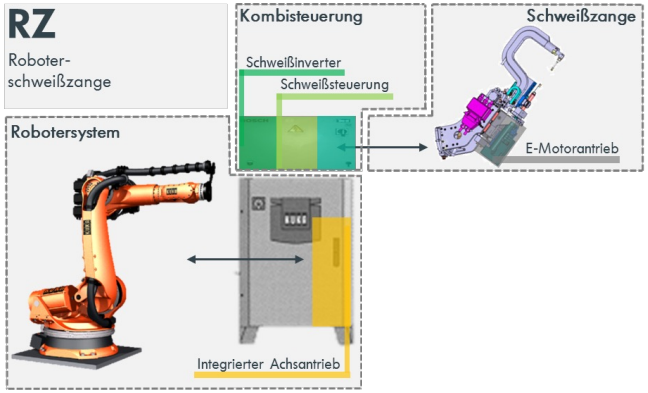
Auf die Liste

Robotic welding clamps

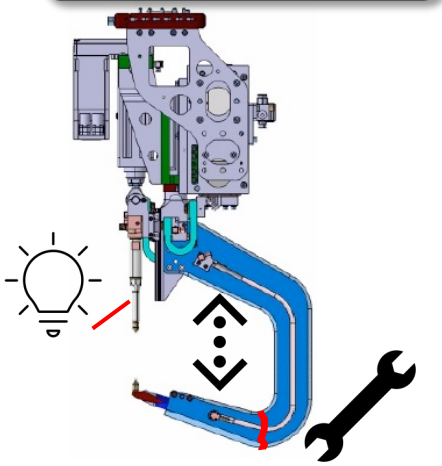
EMZ/Bosch



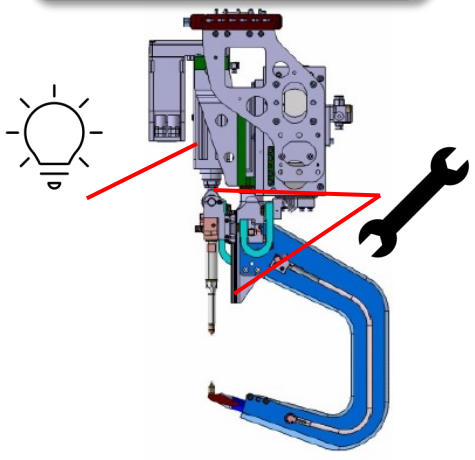
Robotic welding clamp ABB



Rupture of welding arm



Attrition of clamp mechanics



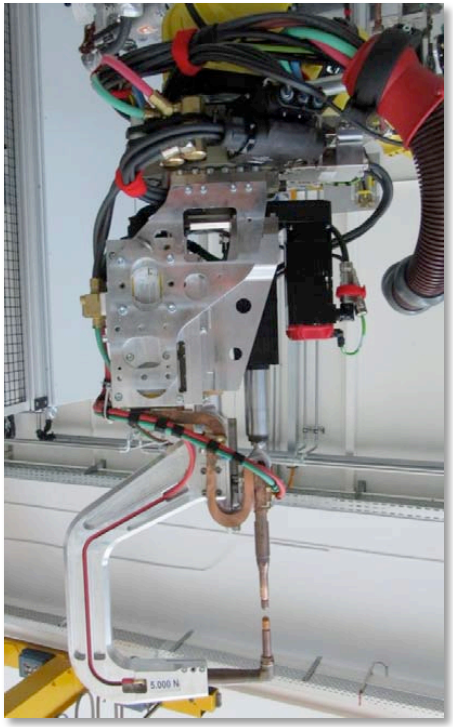
Motivation for Predictive Maintenance

	WITHOUT pred. maintenance	WITH pred. maintenance
Total number of machines	1,000	1,000
Outages in percent per year	10%	10%
Number of outages per year	100	100
Cost of clamp changes (without clamp costs)	100 x 2h x € 100 = € 20,000	100 x 2h x € 100 = € 20,000
Outage time	2 h (during production time)	0 h (change during production free time)
Lost workforce per year (without car losses)	200h x 10 people x €100 = € 200,000	€ 0
Total cost per clamp change	[€ 200,000 + € 20,000] / 100 = € 2,200	€ 20,000 / 100 = € 200
Development cost	0	€ 200,000
	Amortisation of predictive maintenance project after 1 year.	

Understanding the business domain

Reasons for Failures

Attrition	E-Motor Clamp mechanics	Rupture of welding arms	Cone attrition	Transformer
Measured Parameter	Torque Mech. Distance	Mech. Distance Electrical Resistance		Current Voltage Phase Cut



Understanding the business domain

Rupture of welding arm

(Greater flex in welding arms due to fractures)

Parameters:

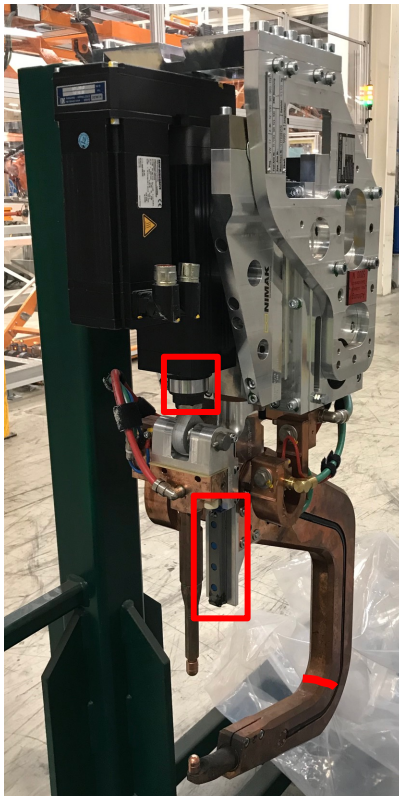
- Distance of mechanical travel
- Torque of clamps

Attrition of clamp mechanics

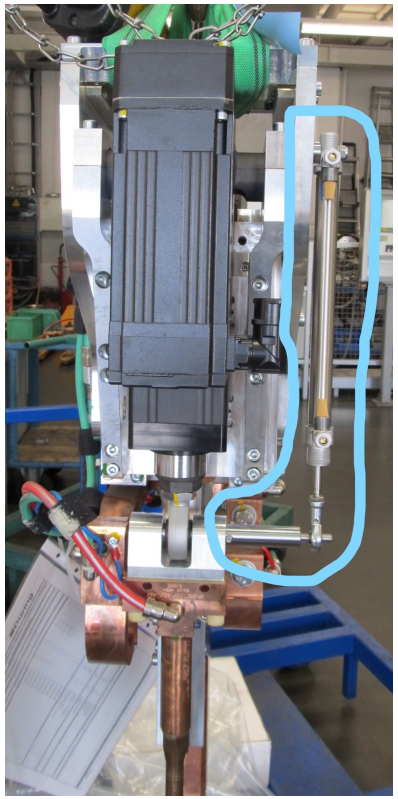
(Clamp movement impaired)

Parameter:

- Torque of clamps



Attrition of clamp mechanics



Pneumatic cylinder

Development of a prediction model

Rupture of welding arm

(Greater flex in welding arms due to fractures)

Parameters:

- Distance of mechanical travel
- Torque of clamps

Anomalies detectable

(clamps must be opened 1,5 mm in add.)

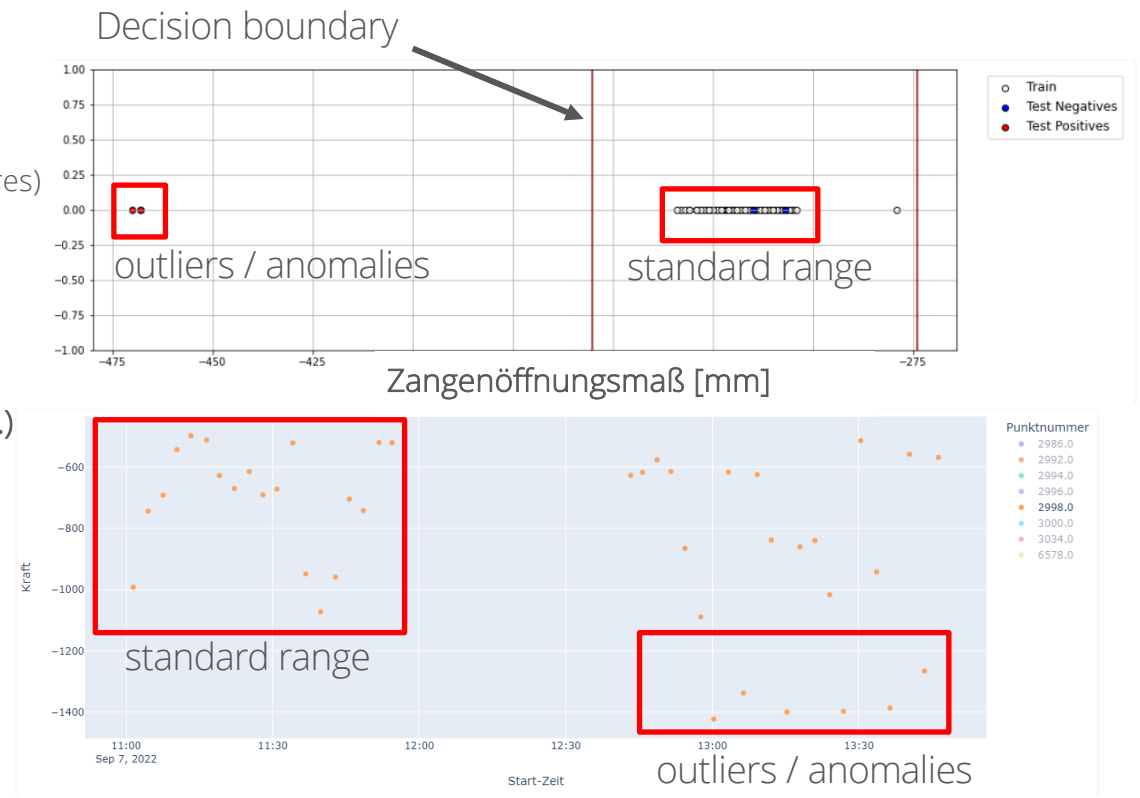
Attrition of clamp mechs.

(Clamp movement impaired)

Parameter:

- Torque of clamps

Anomalies detectable



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Summary

1. Data transformation can be performed after digital transformation; data transformation is needed for leveraging efficiencies and generating new profit pools
2. Data will be used in future for handling the ever-increasing complexity of (autonomous) cars
3. Data will be used to create an overall predictive factory and supply chain