



NTNU  
revolve



# Who am I?



Lars van der Lee  
Project Manager Team 2020  
Group leader Software Team 2019  
5. Year Cybernetics student



# Who are we?

- Formula Student Team
  - Students who design and produce racecars
- Team 2020
  - 80 members
  - 24 study programs
- Alumni
  - Previous members, from the past 9 seasons, support the team with insight and experience
- Many partners and sponsors



**SIMPRO**  
ELEKTRONIKKPRODUSENTEN

**SKF**



**Hafslund**  
Nett

**Five Years Out**

**radionor**

**Trondheim  
Stål AS**

**MJØS**  
METALLVAREFABRIKK AS

**SAP**

**KONGSBERG**

**KSMV**

**OUSTER**

**PLM technology**

**molstad**  
modell&form

**DASSAULT  
SYSTEMES**

**COWI**

**sensoror**

**Danske Bank**

**SEMCON**

**Skriverform a.s**

**NTNU**  
Fakultet for ingeniervitenskap  
og teknologi

**NTNU**  
Fakultet for informasjonsteknologi  
og elektroteknikk

**NORBIT**  
- explore more -

**BDO**

**Bertel O. Steen**

**SINTEF**  
SINTEF Energi

**K. LERØY**  
METALLINDUSTRI AS

**induform**  
Plast og Metallprodukter

**TRONRUD  
ENGINEERING AS**





The vision

Pushing students to become  
world class engineers





How do we  
achieve this?

- Experience the full engineering cycle
  - Concept development
  - Design systems
  - Produce the entire car
  - Testing and verification
  - Compete against the biggest universities in Europe



# Static Events

Business Plan

Cost & Manufacturing

Engineering Design



Investors  
Mass produce Race Cars



Cost of all Parts  
Production Processes



Design Decisions  
«Why this and not that?»



# Dynamic Events

Acceleration



75 Meters

Skid Pad



Figure Eight Track

Autocross



One Lap

Endurance



22 km w/Driver Change





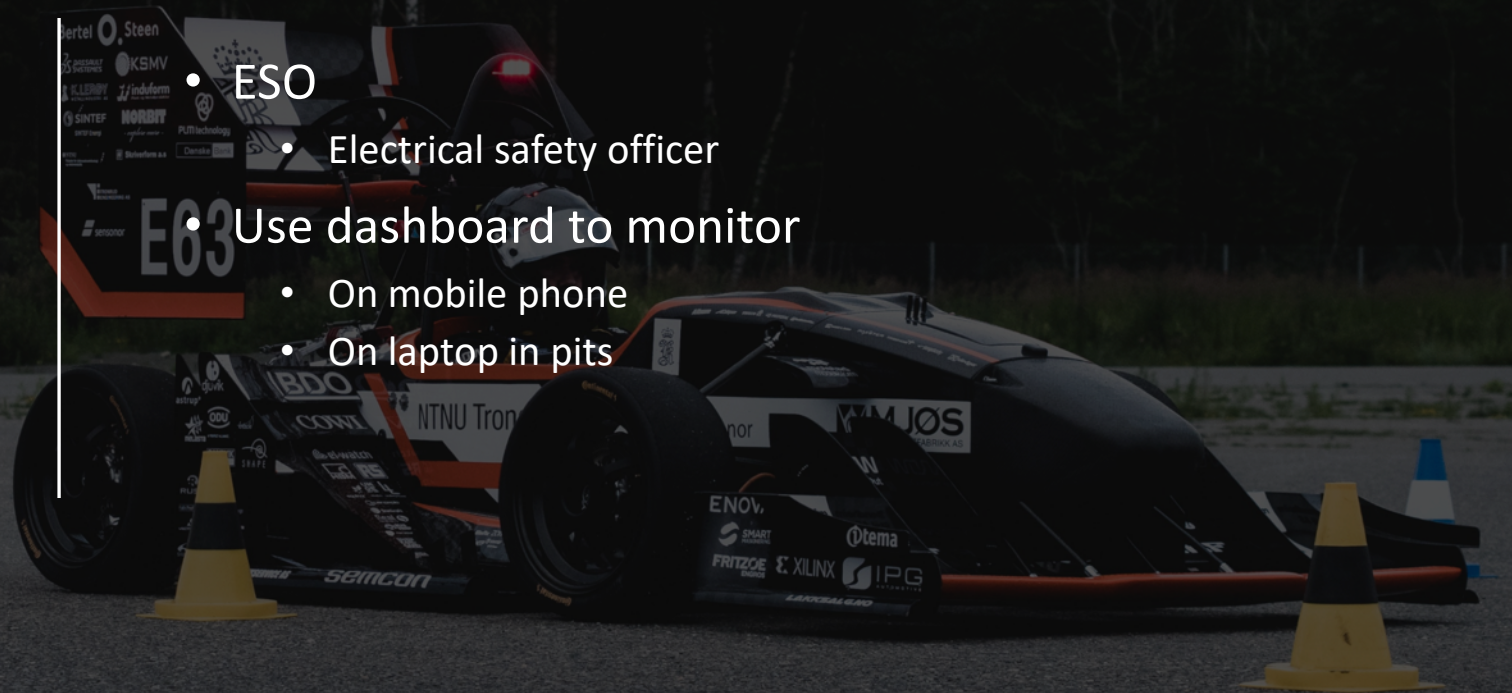
# Revolve NTNU and SAP

- Cloud based monitoring system
  - SAP Streaming Analytics
  - SAP HANA Database
  - SAP UI5 Dashboard
- Support from SAP Engineers
  - Design and development



# Testing crew

- ESO
- Electrical safety officer
- Use dashboard to monitor
  - On mobile phone
  - On laptop in pits



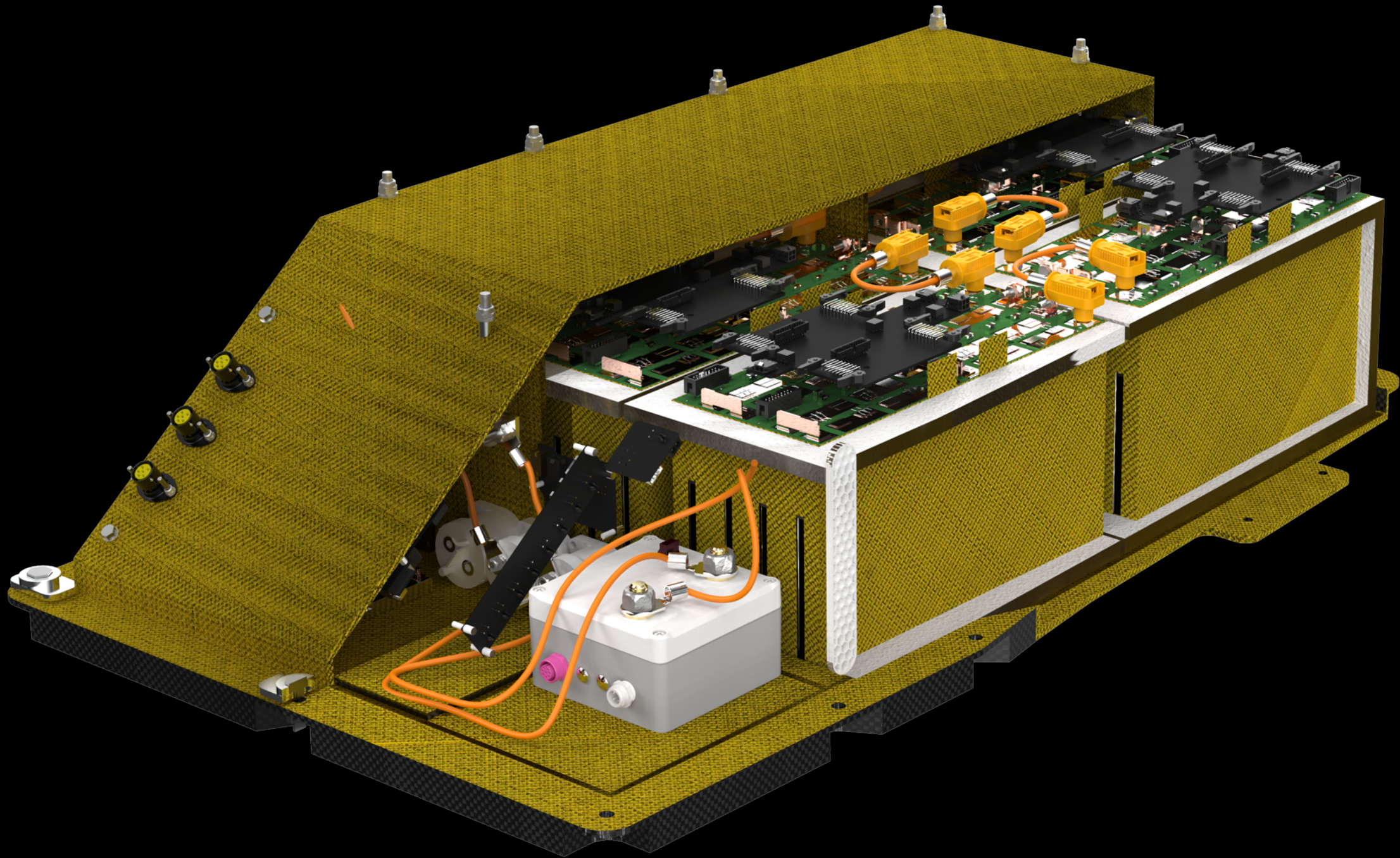


# The system

- The accumulator
  - Sensor measurements
- Data streaming
- Data storage
- Data visualisation





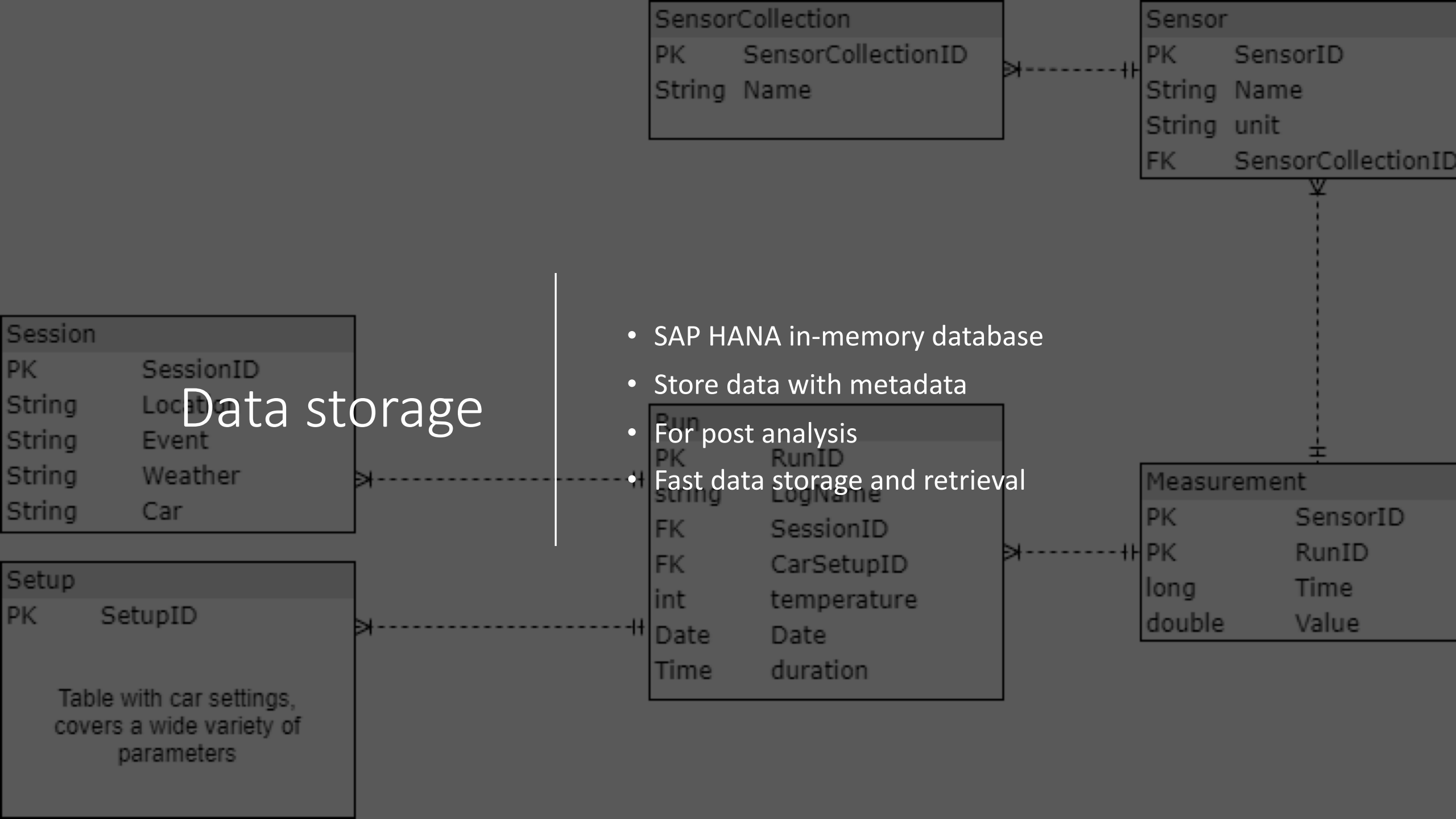








# Data storage

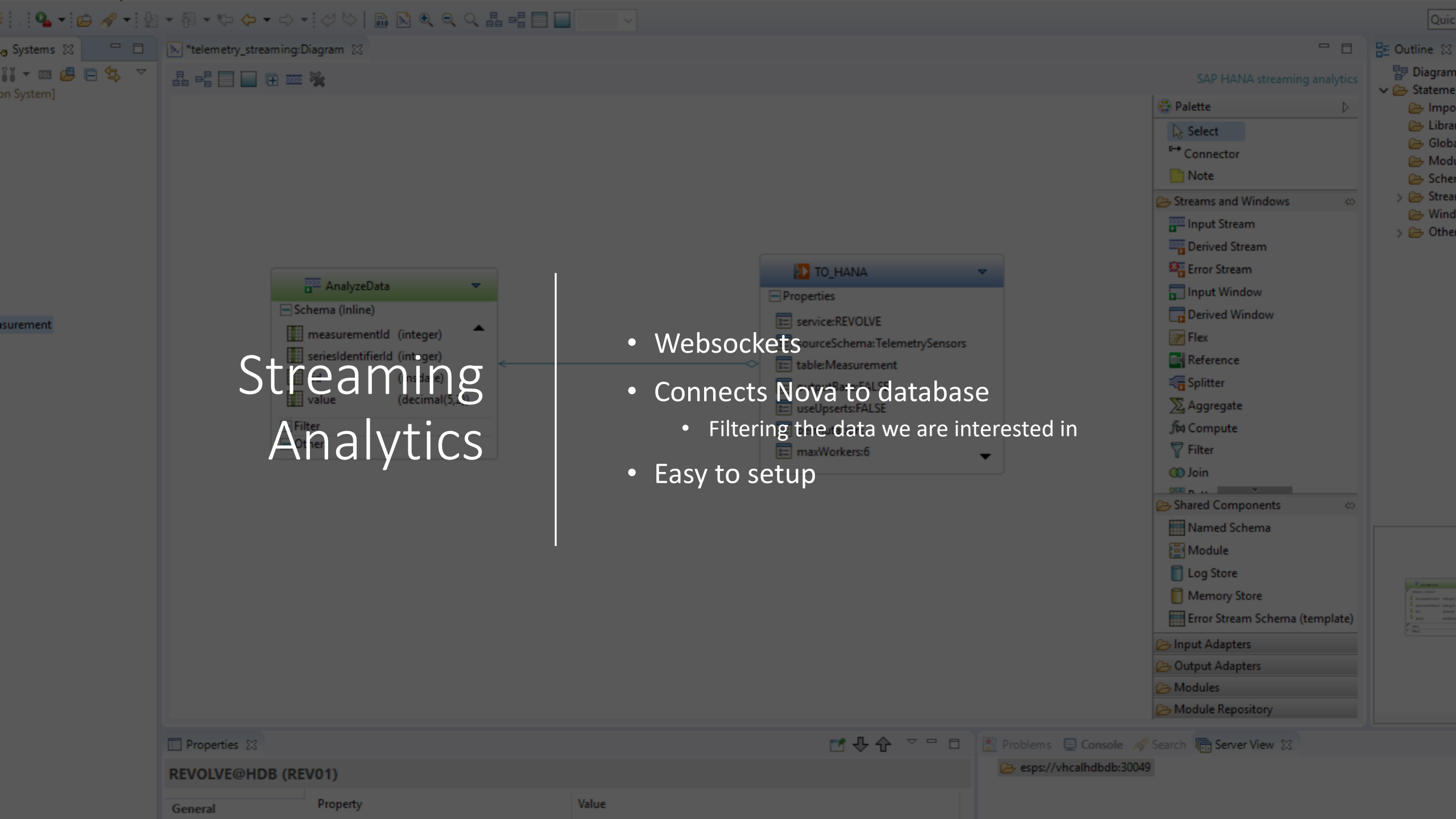


- SAP HANA in-memory database
- Store data with metadata
- For post analysis
- Fast data storage and retrieval



# Streaming Analytics

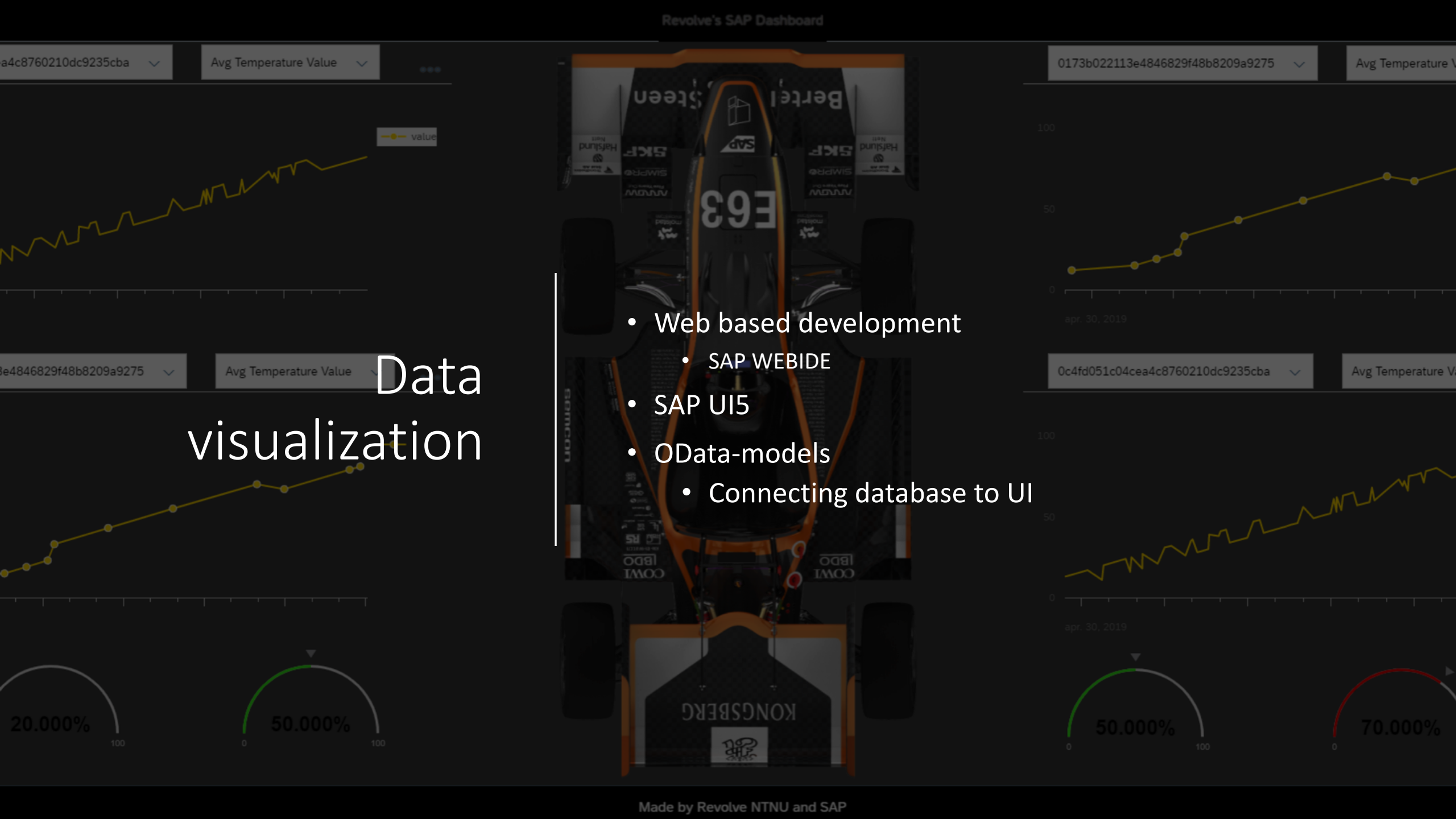
- Websockets
- Connects Nova to database
  - Filtering the data we are interested in
- Easy to setup





# Data visualization

- Web based development
  - SAP WEBIDE
- SAP UI5
- OData-models
  - Connecting database to UI







# Questions?

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# Results



- ① Engineering Design
- ② Endurance
- ② Auto Cross
- ② Efficiency

2. place Electric Overall

- ① Engineering Design
- ② Auto Cross
- ② Skid Pad

10. place Electric Overall

15. place Driverless Overall