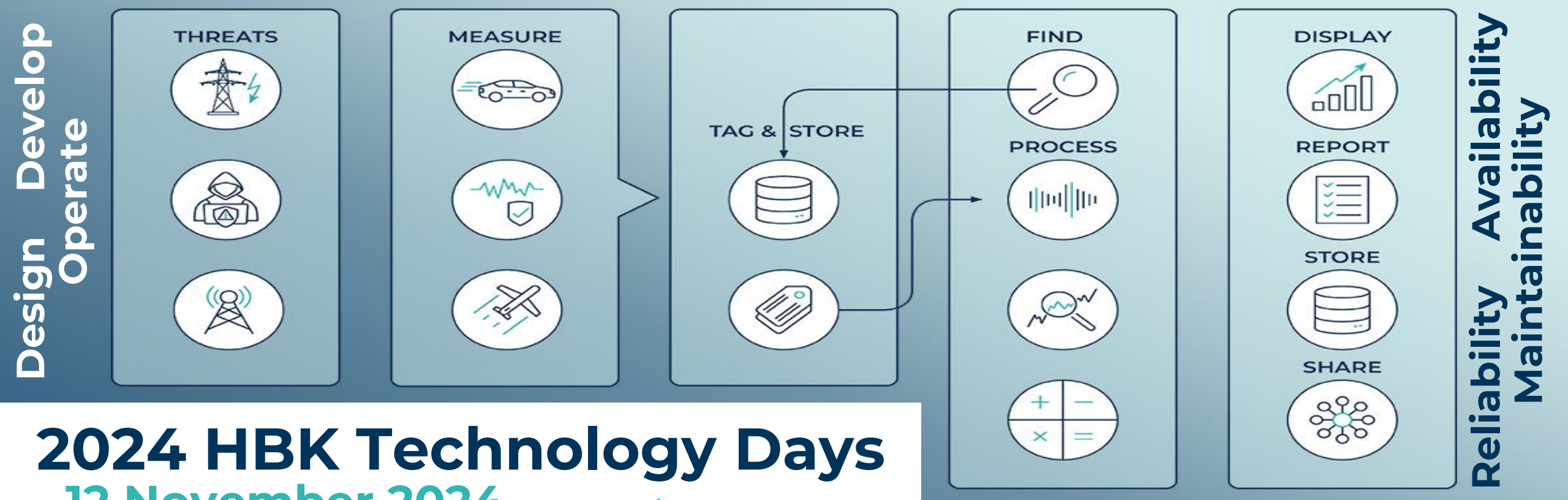




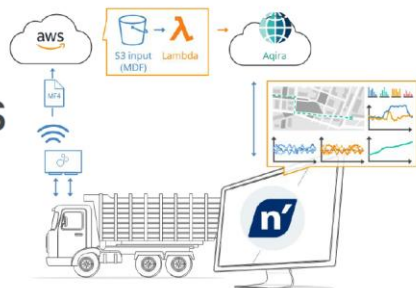
2024 HBK Technology Days

12 November 2024

Session 4: Vehicle Network Analytics

OEM Telematics with WiFi/LTE CAN Loggers

CSS Electronics
www.csselectronics.com



- OEM telematics with WiFi/LTE CAN loggers

Martin Falch,
Co-owner at CSS Electronics

OEM telematics with WiFi/LTE CAN loggers

▲ Abstract

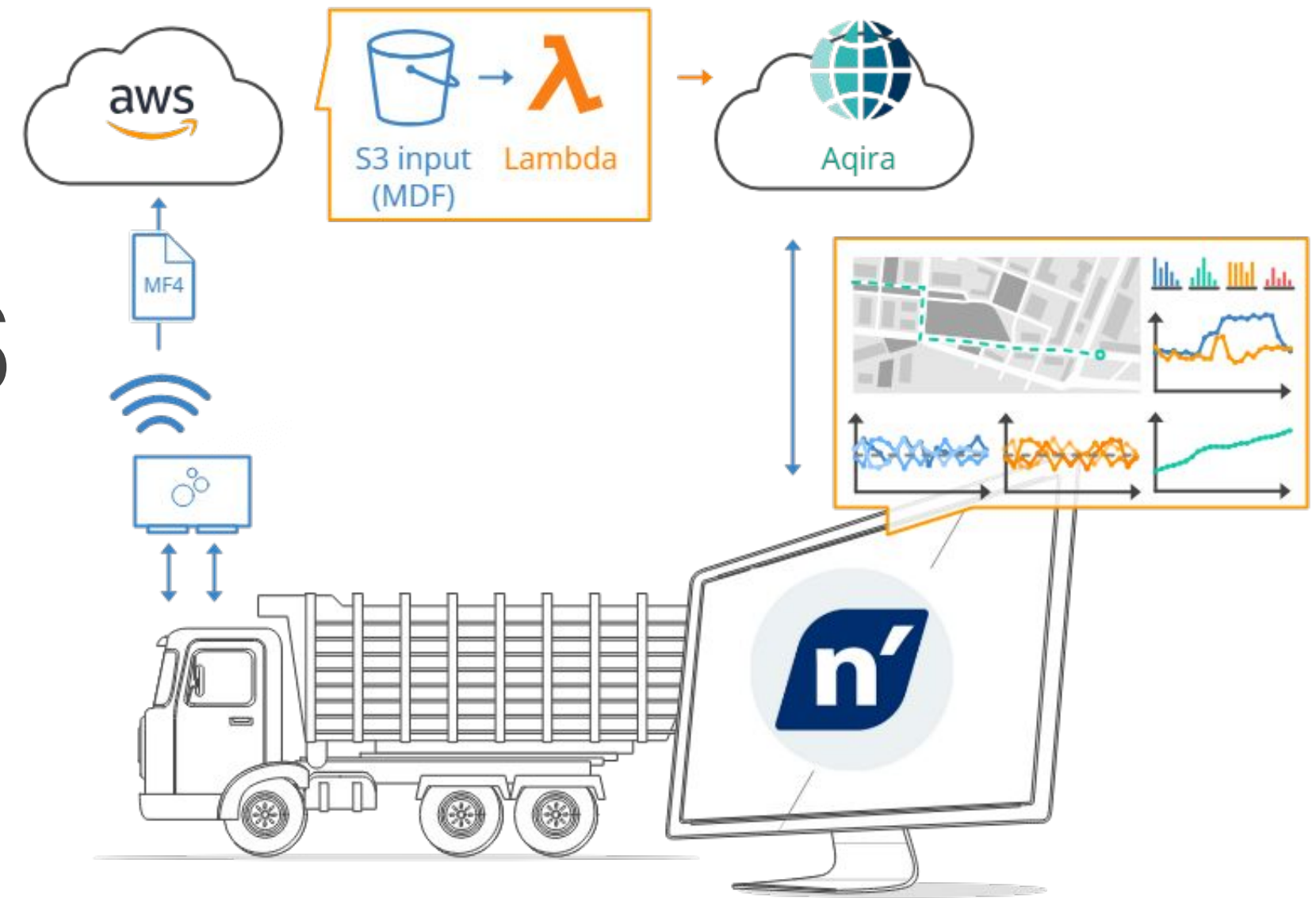
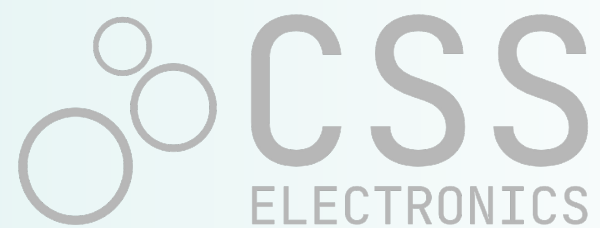
- For many OEMs (Original Equipment Manufacturers), collecting CAN bus data from their vehicles/machinery at scale can be a challenge. In this session, CSS Electronics will cover how CAN bus data loggers with WiFi/LTE can be used to automate this data collection - from installation to post processing. This will include example data collection work flows, considerations on data sensitivity and security - and details on how data can be integrated with any software/API tool, including tools from HBK.

▲ About the presenter, Martin Falch, Co-owner at CSS Electronics

- Martin Falch has a master's degree in quantitative economics and has worked in management consulting and strategy. In 2015 he started CSS Electronics with founder Christian Steiniche, a Danish company specializing in CAN/LIN data loggers and modules.
- Martin is responsible for sales & marketing and is the author behind hundreds of articles and videos including the popular 'simple intro' tutorials on CAN related protocols. In addition, he collaborates with end users to ensure successful deployments of CSS hardware across 5000+ companies and 100+ countries.

OEM Telematics with WiFi/LTE CAN Loggers

CSS Electronics
www.csselectronics.com

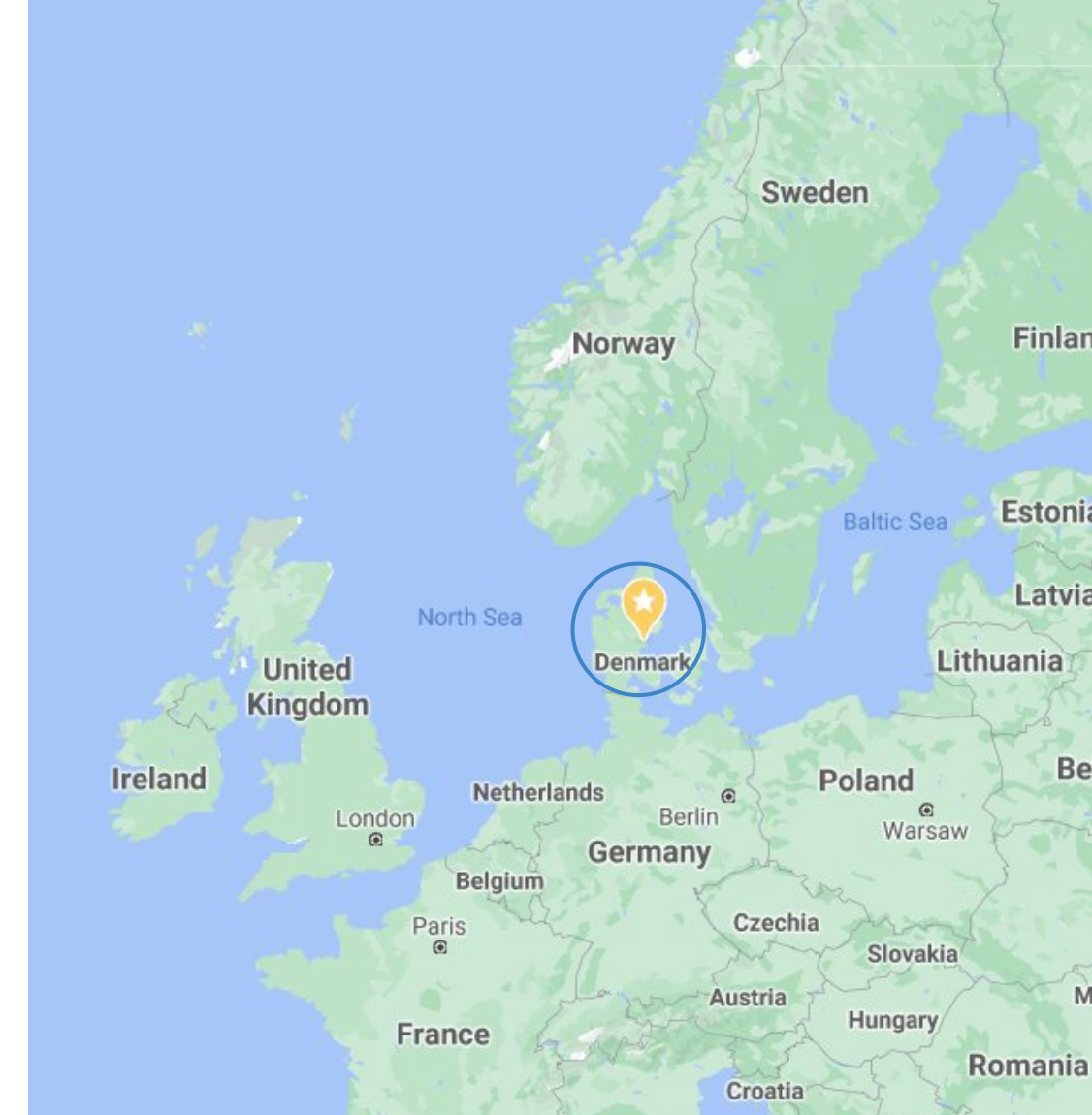


agenda

- **Introduction** [5 min]
- **Basics on CAN logging** [5 min]
 - Connecting to the CAN bus
 - Raw vs. decoded CAN data & DBC files
- **Modern OEM telematics** [15 min]
 - Pro specs
 - Data ownership
 - E2E security
 - Interoperability
- **Q&A** [5 min]

about CSS Electronics

- Started in 2015, based in Denmark
- Develop & sell CAN bus hardware (loggers, sensor modules)
- Popular CAN content (100K+ sessions/month, 25K+ YouTube subs)
- Products used by 5,000+ companies across 100+ countries
- 80%+ of end users are automotive/industrial OEM engineers



CSS Electronics

- www.csselectronics.com
- contact@csselectronics.com
- +45 91 25 25 63
- www.linkedin.com/company/css-electronics
- 100% carbon offset since 2015



about me

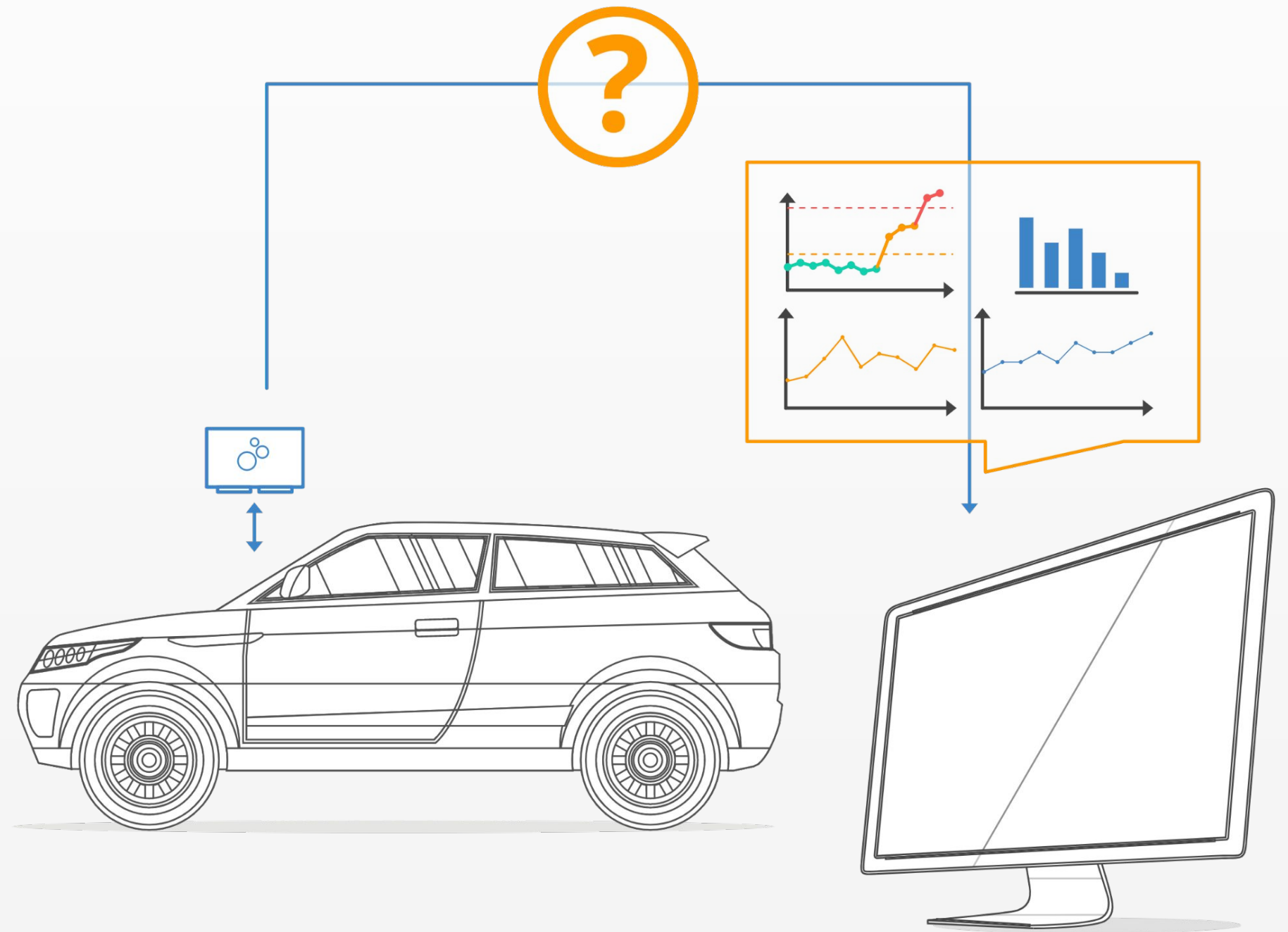
- Co-owner at CSS Electronics
- Main responsibilities
 - Sales & marketing (articles, videos, SEO, social, ...)
 - Technical sparring and support
 - Software development (React, Python, ...)



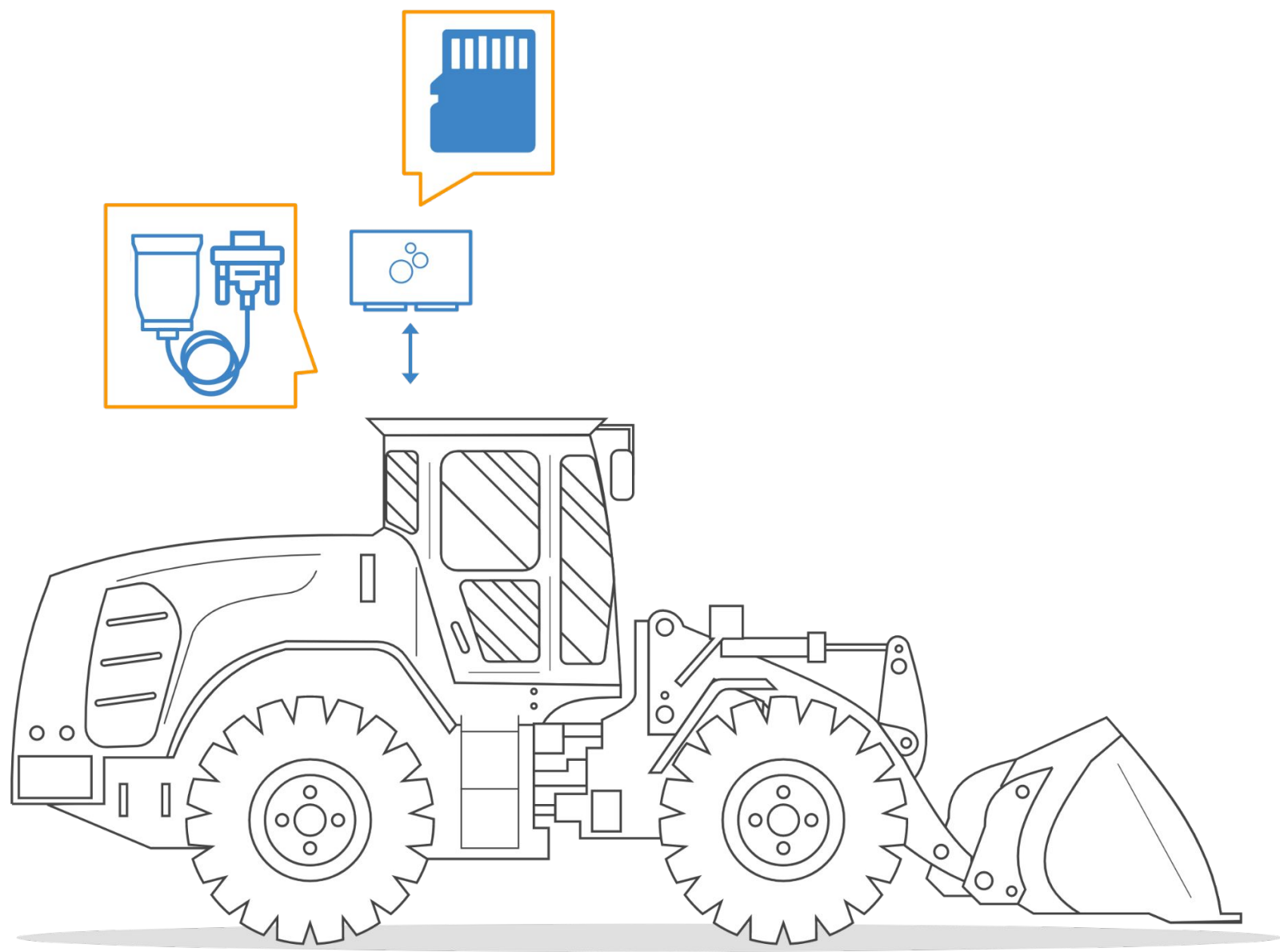
Martin Falch

- www.linkedin.com/in/martin-falch-a7579821
- contact@csseletronics.com

how to log & decode CAN data



connect to your CAN bus



DB9-J1939

Trucks, buses, ...



DB9-CAT

Caterpillar vehicles



DB9-OBD2

Cars, trucks, ...



DB9-generic

Custom cables



DB9-M12

Marine, industrial



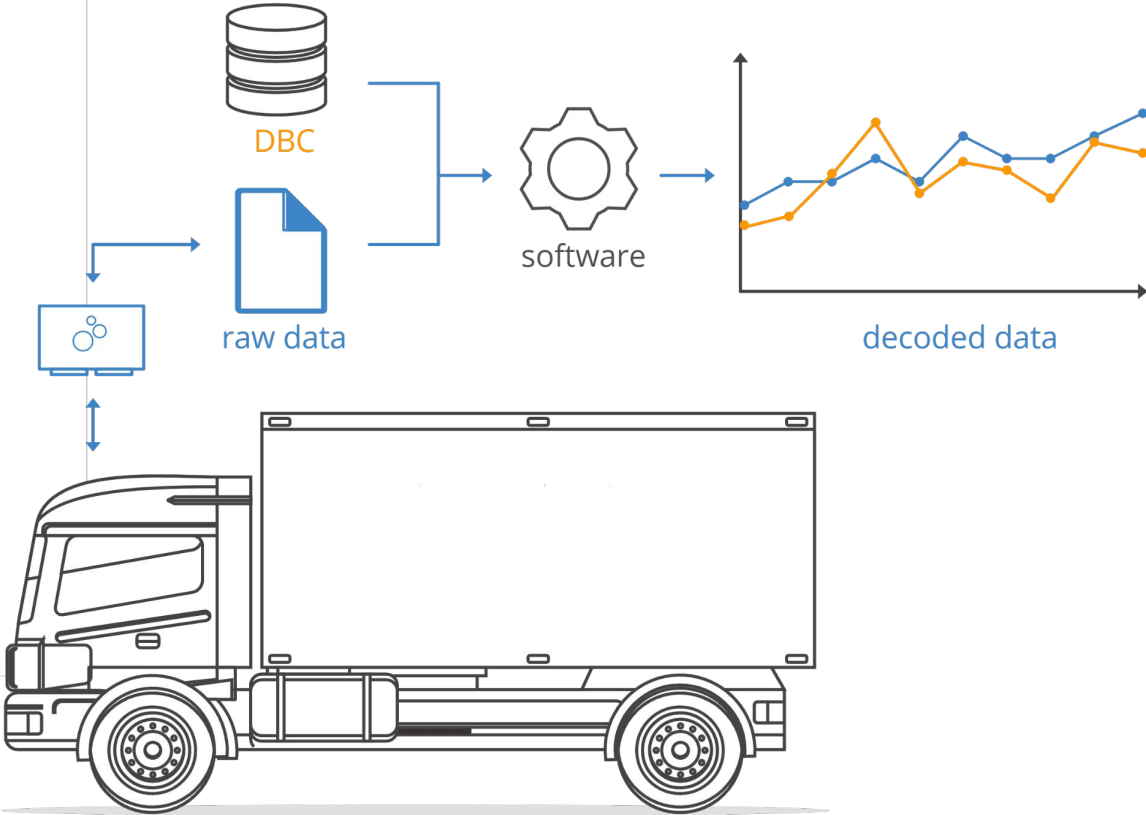
CAN reader CH1

Contactless

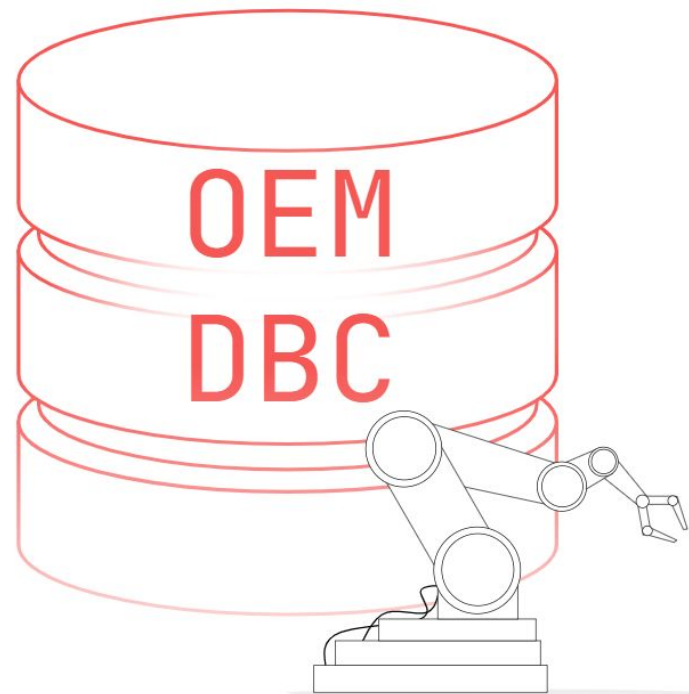


decode your raw CAN data

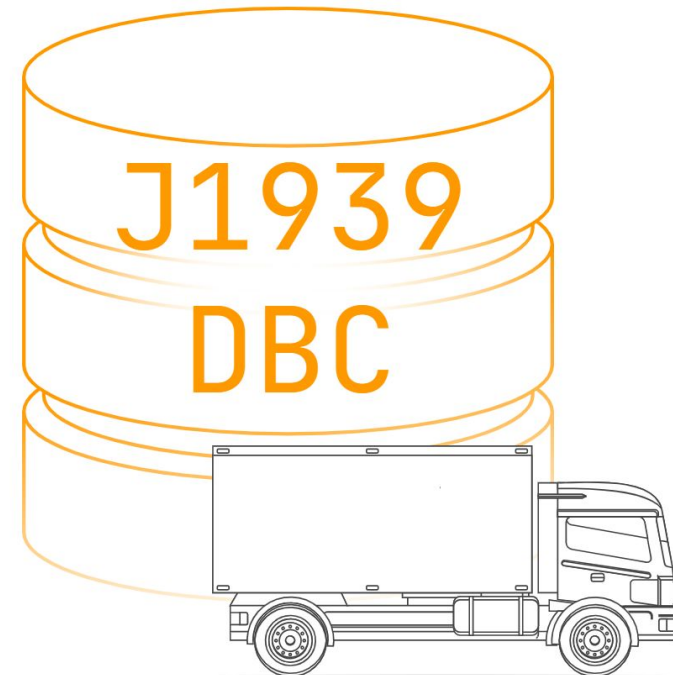
raw CAN Bus data					decoded CAN bus data (aka physical values)									
timestampEpoch	Channel	ID	DataBytes		timestamps	EngineExhaustTemp	EngineSpeed	EngineHours	FuelLevel1	Speed	...			
1578927025.6604	1	18FEF000	FFFFFFFF0000F000FF		2020-01-13 15:50:25.670249939+01:00	299	1455.625	8596.35	54.80	82.898				
1578927025.6648	1	14FF2321	000CE1FFFFFFFFFFFF		2020-01-13 15:50:25.679949999+01:00	299	1457.000	8596.35	54.80	82.898				
1578927025.6662	1	CF00A01	16342F47FFFFFFFFFF		2020-01-13 15:50:25.681649923+01:00	299	1457.108	8596.35	54.80	82.898				
1578927025.6668	1	10F01A01	A802FFFFFFFFFFFF		2020-01-13 15:50:25.689800024+01:00	299	1457.625	8596.35	54.80	82.880				
1578927025.6691	1	18F00E3D	2C1AFFFFFFFFFFFF		2020-01-13 15:50:25.699749947+01:00	299	1457.500	8596.35	54.80	82.857				
1578927025.6697	1	18F00F3D	9010FFFFFFFFFFFF		2020-01-13 15:50:25.709800005+01:00	299	1457.500	8596.35	54.80	82.834				
1578927025.6703	1	CF00400	01B5B57D2D00F4B5		2020-01-13 15:50:25.715950012+01:00	299	1457.215	8596.35	54.80	82.820				
1578927025.6708	1	18FD8C3D	32001D00FFFFFFFF		2020-01-13 15:50:25.720599890+01:00	299	1457.000	8596.35	54.80	82.810				
1578927025.6714	1	18FEE000	F8B83800F8B83800		2020-01-13 15:50:25.726000071+01:00	299	1455.967	8596.35	54.80	82.798				
1578927025.6720	1	18FDB23D	FFFF28501C00FFFF		2020-01-13 15:50:25.729749918+01:00	299	1455.250	8596.35	54.80	82.789				
1578927025.6725	1	18FDB300	FFFF6B55FFFFFFFF		2020-01-13 15:50:25.736000061+01:00	299	1455.250	8596.35	54.80	82.775				
1578927025.6731	1	18FDB400	81478147FFFFFFFF		2020-01-13 15:50:25.738500118+01:00	299	1455.250	8596.35	54.80	82.769				
1578927025.6748	1	C00100B	FCFFFA00FFFFFFFF		2020-01-13 15:50:25.739799976+01:00	299	1455.250	8596.35	54.80	82.766				
1578927025.6753	1	14FF0121	FFFFFFFFFFFFFCFF		2020-01-13 15:50:25.749749899+01:00	299	1454.125	8596.35	54.80	82.743				
1578927025.6800	1	CF00400	01B6B5882D00F4B5		2020-01-13 15:50:25.759799957+01:00	299	1455.875	8596.35	54.80	82.721				
1578927025.6805	1	C000F0B	FCFFFA00FFFFFFFF		2020-01-13 15:50:25.770200014+01:00	299	1458.500	8596.35	54.80	82.697				
1578927025.6811	1	CF00300	DCA138FFFFFFFF93FF		2020-01-13 15:50:25.780050039+01:00	299	1460.125	8596.35	54.80	82.674				
1578927025.6817	1	18FEF100	C3E6520000000030		2020-01-13 15:50:25.781199932+01:00	299	1460.184	8596.35	54.80	82.672				
1578927025.6848	1	14FF0221	FFFFFFFFFFFFFFFF		2020-01-13 15:50:25.789799929+01:00	299	1460.625	8596.35	54.80	82.663				
1578927025.6854	1	C00290B	FCFFFA00FFFFFFFF		2020-01-13 15:50:25.799799919+01:00	299	1460.375	8596.35	54.80	82.652				
1578927025.6898	1	CF00400	71B8B48D2D00F4B5		2020-01-13 15:50:25.809799910+01:00	299	1459.250	8596.35	54.80	82.641				
1578927025.6904	1	18FEDF00	850013FF7D0311FF		2020-01-13 15:50:25.815999985+01:00	299	1458.461	8596.35	54.80	82.634				
1578927025.6909	1	18FEBF0B	33527E7B7775FFFF		2020-01-13 15:50:25.820600033+01:00	299	1457.875	8596.35	54.80	82.629				
1578927025.6962	1	14F00031	CFFFFFFFFFFFFFFFFF		2020-01-13 15:50:25.825999975+01:00	299	1456.326	8596.35	54.80	82.623				
1578927025.6998	1	CF00400	71BAB48C2D00F4B5		2020-01-13 15:50:25.829750061+01:00	299	1455.250	8596.35	54.80	82.619				
1578927025.7013	1	18FE4F3E	0400FFFFFFFFFFFF		2020-01-13 15:50:25.836050034+01:00	299	1454.388	8596.35	54.80	82.612				
1578927025.7021	1	14FF2321	0120030000000000		2020-01-13 15:50:25.838000007+01:00	299	1452.000	8596.35	54.80	82.600				



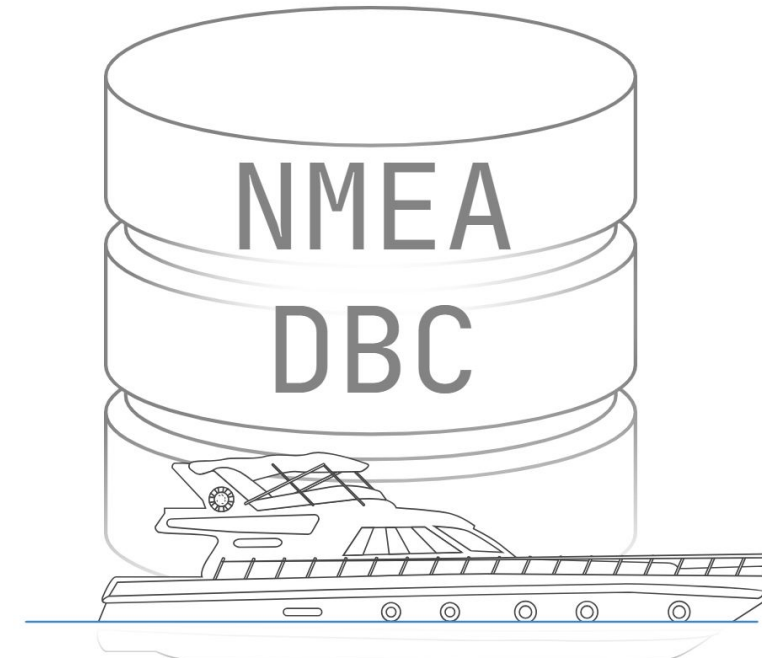
a DBC may be proprietary - or standardized



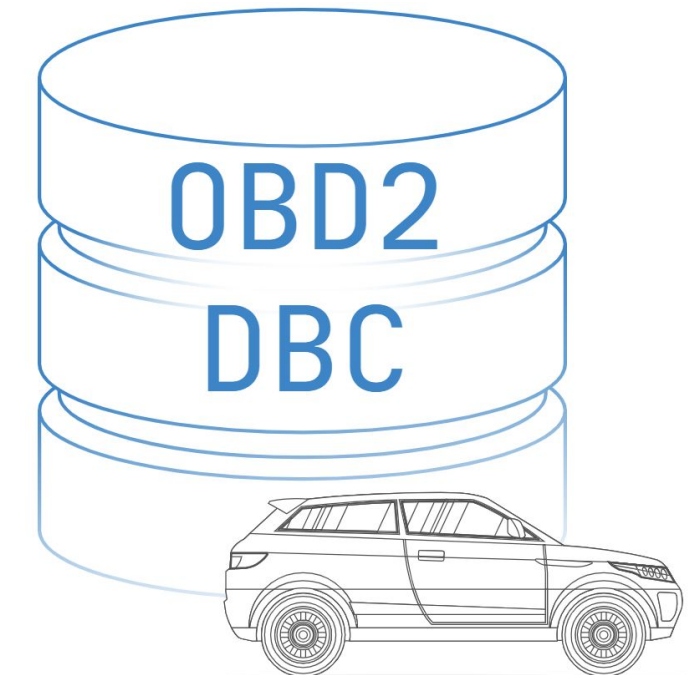
- Proprietary CAN encoding
- Known to the OEM
- May be shared with partners
- May be reverse engineered
- For CAN modules designed for integration, it is often supplied (e.g. sensor-to-CAN)



- Standard for most heavy-duty
- DBC typically decodes 60-80%

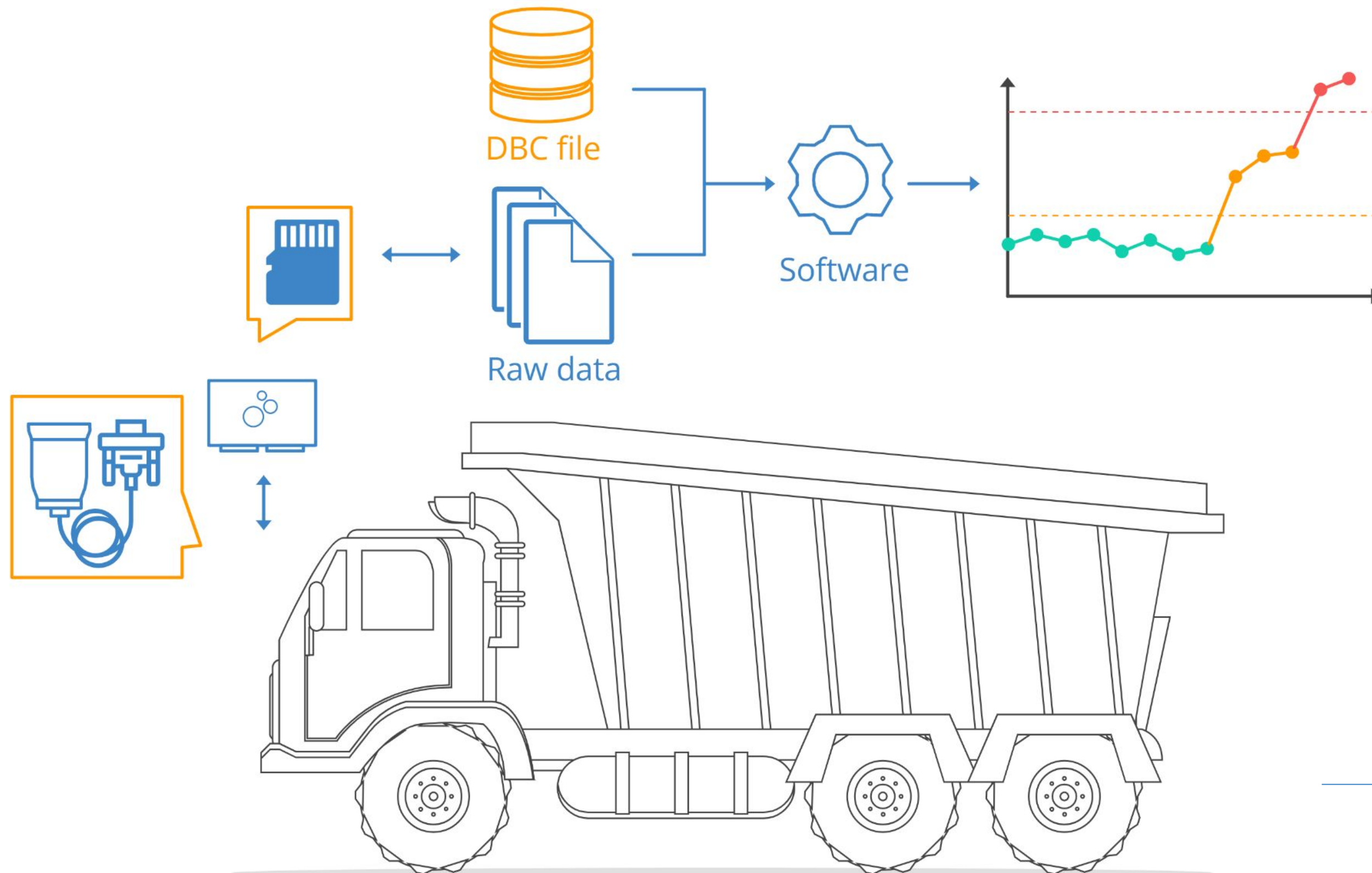


- Used in ships/boats
- DBC typically decodes 60-80%
- Frequent use of 'fast packets'
- Vessels often also use J1939



- Supported in most non-EV cars
 - De facto standard since 2008
 - Only a subset of signals
 - Lower frequency/resolution
 - Available on-request
-

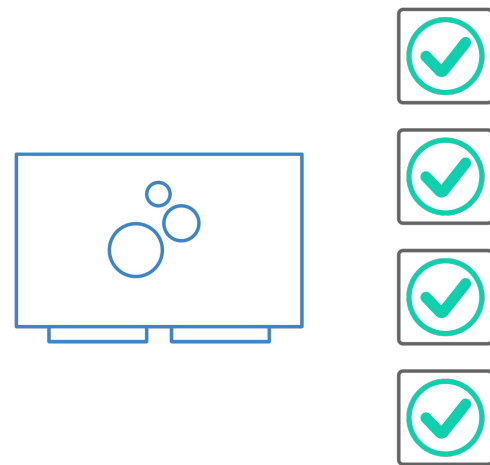
recap



OEM telematics

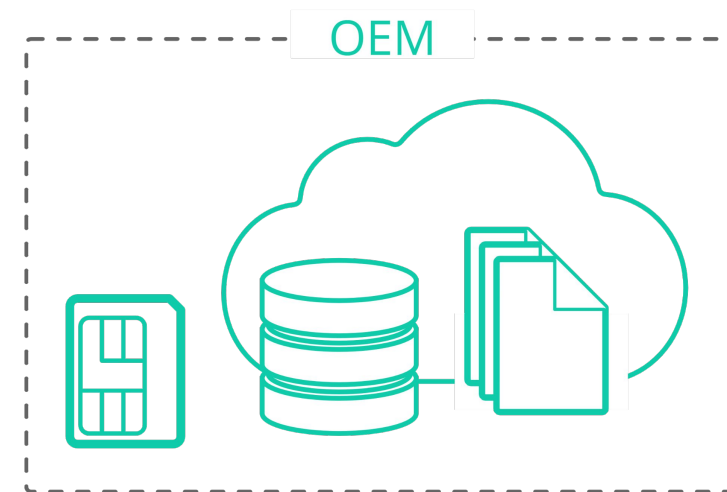


OEMs have unique telematics requirements



PRO SPECS

- Lossless logging
- Multiple channels
- High precision RTC
- Error frame support
- ...



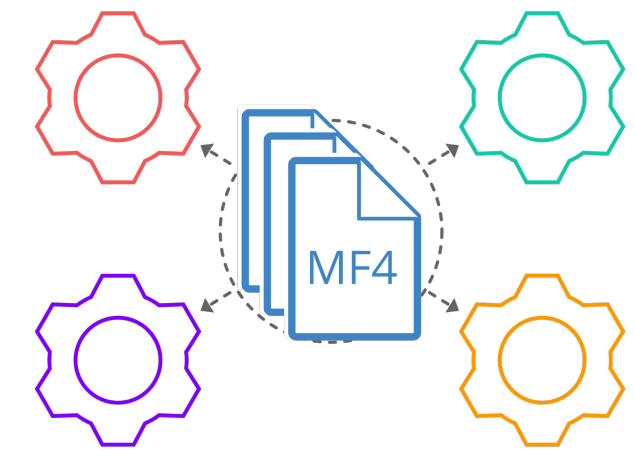
DATA OWNERSHIP

- Full data access
- OEM server
- OEM WiFi/SIM cards
- No sharing of DBCs
- ...



E2E SECURITY

- PW/data encryption
- Data integrity
- Secure transfer
- Manage user access
- ...



INTEROPERABILITY

- Standard formats
 - Custom integration
 - Free software/API
 - Data lakes for scale
 - ...
-

pro specs CAN/LIN loggers serve as basis



CANedge1: 2xCAN/LIN logger
Pro specs & interoperable [i](#)



CANedge1: 2xCAN/LIN logger
Incl. GNSS/IMU [i](#)



CANedge2: 2xCAN/LIN logger
Incl. WiFi [i](#)



CANedge2: 2xCAN/LIN logger
Incl. WiFi + GNSS/IMU [i](#)



CANedge3: 2xCAN/LIN logger
Incl. 3G/4G + GNSS/IMU [i](#)

CANedge1: 2x CAN/LIN data logger (RTC + SD)



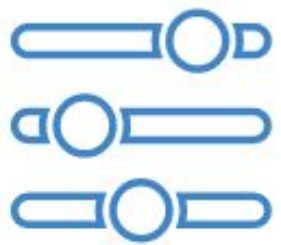
PLUG & PLAY



PRO SPECS



SO SMALL



CONFIGURABLE



FAST & SECURE



INTEROPERABLE



CANedge2: 2x CAN/LIN data logger (+WiFi)



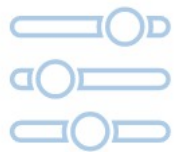
PLUG & PLAY



PRO SPECS



SO SMALL



CONFIGURABLE



FAST & SECURE



INTEROPERABLE



SECURE WIFI



MANAGE FLEET



CANedge3: 2x CAN/LIN data logger (+3G/4G)



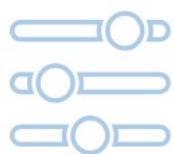
PLUG & PLAY



PRO SPECS



SO SMALL



CONFIGURABLE



FAST & SECURE



INTEROPERABLE



SECURE 3G/4G



MANAGE FLEET

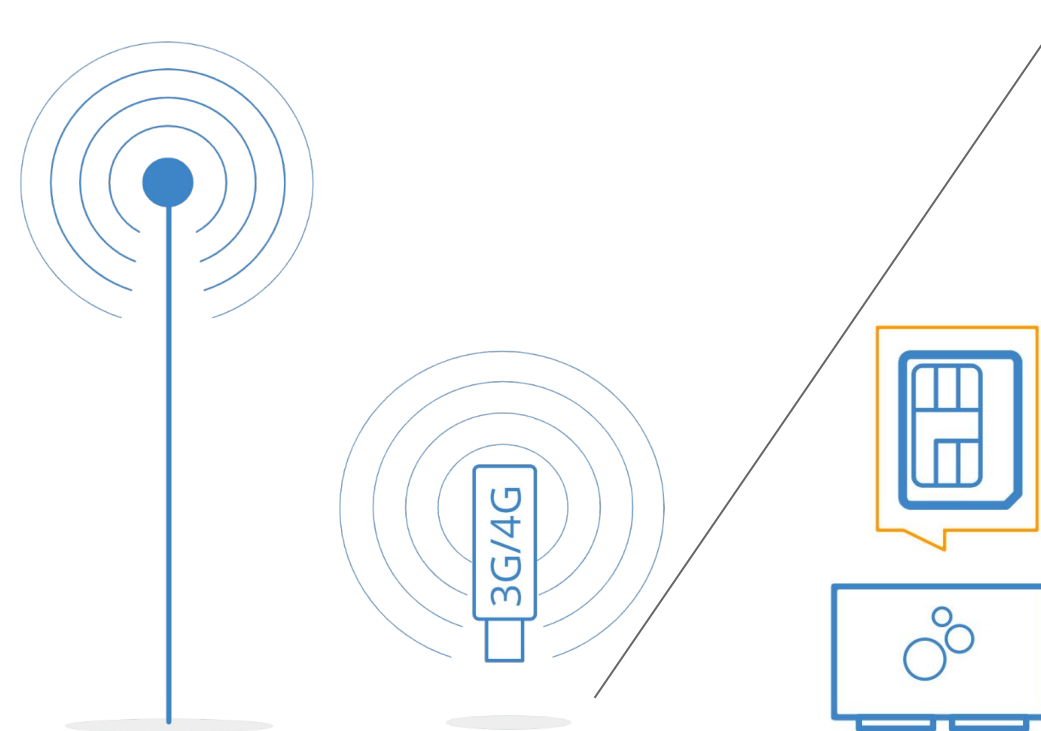


OEMs use their own S3 bucket and WiFi/SIM



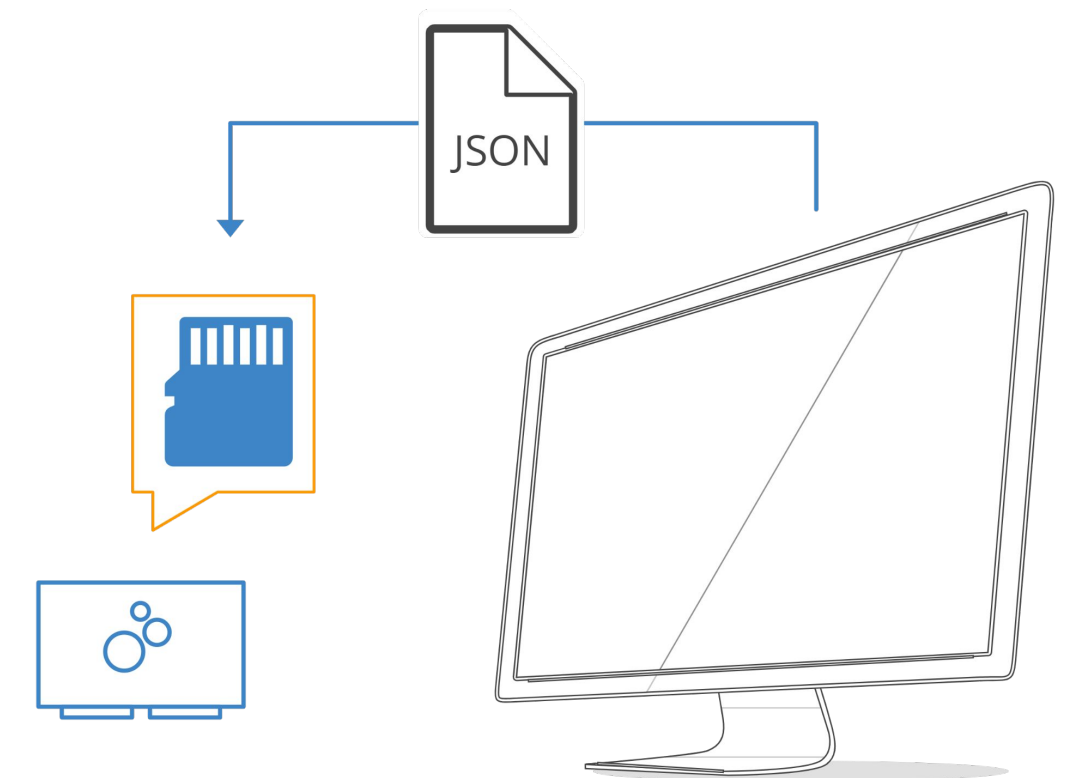
1: Set up your own S3 server

Easily set up low cost cloud - or use free self-hosted option



2: Select WiFi/SIM

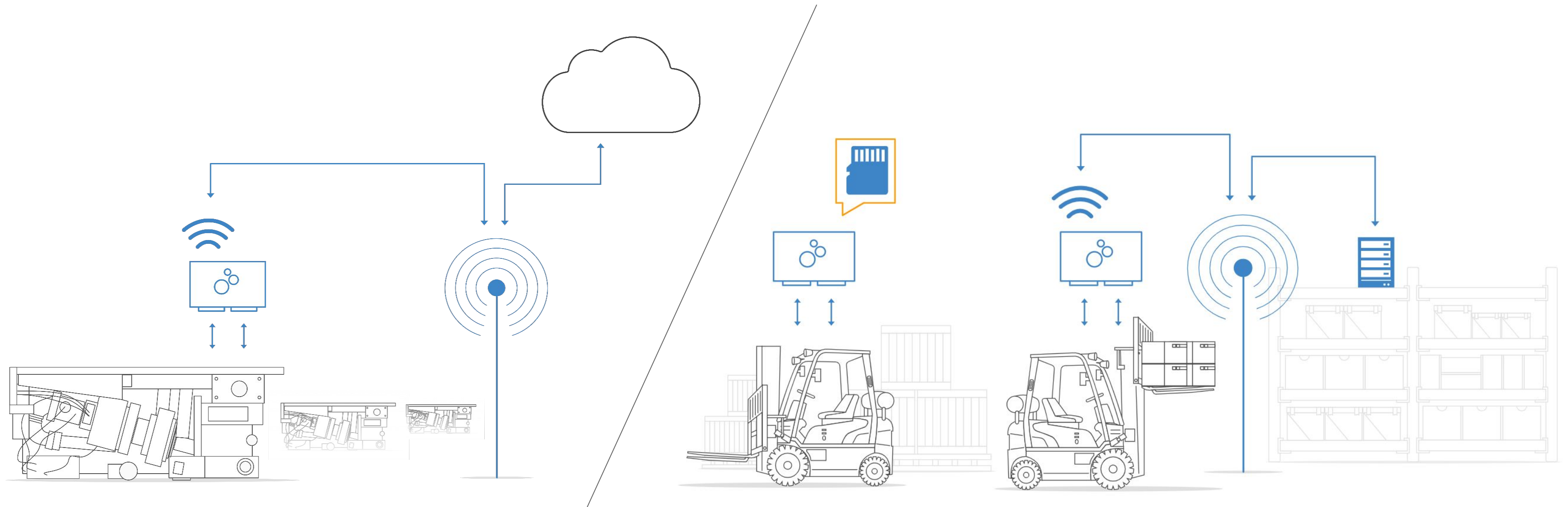
Use your own WiFi router (stationary, smartphone, ...) or SIM



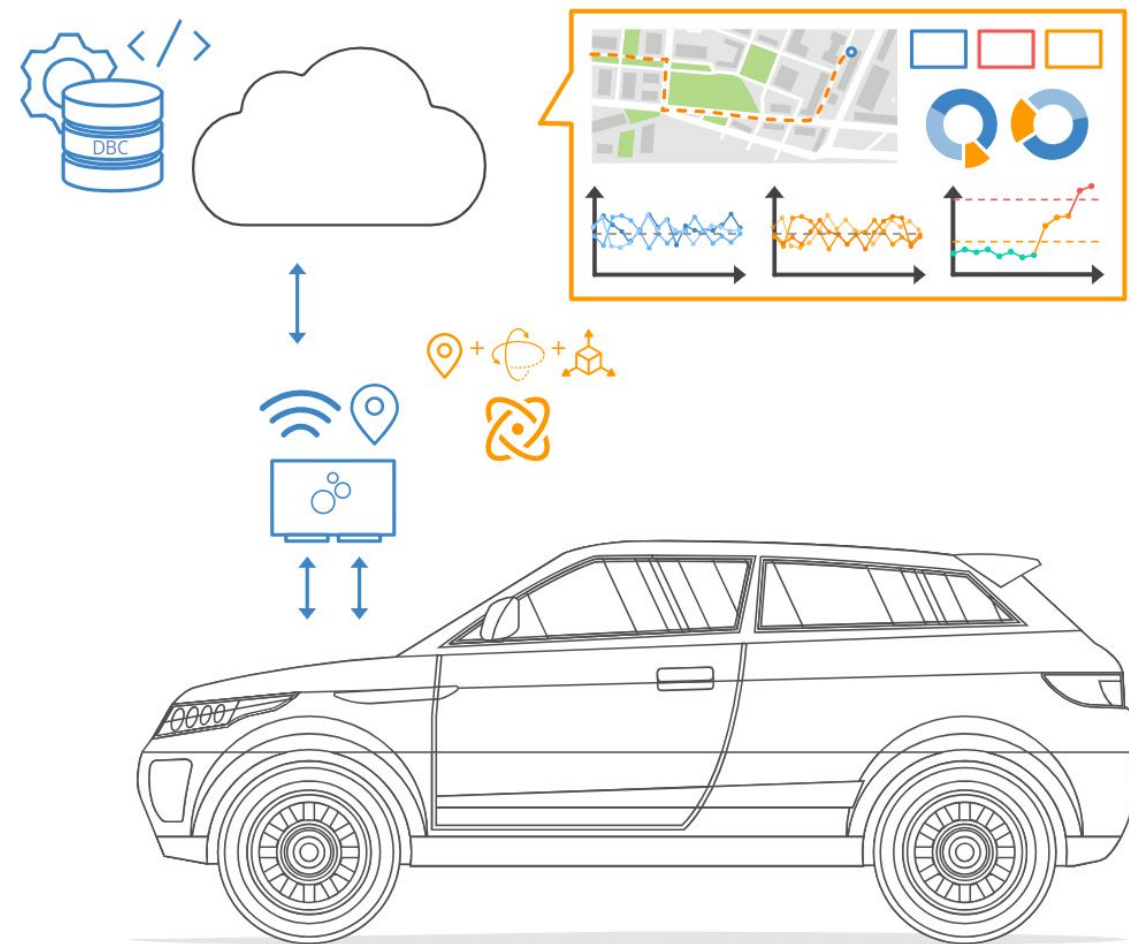
3: Configure CANedge

Add WiFi/SIM/S3 details to the SD via configuration editor

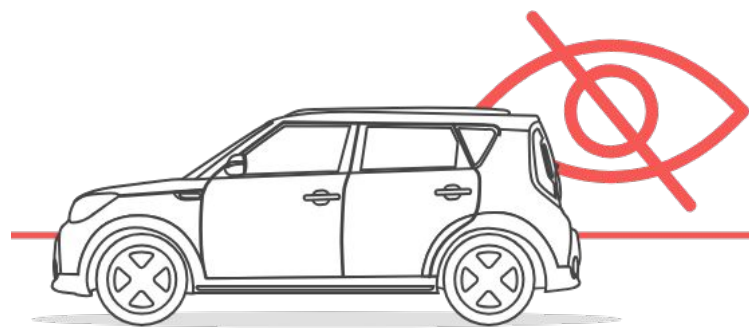
with WiFi for stationary/periodic uploads ...



... and LTE for mobile asset data collection



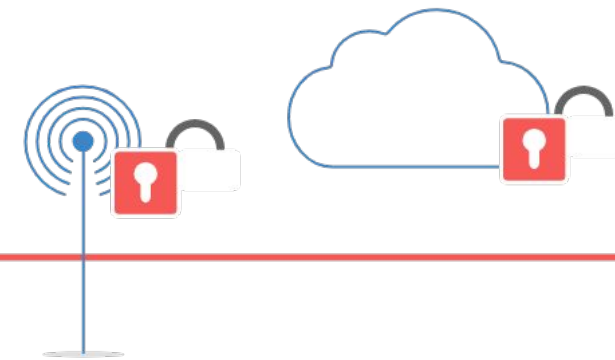
CAN telematics involves critical risks ...



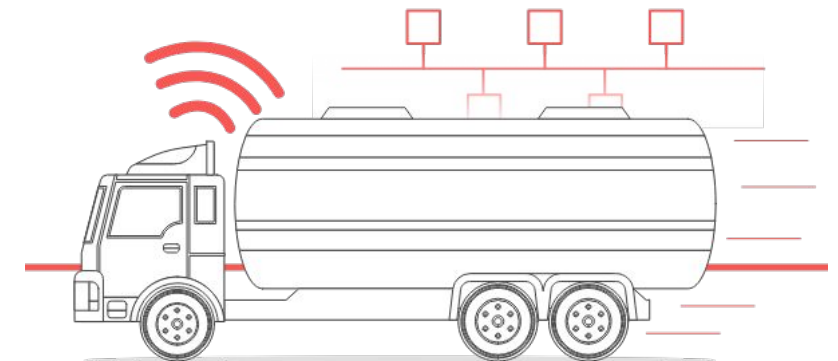
**GDPR/CCPA
regulation**



**Data integrity &
confidentiality**



**Exposure of
WiFi/S3**



**Remote
cyber attacks**

... which require specific solutions



**Password
encryption**



**Log file
encryption**



**Data transfer
encryption**

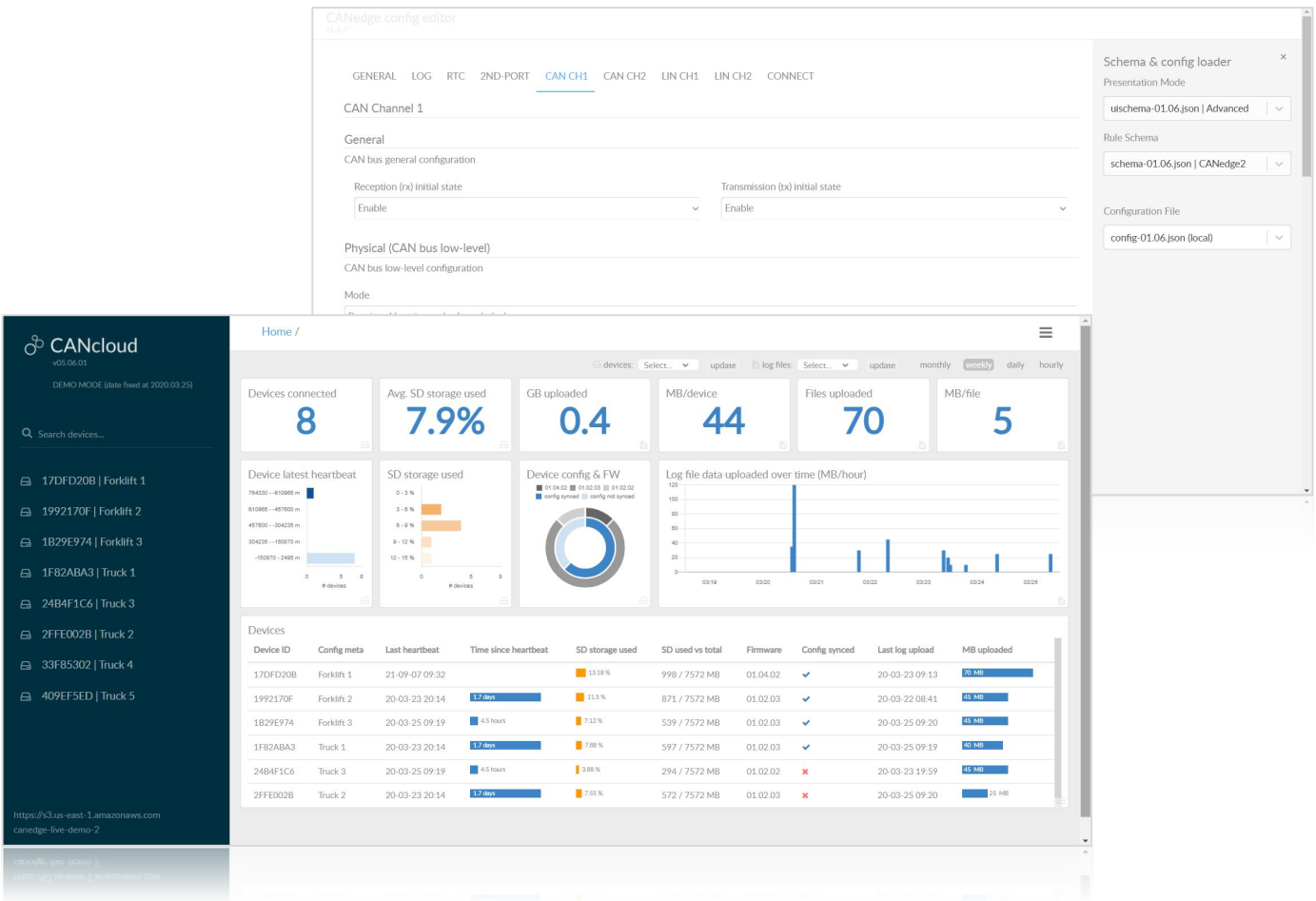


**Signed
firmware**



**User access
control**

devices/data must be interoperable

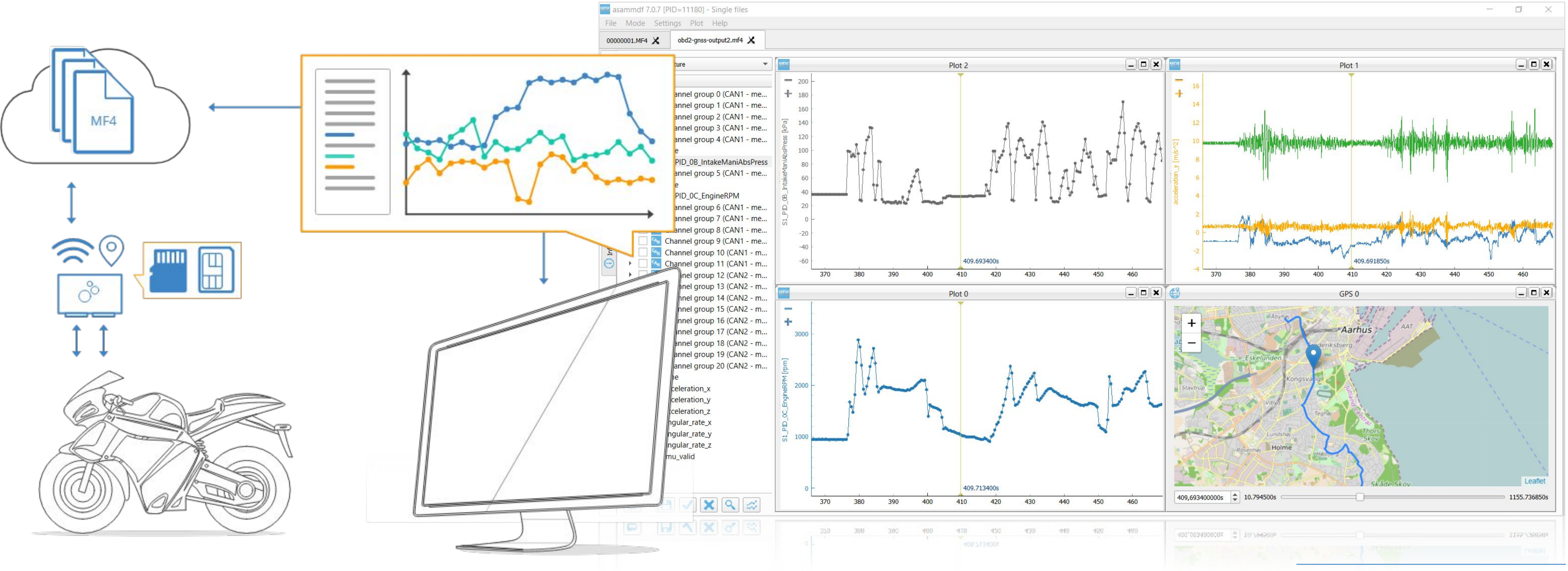


Device configuration
& management

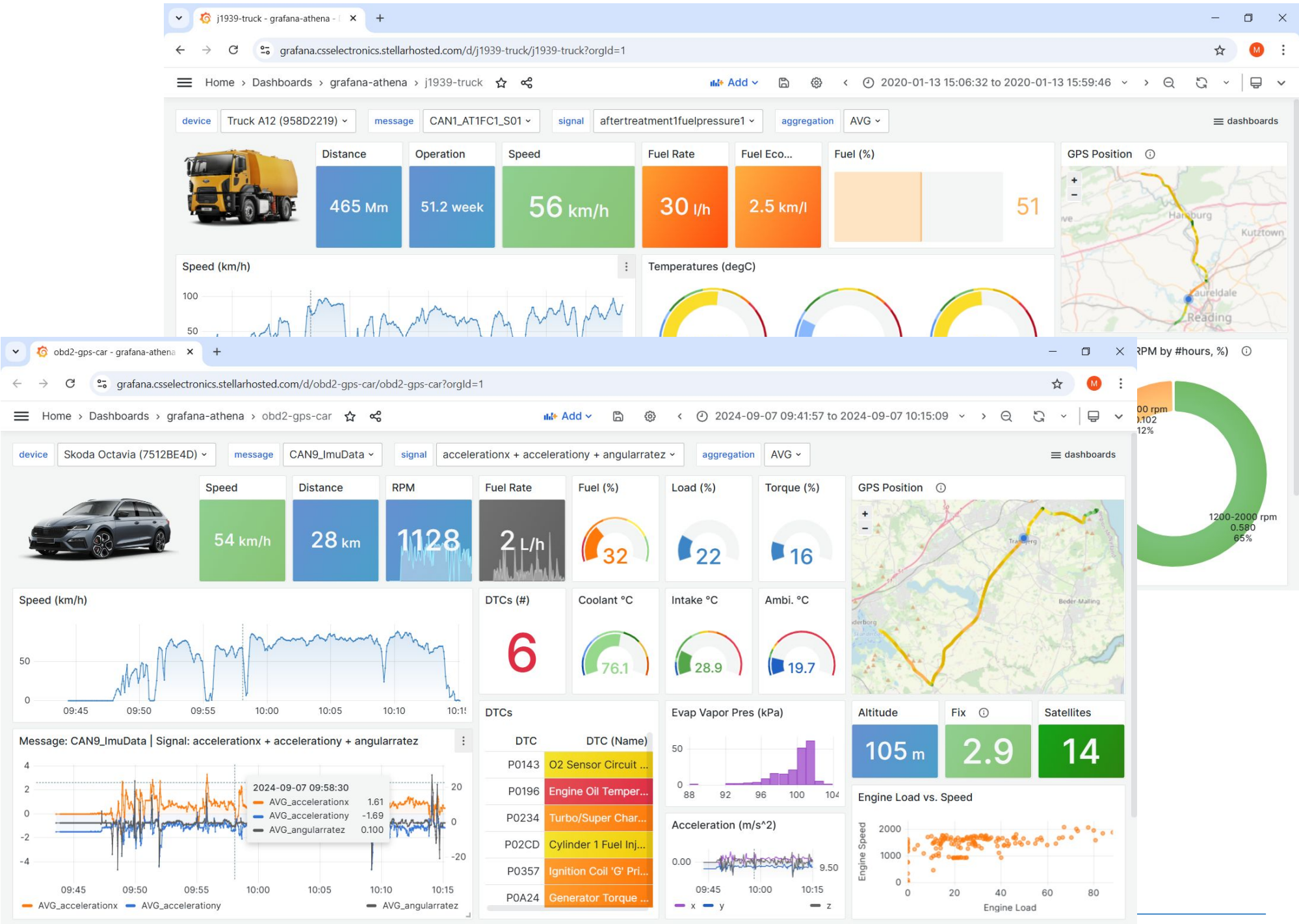
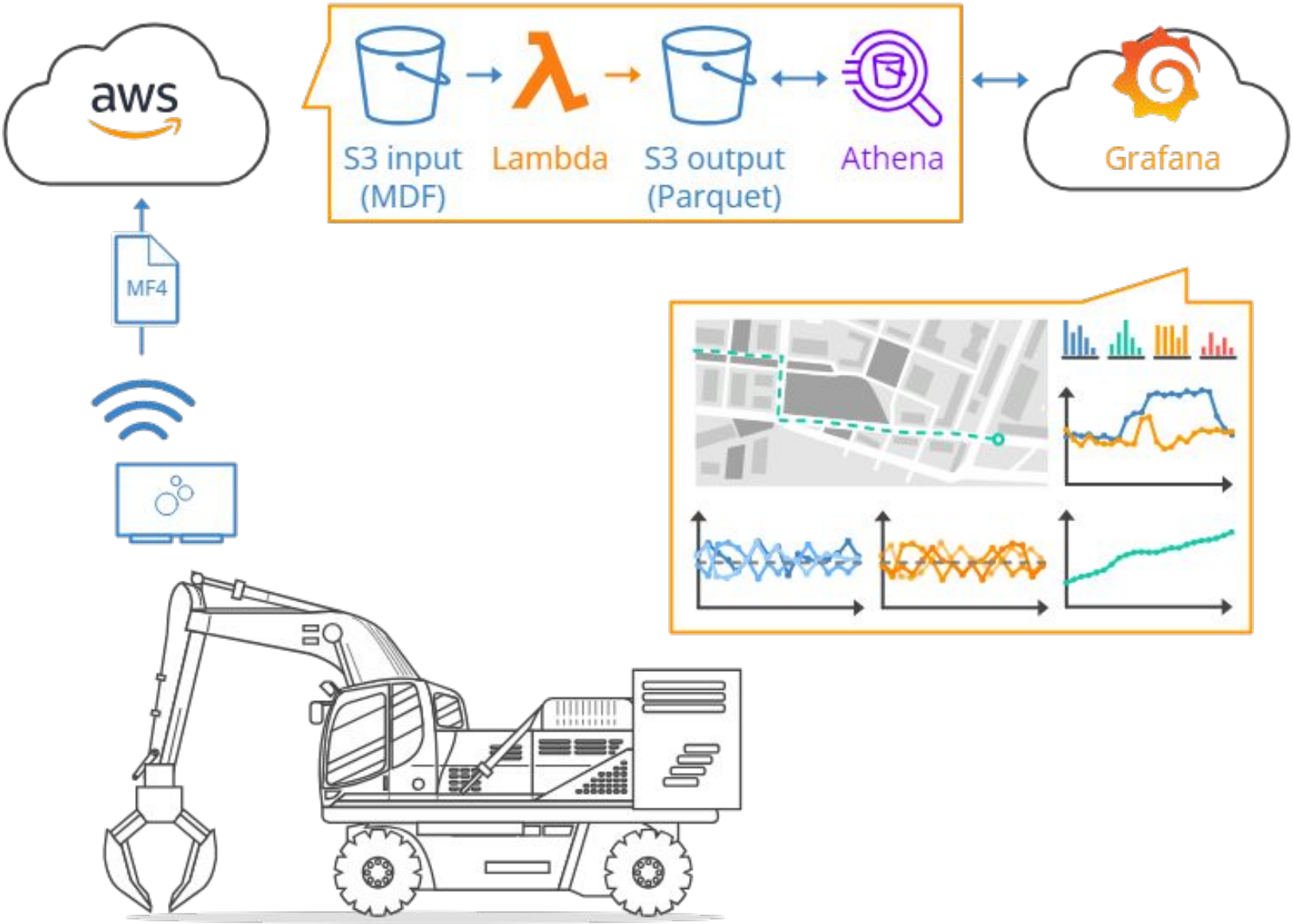


Data processing
& visualization

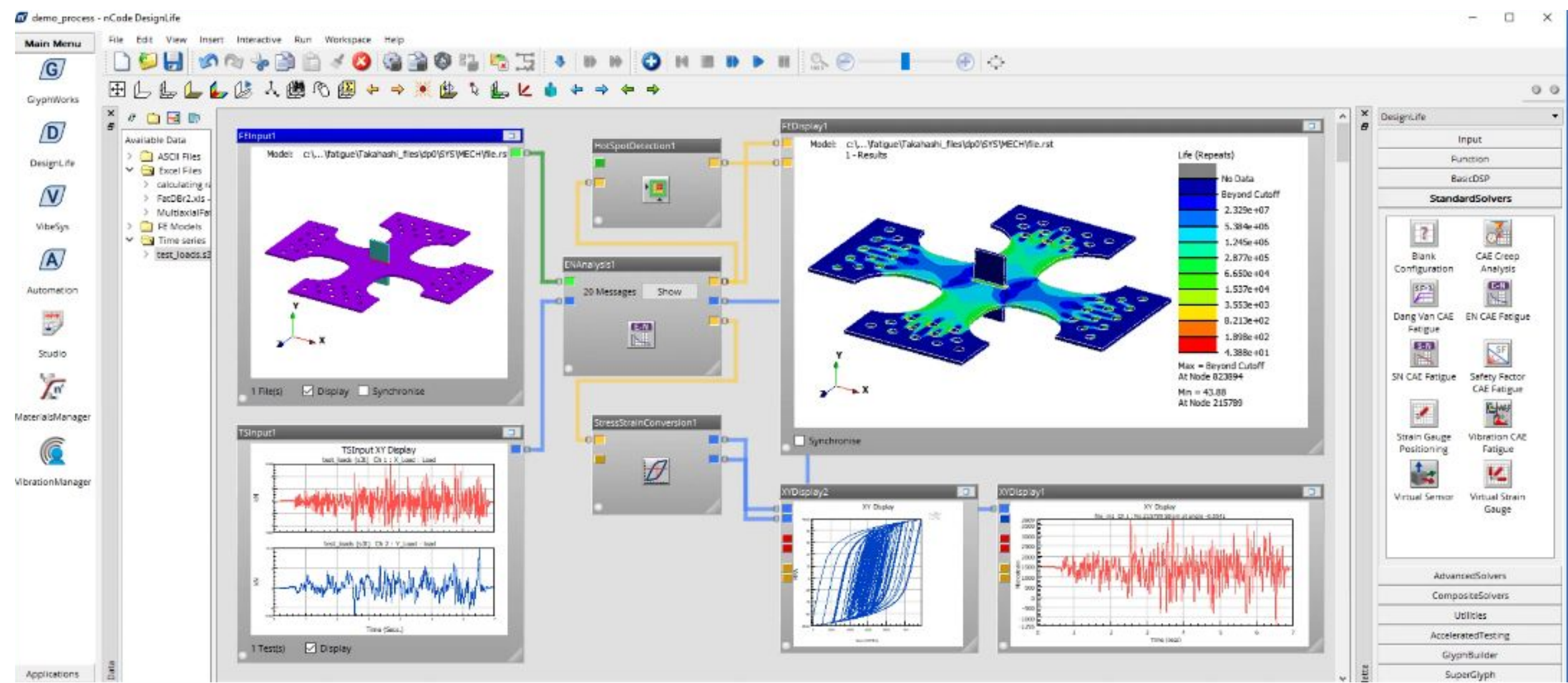
data can e.g. be integrated with FOSS GUIs ...



... or automated dashboard visualization

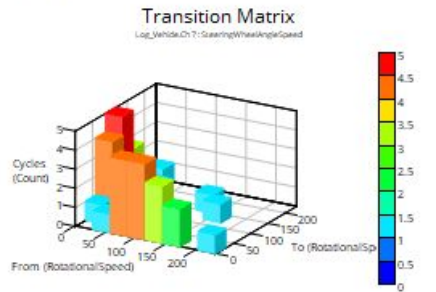
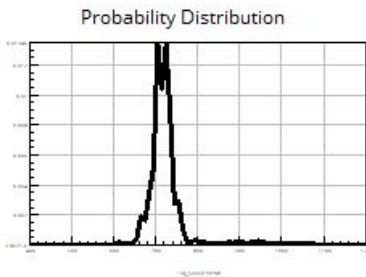
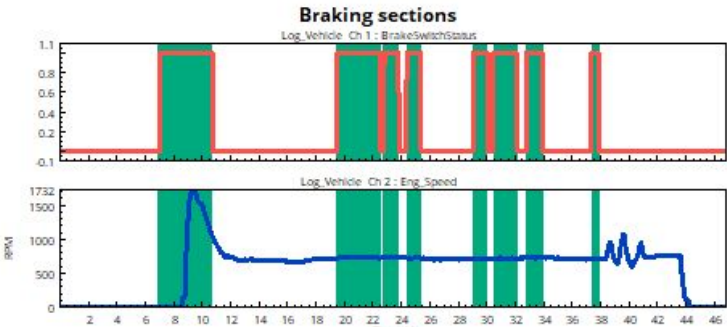
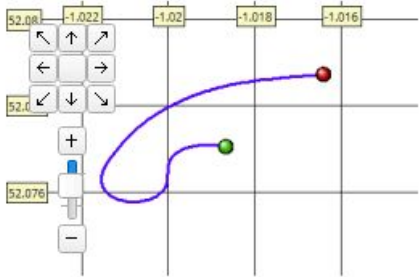


data can also be easily loaded in HBK tools

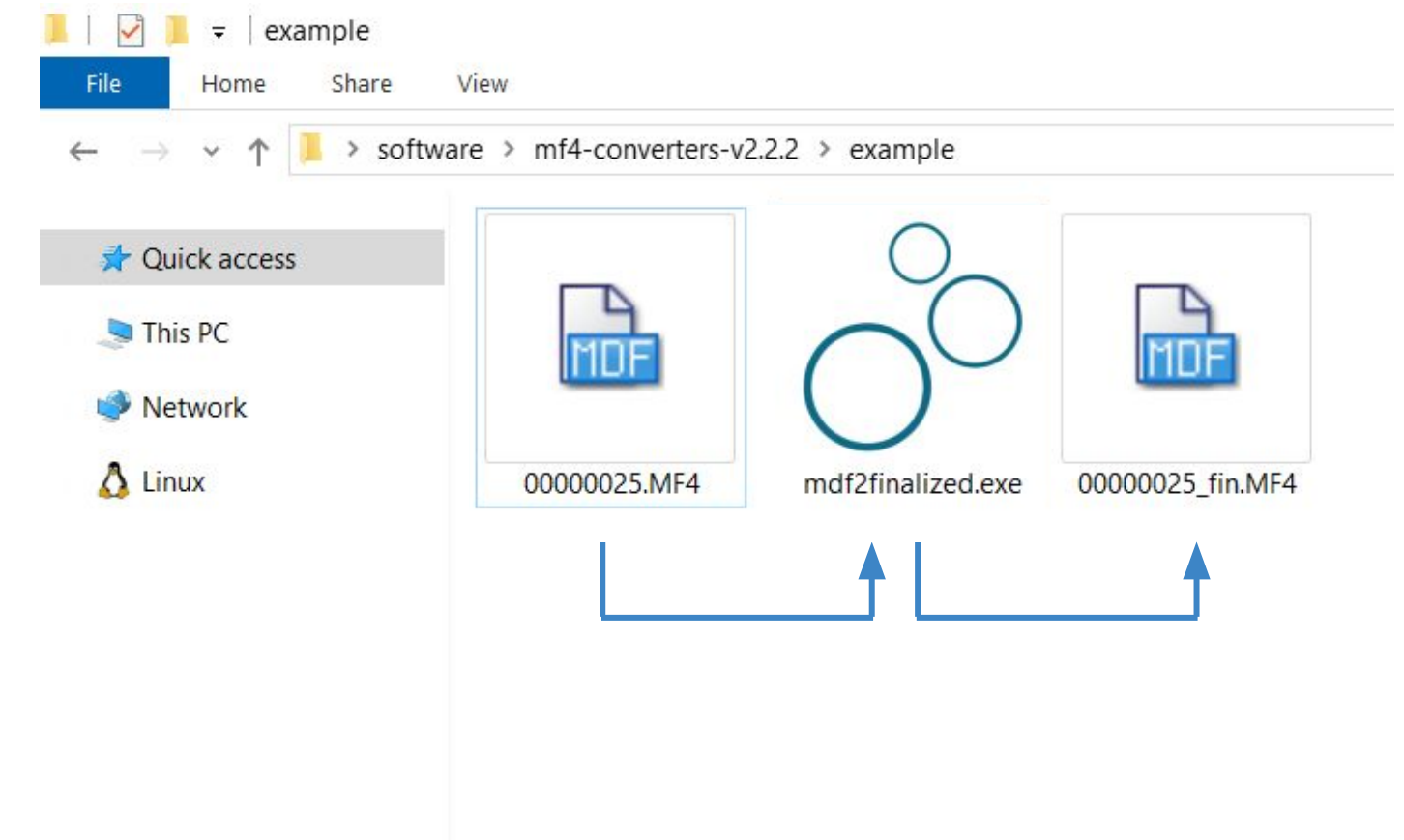
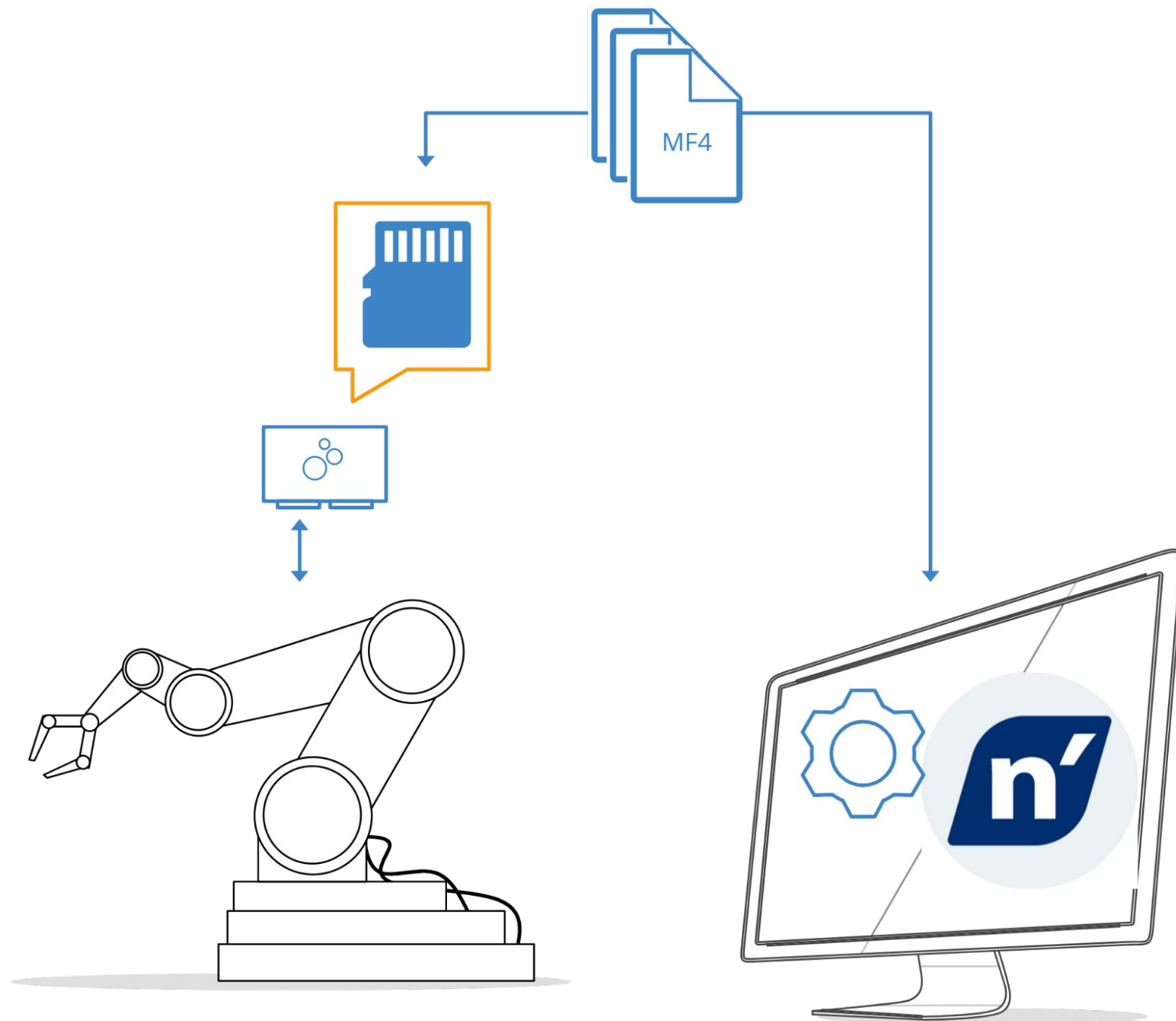


Analysis of CAN data

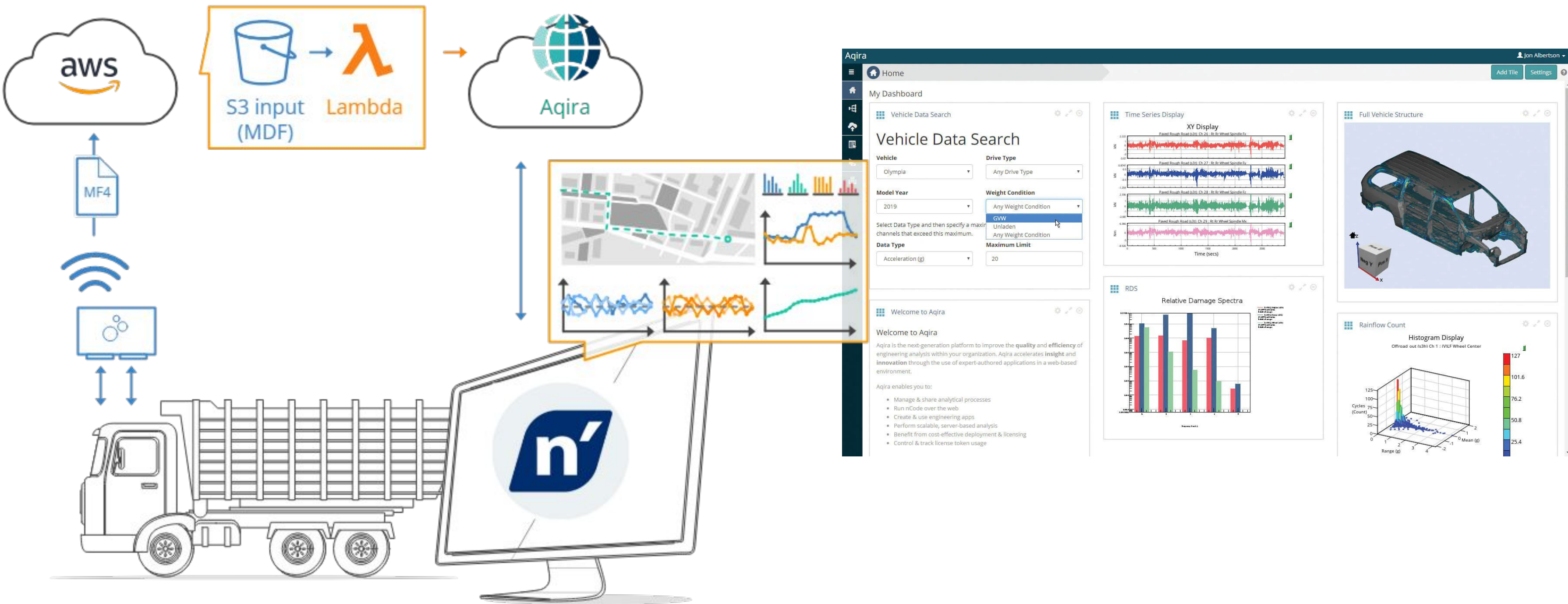
Trip duration : 47 s
Distance driven : 0.4 km
Number of brake events : 8
Maximum brake duration : 2.6 s
Minimum brake duration : 0.5 s



example 1: Load raw finalized data in nCode



example 2: Automate integration with Aqira



example 3: eBike telematics with nCode

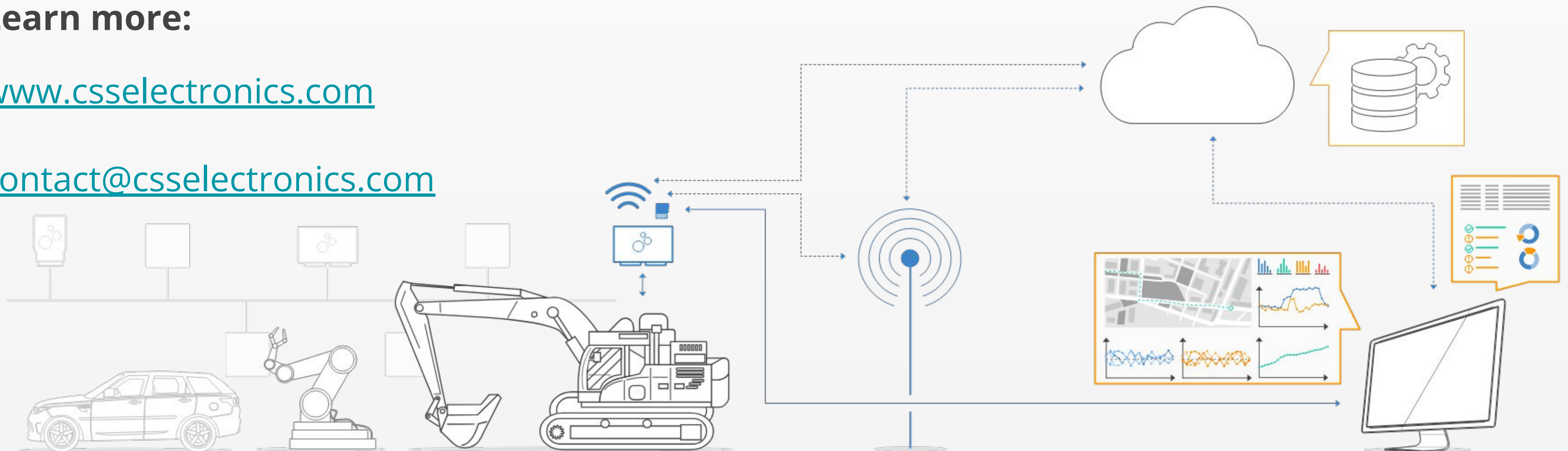


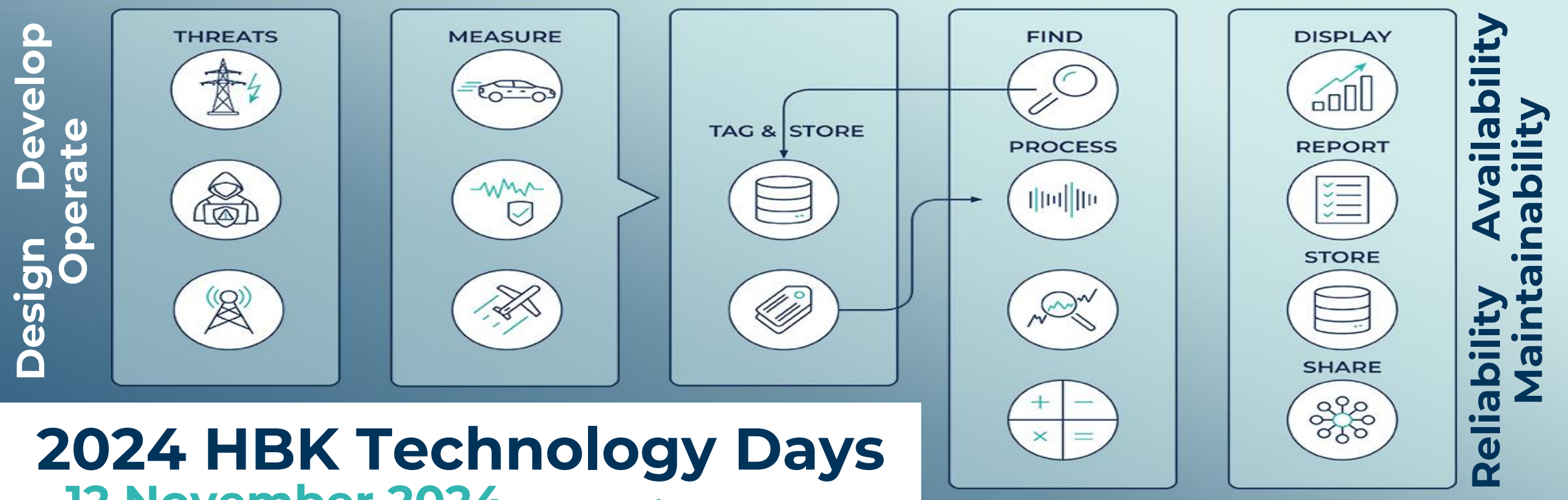
questions & answers

Learn more:

www.csselectronics.com

contact@csselectronics.com





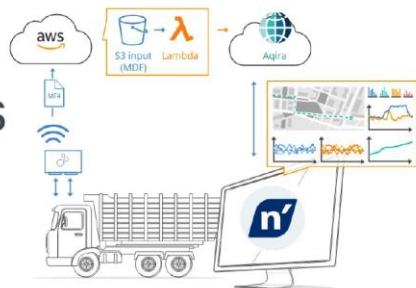
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