Integrate VSS with Automotive Systems:
Aligning Data Collection with Business Requirements

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Technical Aspects of Data Collection

1. Signal Definition
   a. Source
   b. Name
   c. Conversion
2. Self Awareness
   a. Knowledge of what signals a vehicle can supply
   b. How are after-manufacture changes handled?
3. Transmission
   a. Bandwidth efficiency (G4/G5)
   b. Interruptions (spooling, priority)
4. Data Acquisition Plan
   a. Which signals
   b. When to collect
   c. What data to send
   d. What local processing to do

Dynamic and Efficient Data Aquisition

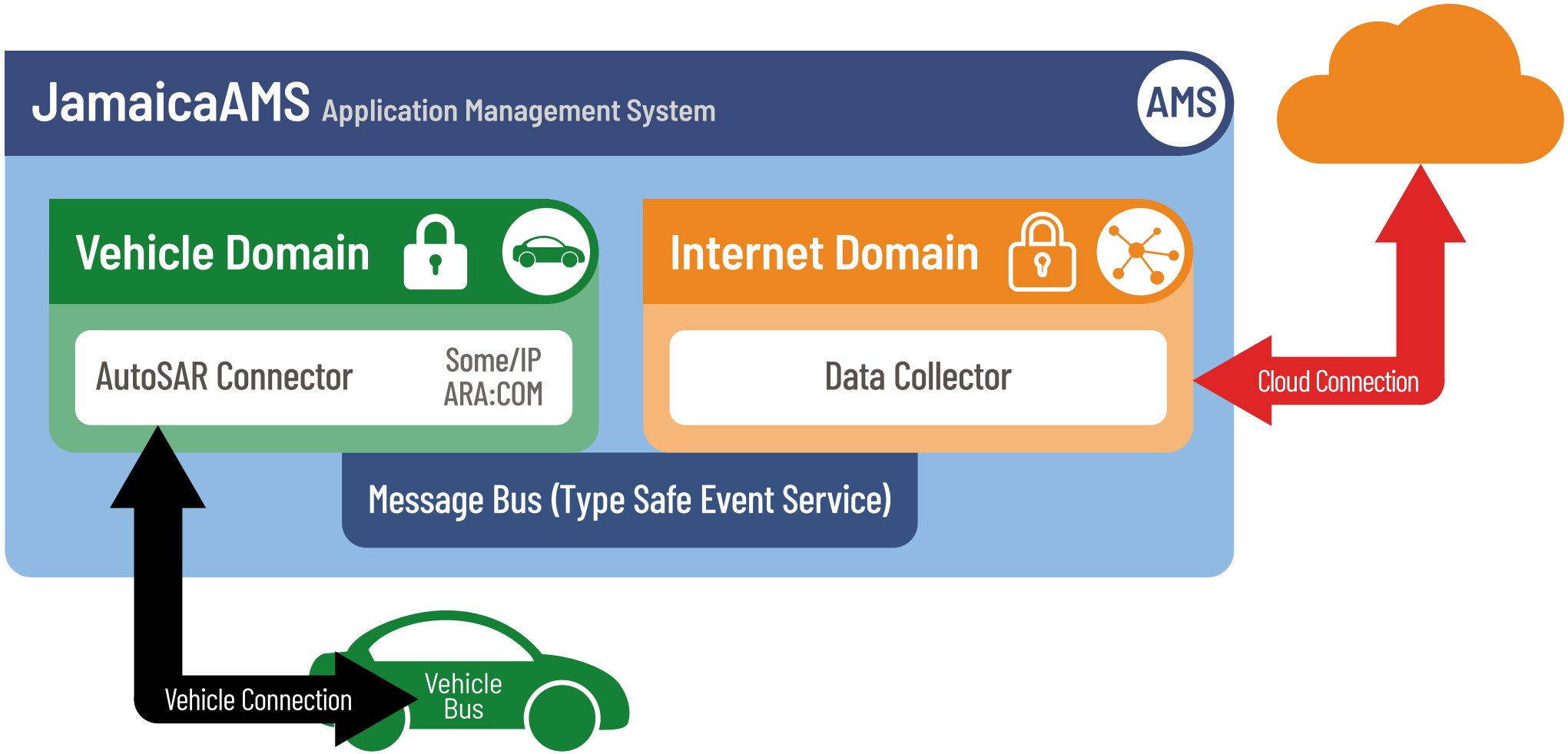
Why Does Data Aquisition Need to be Dynamically Determined?

1. Data experts need to make data acquisition decisions, not programmers.
2. Support diverse data requirements should be supported
   a. Conditional delivery
   b. Signal Synthesis
   c. Form conversion
   d. Model-based transmission
3. DCS (Data Collection Scheme) is just the start,

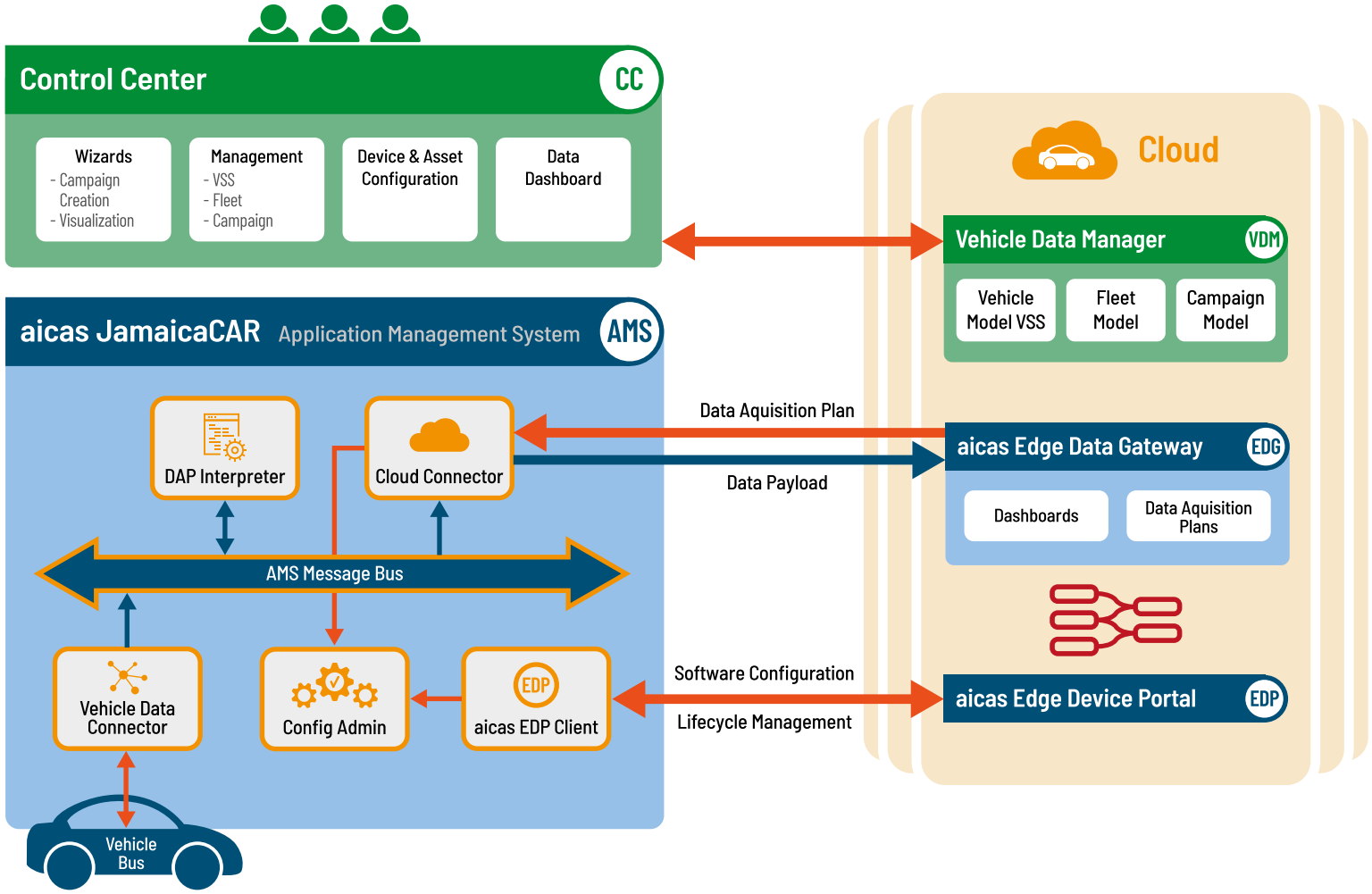
Vehicle to cloud must deal with limited bandwidth

1. VISS is fine for intracloud communication, but rather verbose for vehicle to cloud communication.
2. AWS Fleetwise compresses data using ProtoBuf and generated IDs.
3. Predefined signal IDs would help.

Vehicle Data Collection Architecture



Data Collection Architecture in Vehicle



Data Acquisition Plan Examples

W/O CODING

Tailored Data Acquisition Plans

- Collect all required data; no more, no less.
- Graphically editable.
- Safe and secure update.

SIMULATE

Rapid Turnaround

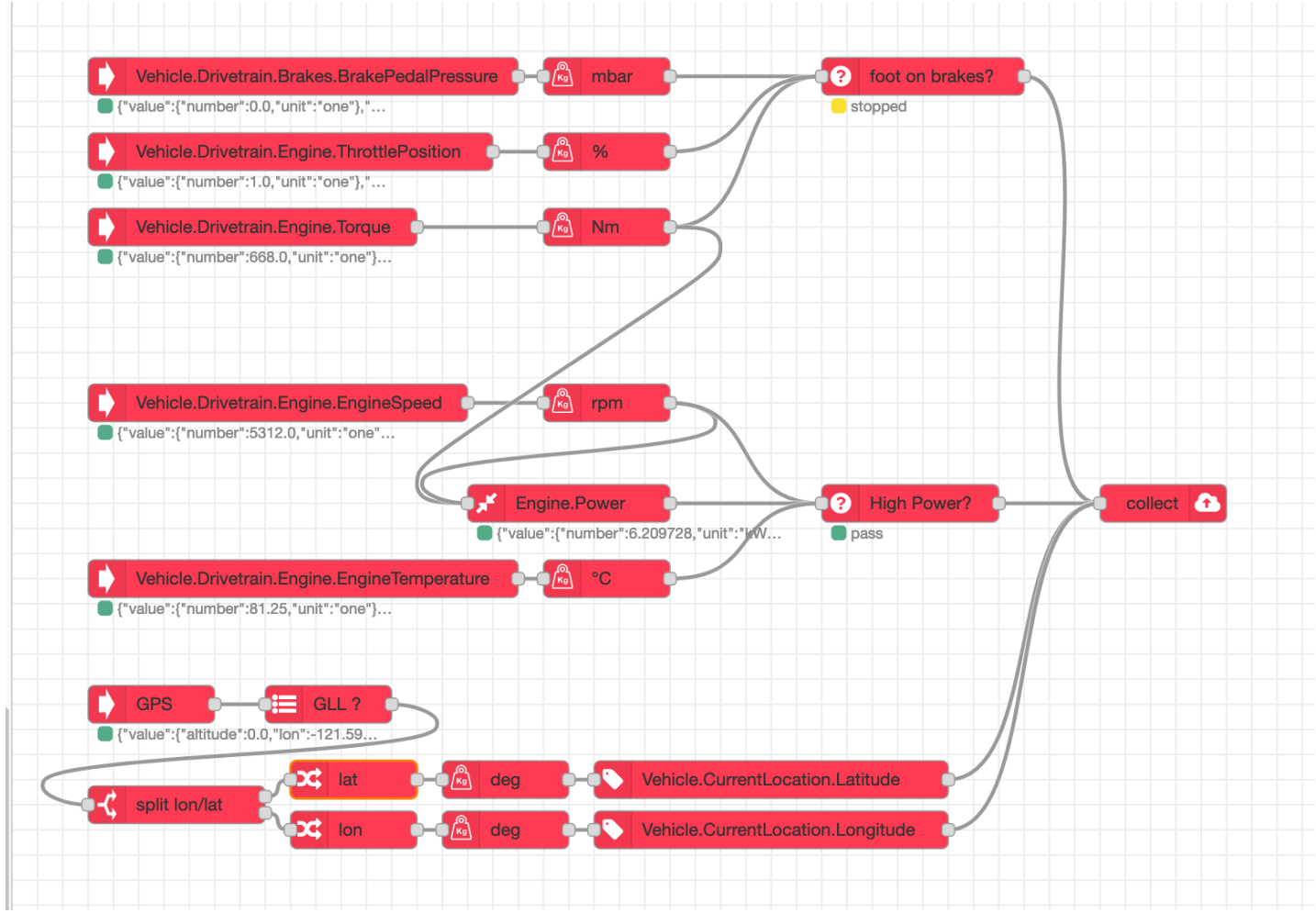
- Off-board testing.
- Same tools for data generation.
- Generate VSS defined signals.

Data Acquisition Plan Examples

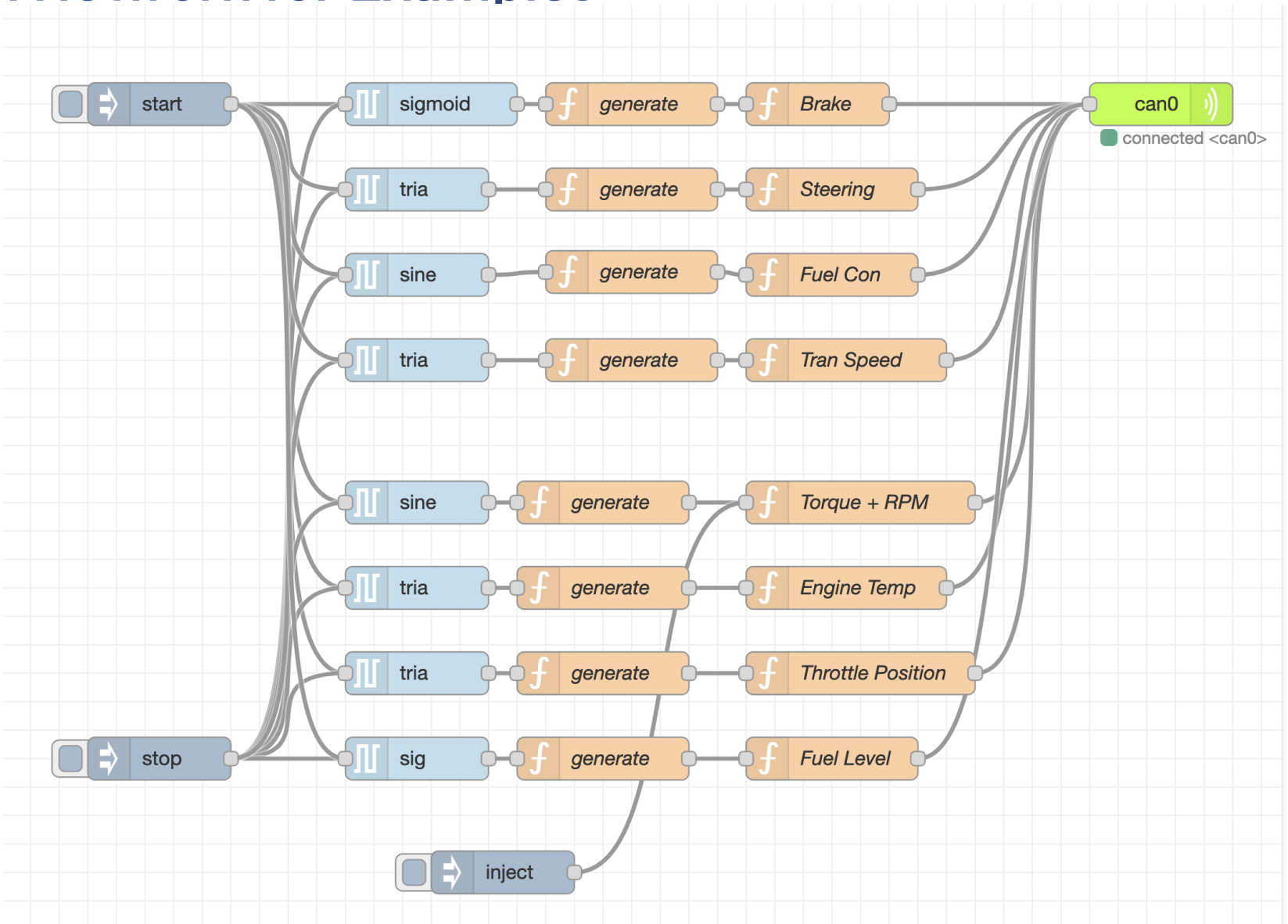
1. **Conditional**
   Pressure on
   Brake & Throttle

2. **Synthesis**
   Power from
   RPMs & Torque

3. **Conversion**
   Device binary or
   text data stream
   to VSS signal



Simulation Network for Examples



Vehicle Signal Specification SWOT Analysis

Strengths

- Single language for sensors & actuators
- Open Standard
- Logically structured
- Extendable

Weaknesses

- Lacks rigorous definition (DDT)
- No distinction between definition and use
- Overlay concept lacks structure
- Units of measurement not well handled

Opportunities

- Open standard for defining signals & actuators
- Promotes interoperability of tools & services
- VISS for enterprise communication

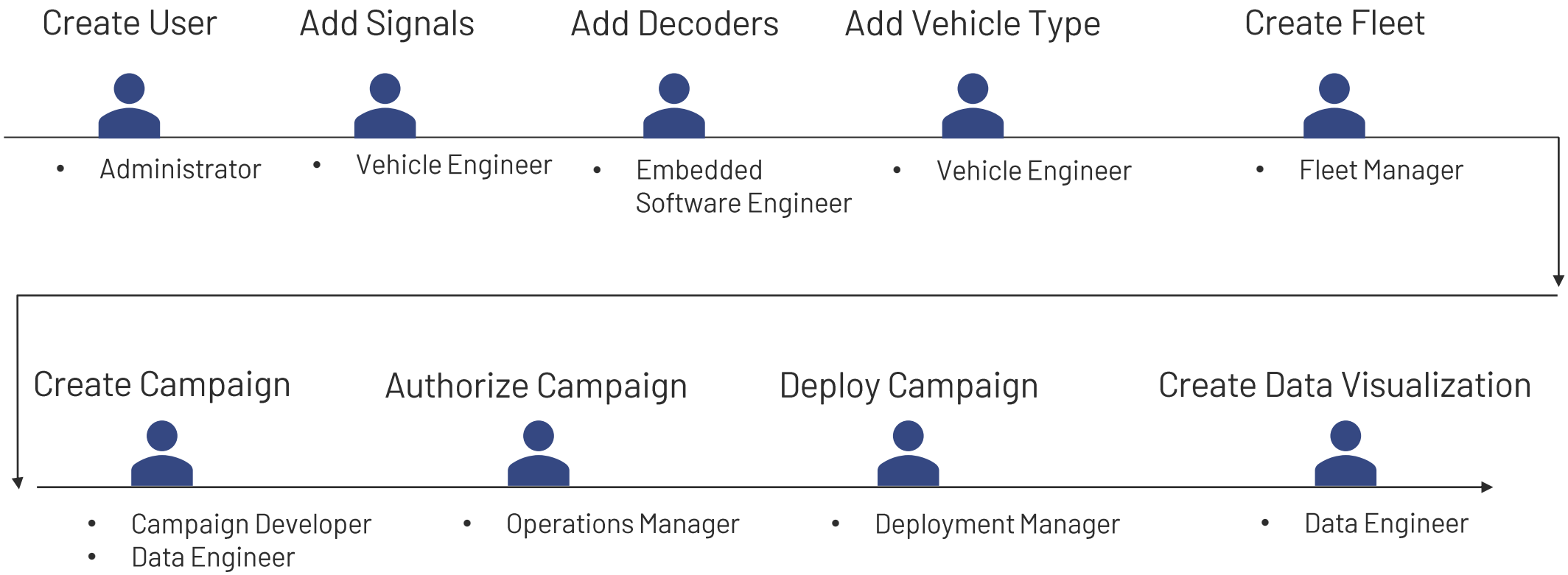
Threats

- Overreach: "have hammer, everything is a nail"
- Reduce Data collection to retrieving signal values
- Forcing data communication into a single form

Business Aspects of Data Collection

1. Data Collection and Analysis Roles
   a. Quality and maintenance analysis
   b. Vehicle service
   c. Value creation
   d. External consumers
2. Data Management
   a. Data persistence
   b. Digital Twins
3. Data Privacy
   a. Track what data may be collected
   b. Track who has the right to see what data,e.g. prevent data leakage
   c. Manage data aggregation to prevent idenity leakage
   d. When can data be released

Role-Based Access UI



Validation and Approval Staging Example

Data Acquisition Plan Deployment Process

Initial Development

- Select signals
- Design Preprocessing
- Test functionality with simulated data

Integration Test

- Test with simulated data
- Integrate with other data collection plans
- Check performance

Deployment Test

- Test with real-world data
- Check performance
- Test usefulness

Who needs Data Collection? Example Roles and Permissions

Acquisition Element	Create	Read	Use	Authorize	Update	Delete
Vehicle connector	ESW Eng	ESW Eng SW Eng	ESW Eng SW Eng	QA	ESW Eng	ESW Eng Ops Mgr
Enterprise VSS catalog	Vehicle Mgr	Vehicle Mgr SW Eng	Vehicle Mgr SW Eng	QA	Vehicle Mgr	Ops Mgr
DB Schema	IT Eng	IT Eng SW Eng	IT Eng SW Eng	QA	IT Eng	Ops Mgr
Vehicle Data	Vehicle Eng	Vehicle Eng Data User	Vehicle Eng Data User	Vehicle Mgr	Vehicle Eng	Vehicle Mgr Ops Mgr
Vehicle Definition (VSS)	Vehicle Eng	Vehicle Eng Data User	Vehicle Eng Data User	Vehicle Mgr	Vehicle Eng	Vehicle Mgr
Fleet	Fleet Mgr	Fleet Mgr Data User	Fleet Mgr	Deploy Mgr	Fleet Mgr	Fleet Mgr
Data Acquisition Plan	Data User	Data User	Data User	Deploy Mgr	Data User	Data User
Campaign	Data User	Data User	Data User	Ops Mgr	Data User	Data User
Visualization Template	UI Design	UI Design Data User	UI Design Data User	Data Mgr	UI Design	UI Design

Summary

1. VSS is a great contribution to interoperability for automotive data collection
2. Vehicles should be self-aware (maintain their own VSS description)
3. More work needs to be done to formalize the semantics (DDL)
4. VISS is fine for cloud communication but rather verbose
5. A better protocol for vehicle to cloud would be helpful
6. A flexible means of selecting, preprocessing, and sending data is needed
7. Rolls, responsibilities, and data protection for data collection is a whole other ballgame

Simplify Edge-to-Cloud

aicas. embedded. connected.

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