SDV
Eclipse Software Defined Vehicle

Freya – a companion to Eclipse Ibeji (and other Digital Twins)

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Freya

The project takes its name from the Old Norse goddess Freyja. This name was chosen because she is a twin (her brother's name is Freyr) and is associated with seiðr, which is magic for seeing and influencing the future. She is also commonly associated with fertility and gold, and rules over the heavenly field of Fólkvangr. She has a necklace called Brísingamen, a cloak of falcon feathers, a boar named Hildisvíni, and rides a chariot pulled by two cats.

Johannes Gehrts/Eduard Ade (Public Domain)*

*https://www.worldhistory.org/trans/pt/1-16806/freia/

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Why

- The Software-Defined Vehicle will need to connect to the cloud for scenarios such as data synchronization, command processing, and analytics. However, this is a hard problem when different vehicles with different in-vehicle digital twin models need to synchronize on a common "canonical model" in the cloud.

- Freyja, a new capability, aims to solve this problem by creating a flexible framework for synchronization between the in-vehicle digital twin state (the "instance digital twin") and the digital twin state in the cloud (the "canonical digital twin")

Architecture

- ❑ **Cartographer - core component responsible for managing the digital twin mapping.**
- ▪ Poll the mapping client for updates.
- ▪ If there is an update pending, the cartographer will download it and update the application's stored mapping info

- ❑ **Emitter - core component responsible for emitting data.**
- ▪ Supports intervals at a per-signal level to enable signals to have different requirements on how often they are synced with the cloud.
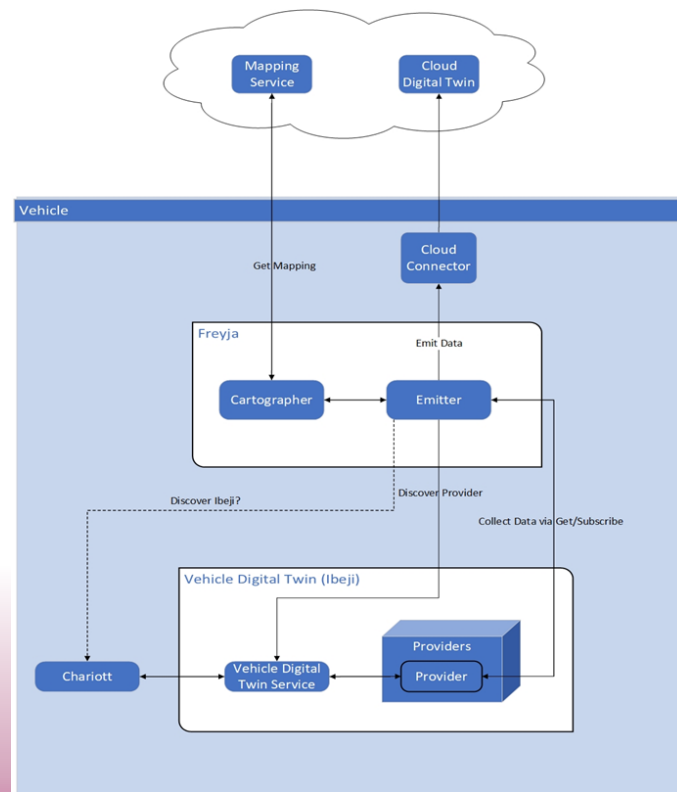
Architecture

❑ **External Interfaces**

| Component	Examples	Interface Trait	Description
In-Vehicle Digital Twin	Ibeji and its providers	DigitalTwinAdapter	Communicates with the in-vehicle digital twin to get signal values during emission. Often referred to as "DT Adapter"
Mapping Service	MockMappingService, other customer-provided implementations	MappingClient	Communicates with the mapping service
Cloud Digital Twin	Cloud Agnostic Digital Twin, Azure, Aws, etc	CloudAdapter	Communicates with the cloud digital twin provider
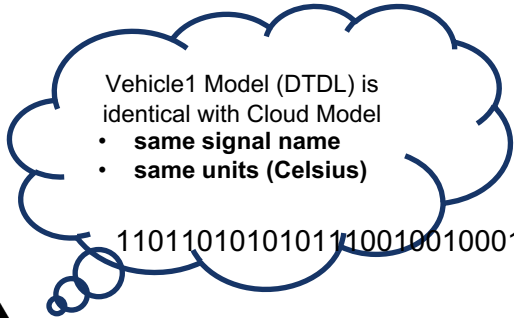
Vehicle1 Model (DTDL) is identical with Cloud Model
- **same signal name**
- **same units (Celsius)**

110110101010111001001000100001100
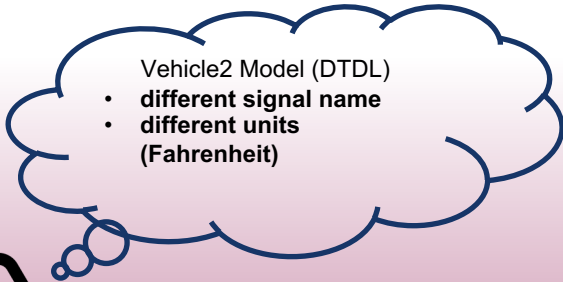
Vehicle1

Vehicle2 Model (DTDL)
- **different signal name**
- **different units (Fahrenheit)**

110110101010111001001000100001100

Vehicle2

Cloud Digital Twin

Model Information

```
{
 "@context": [
  "dtmi:dtdl:context;2"
 ],
 "@type": "Interface",
 "@id": "dtmi:sdv:Cloud:Vehicle:Cabin:HVAC;1",
 "description": "Heat, Ventilation and Air Conditioning",
 "contents": [
  {
   "@type": [
    "Property",
    "Temperature"
   ],
   "@id": "dtmi:sdv:Cloud:Vehicle:Cabin:HVAC:AmbientAirTemperature;1",
   "name": "AmbientAirTemperature",
   "description": "The immediate surroundings air temperature (in Celsius).", ,
   "schema": "double",
   "unit": "degreeCelsius"
  },
  {
   "@type": "Property",
   "@id": "dtmi:sdv:Cloud:Vehicle:Cabin:HVAC:IsAirConditioningActive;1",
   "name": "IsAirConditioningActive",
   "description": "Is air conditioning active?",
   "schema": "boolean"
  }
 ]
}
```

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Key Takeways

❏ Eclipse Ibeji aims to provide the capability to express a digital representation of the vehicle state and its capabilities through an extensible, open and dynamic architecture that provides access to the vehicle hardware, sensors and capabilities.

❏ Ibeji's architecture has an In-Vehicle Digital Twin Service at its core. The In-Vehicle Digital Twin Service captures all of the vehicle's primary capabilities and makes them available to Ibeji consumers. A provider exposes a subset of the vehicle's primary capabilities by registering them with the In-Vehicle Digital Twin Service

❏ Freyja aims to solve the hard problem of digital twin synchronization by providing a flexible framework for synchronization between the digital twin state on the vehicle (the "instance digital twin") and the digital twin state in the cloud (the "canonical digital twin")

❏ Although demonstrated with Ibeji, Freyja can be used with any in-vehicle and cloud digital twin.

❏ DTDL properties can be based on COVESA VSS for syntax and catalog of vehicle signals.

❏ Support for multiple communication protocols like Eclipse uProtocol in on the roadmap.

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THANK YOU!