C-ROADS

CAETANOBUS PILOT IN THE URBAN NODE OF PORTO

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Co-financed by the European Union
Connecting Europe Facility

Agenda

- Goals
- C-ITS Services
- System Overview
- Entities
- Arquitecture
- Functional Design
- Data Exchange

Goals

The project has the following goals:

- Implementation and Development of a set of services called **C-ITS** services Day1 and C-ITS Day 1,5;
- A **Demonstration** in Oporto road network where were identified the following entities for the demonstration:
    1. The **Vehicle** who will circulate;
    2. The **Infrastructure Manager** of Oporto road network;
    3. In adition will be possible to demonstrate in the **Transport Operator** of the city, who will be able to monitorize the vehicle;

C-ITS Services (Day 1 and Day 1,5)

Day 1

- Traffic jam ahead warning
- Road works warning
- Weather conditions
- In-vehicle signage
- In-vehicle speed limits
- Probe vehicle data
- Shockwave damping
- Traffic signal priority for designated vehicles

Day 1,5

- Connected & Cooperative navigation into and out of the city (1st and last mile, parking, route advice, coordinated traffic lights)
- Traffic information & Smart routing

System Overview

Implementation of an ITS solution who allows the integration V2I and I2V from a **bus** with the **infraestructure** for data exchange and shared services.

Levels of Integration:

1. Services for data transfer;
2. Infrastructure to vehicle (I2V) services in real time;
3. Vehicle to Infraestructure (V2I) services in real time;

System Overview
Scenario 1

Collect of operational data from the vehicle and comunication with the **Transport Operator.**

- Monitoring of the vehicle.

  Information from the vehicle to the Transport Operator (posicioning, malfunctions, battery level, …)

- Information to the vehicle

  Route suggestions, estimated travel times, incidents;

System Overview
Scenario 2

Unidirecional comunication between the infrastructure and the vehicle in real time.

Informative

- Alert stoped vehicles or slow vehicles;
- Alert for traffic congestions, road works or extreme weather conditions;
- Signage in vehicle;
- Cooperative navigation and coordinated to enter / leave the city;

Acting

- Speed limit changes;
- Shockwave damping;

System Overview
Scenario 3

Unidirecional comunication between the vehicle and the infrastructure in real time.:

- Traffic signal priority for designated vehicles

Entities

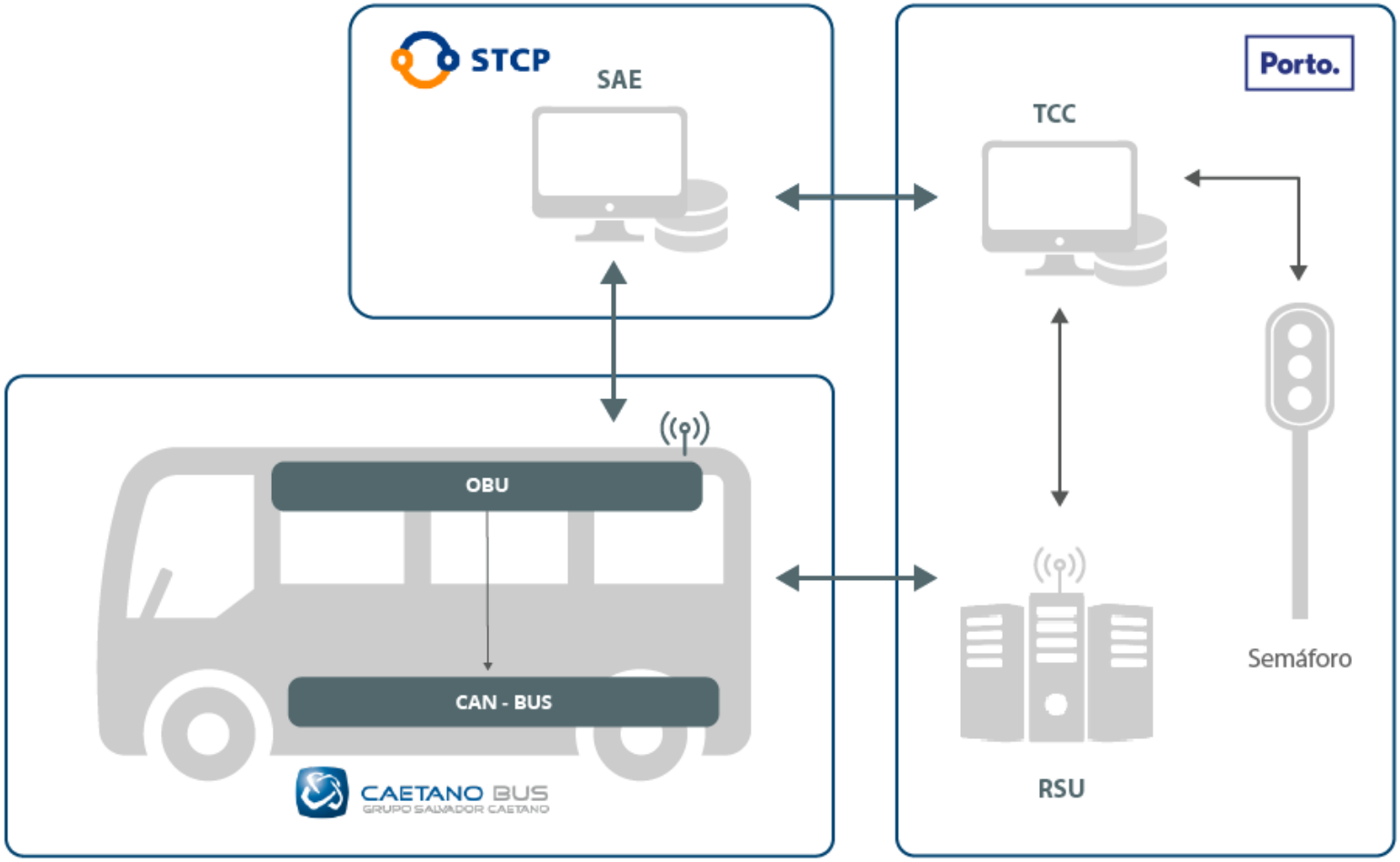
Implementation Phase

- CaetanoBUS
- Armis

Demonstration Phase

- Câmara Municipal do Porto
- STCP
- DMS

Architecture



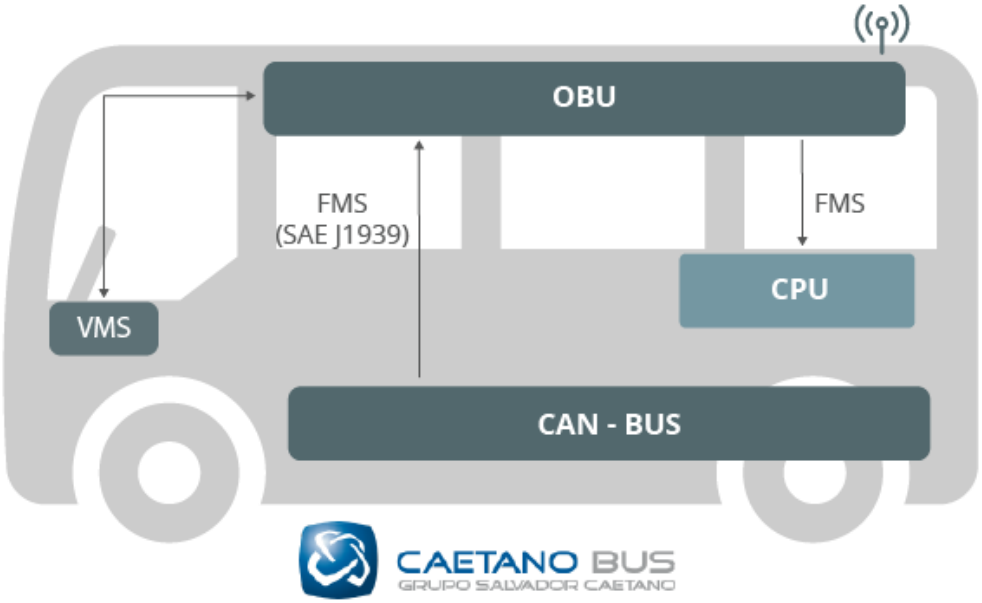
Architecture
Vehicle

CAN-BUS Chassis:

Critical CAN-BUS because its where chassis equipments are connected, associated to the mechanic and to the vehicle control. Processing Unit– **CPU,** developed by CaetanoBUS, who will manage all the information transmitted between the chassis CAN-BUS and the OBU.

Operational CAN-BUS :

CAN-BUS where are connected all the equipments used in the operation of the vehicle



Architecture

Infrasctructure and Transport Operator

Infrastruture

- **TCC** – CMP Traffic Control Center:

  Traffic monitoring, incidente management and netwok operations

- **RSU** –CMP Road-Side Unit:

  The RSU will be the access point for dedicated short distance communications.

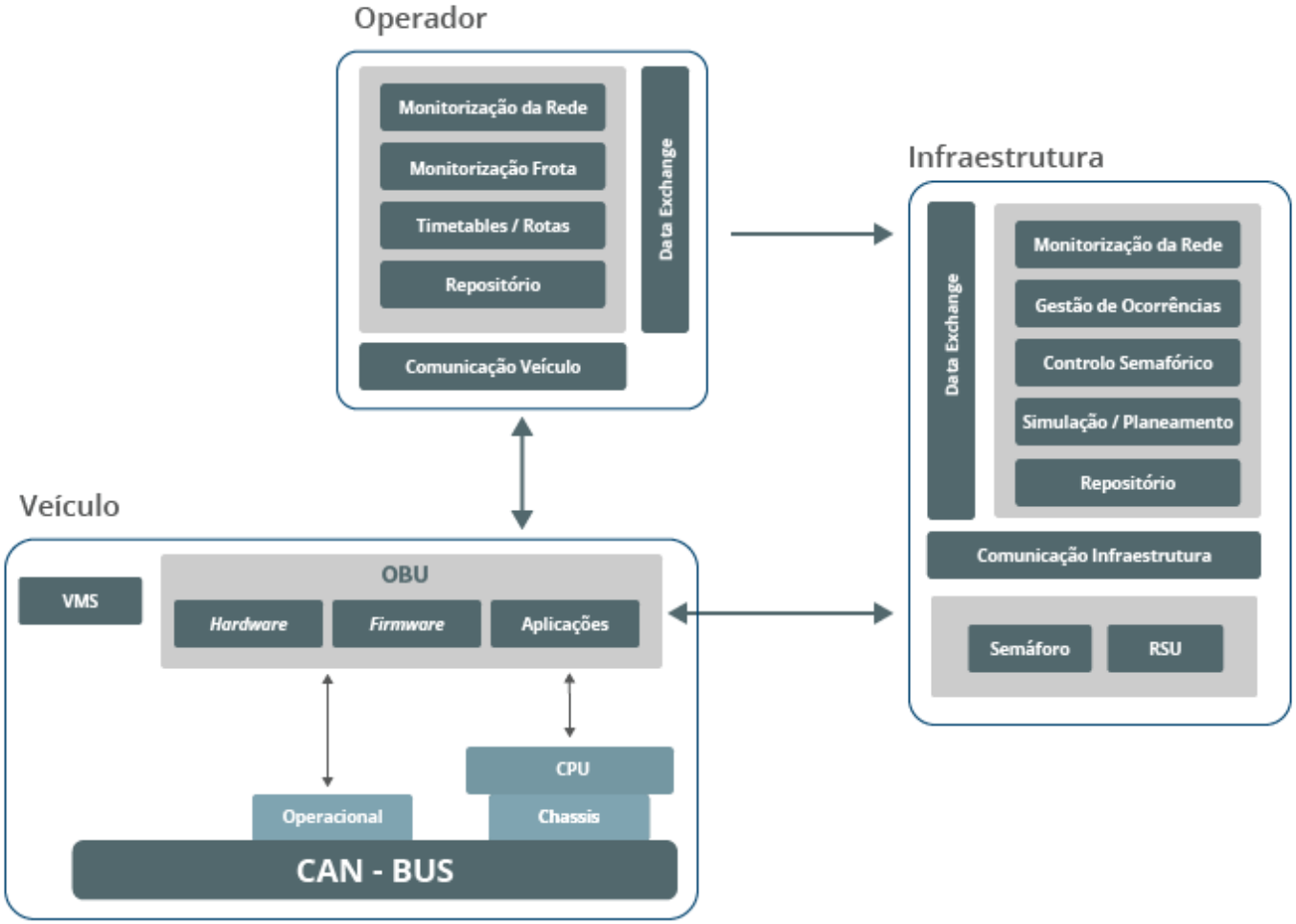
- **Traffic Light controller**

Transport Operator

- **SAE** –STCP exploitation system:

  Exploitation system who collects vehicle informattion

Functional Design



Data Exchange

All the **flux** of information is well defined acording the existing european requirements and standards.

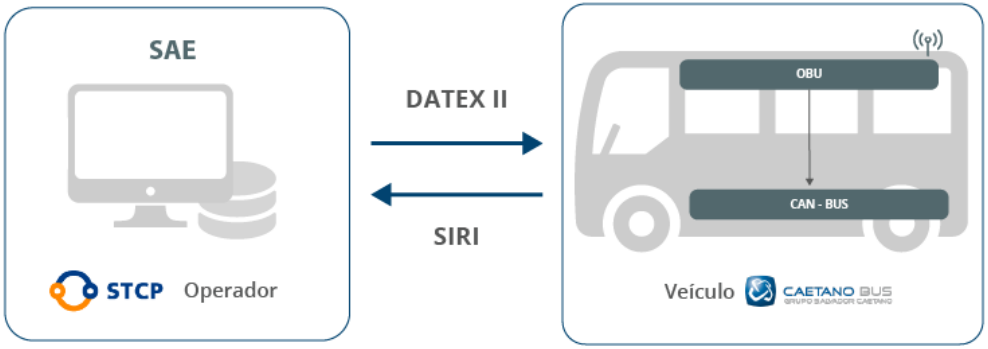
Scenário 1: Communication Vehicle – SAE

Scenário 2: Communication Infrastruture – Vehicle

Scenário 3: Communication Vehicle - Infrastruture

Data Exchange

Scenario 1 : Communication Vehicle – SAE



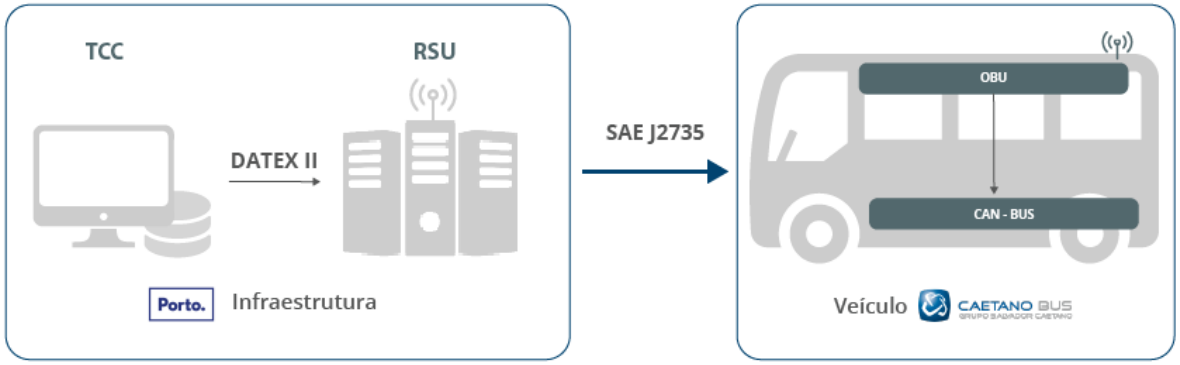
Bidiretional communication between STCP (SAE) and the OBU in the BUS:

- posicionings and state of the trip (on going, stopped, in the bus stop);
- Performance of the vehicle;
- Network incidents;
- Route suggestions
- Estimated travel times

[1]**SIRI** - standard europeu de transmissão de informação em tempo real sobre o estado das frotas e o seu desempenho

Data Exchange

Scenario 2 : Communication Infrastruture - Vehicle



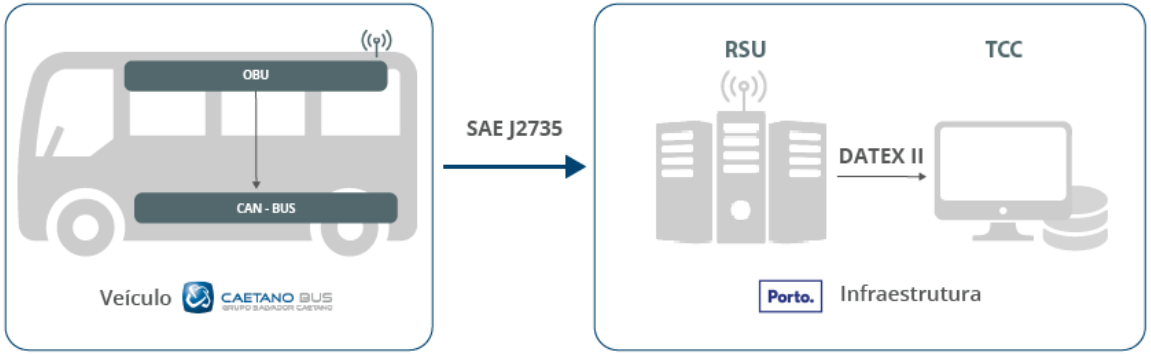
Unidiretional communication between Oporto (TCC), the RSU and the OBU in the BUS:

- Slow vehicles alert;
- Congestions, road works and meteo conditions;
- Traffic Status;
- Speed limit changes;

(1)**SAE J2735** - standard europeu que especifica as mensagens e tipos de dados em comunicações sem fios em ambientes veiculares

Data Exchange

Scenario 3 : Communication Vehicle - Infrastruture



Unidiretional communications between the OBU in the BUS, the RSU and the Oporto TCC:

- Traffic signal priority for designated vehicles

C-ROADS

THANK YOU!

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