ADA
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CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS
SRPSKA ASOCIJACIJA MENADŽERA
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Innovative transport services in smart cities

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The Challenge

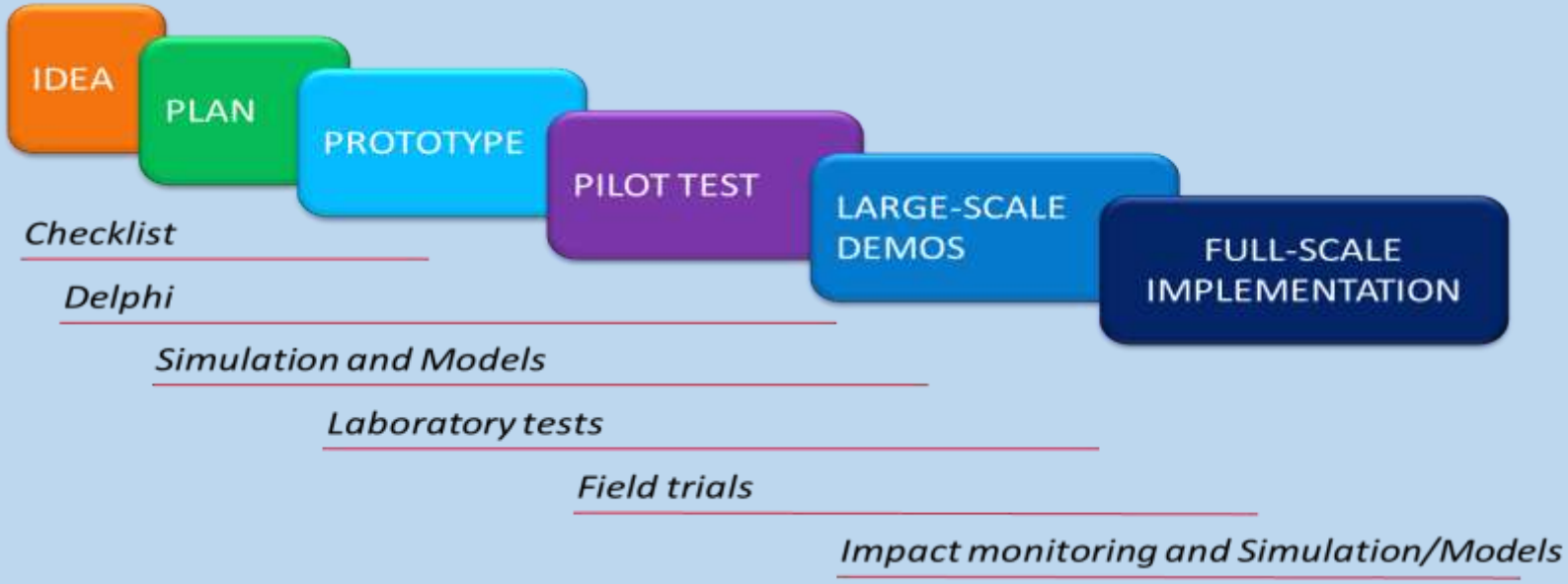
Achieve active cooperative mobility

- 1st: Smart equipment
- 2nd: Smart citizens
- 3rd: Smart authorities

What is the role of ITS?

- Provide cooperative channels and collaboration opportunities to the mobility players/actors
- Provide advanced mobility solutions
- Provide an application development platform for SMEs and web-entrepreneurs
- Coordinate the cooperative mobility eco-system
- Monitor the decision theatre
- Support decision makers
- Provide e-governance opportunities

From idea to implementation



Source: EEG TEMPO Euro-Regional Evaluation Guidelines, 2005

The EasyWay project proposes the following classification of Field Operational Tests (FOTs):

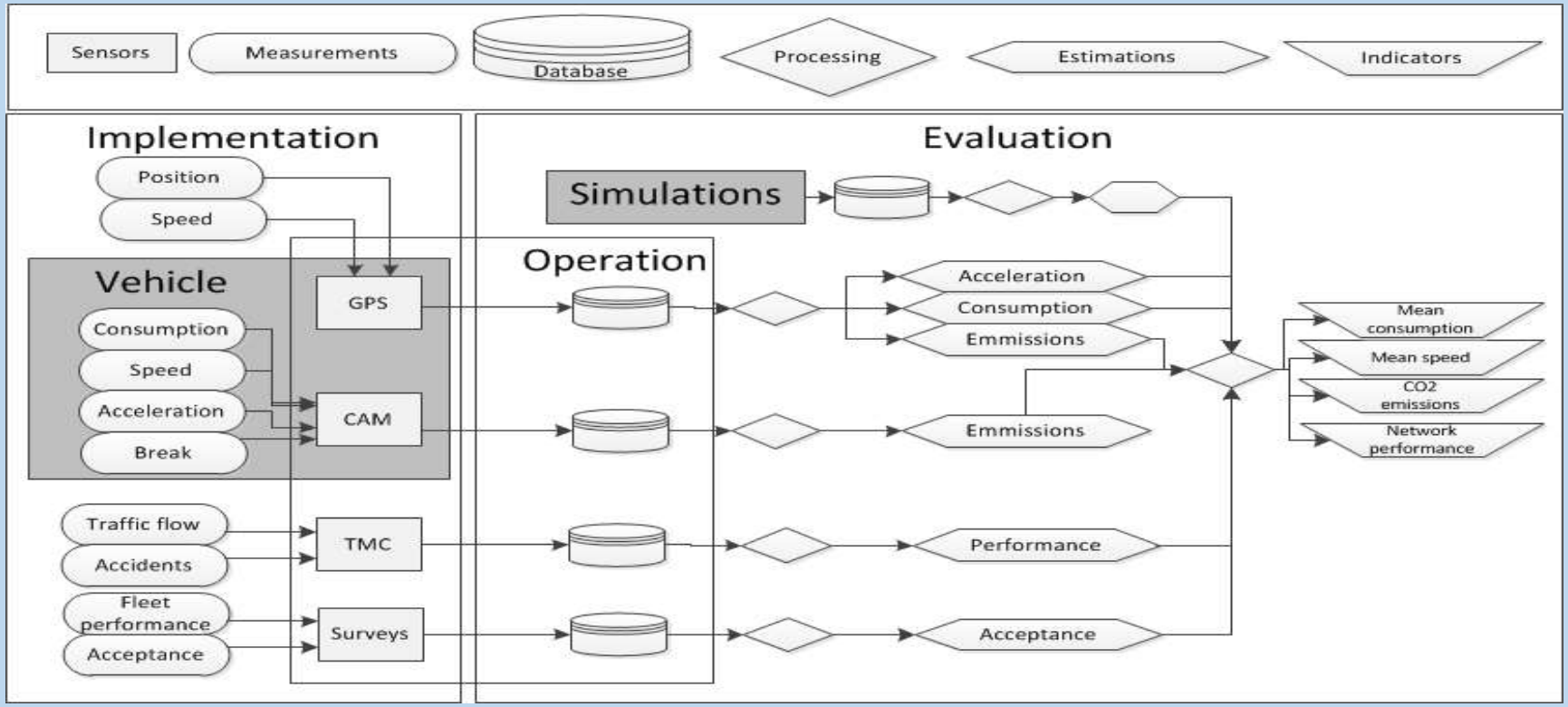
- Pilot project: **technical focus** on meeting the specifications on a wide area
- Implementation project: evaluation of **socio-economic impacts** of the proposed solution
- Demonstration project: focus on **scalability** combining the above two categories

Evaluation of C-ITS

Why Evaluate C-ITS?

- Understand the impacts
- Quantify the benefits
- Help make future investment decisions
- Optimize existing system operation and design

Evaluation of C-ITS

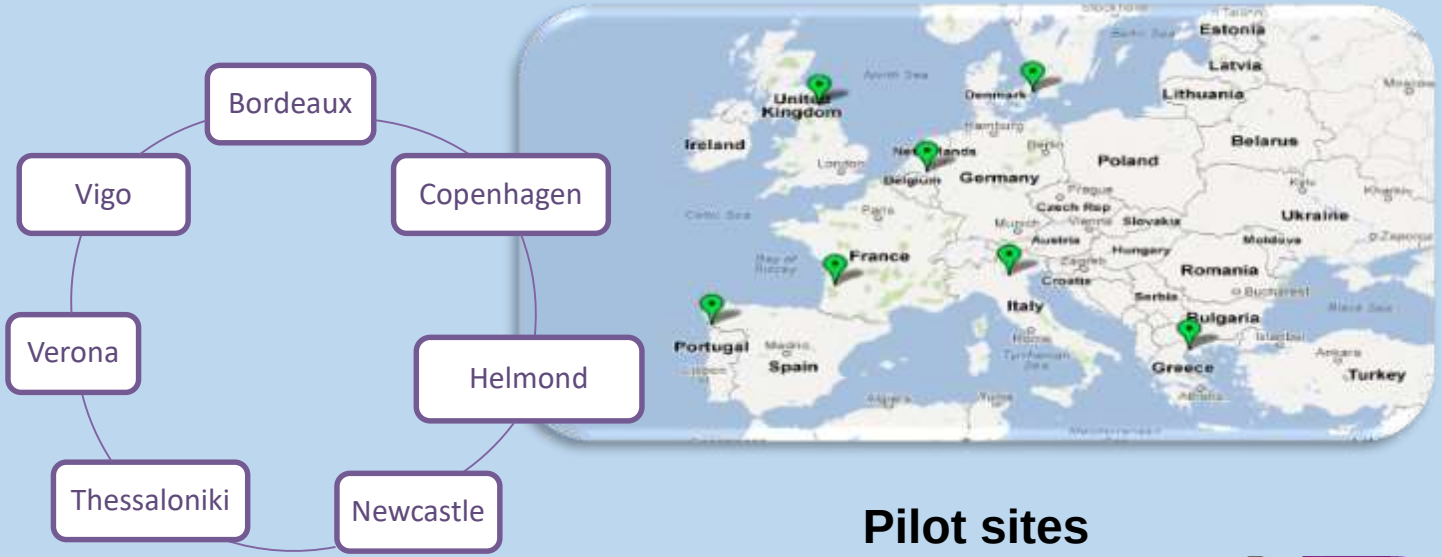


C-ITS in Thessaloniki

- **COMPASS4D**: cooperative services for passenger transport
- **COGISTICS**: cooperative services for freight transport
- **SAFER-LC**: multimodal cooperative safety services at level crossings
- **C-MOBILE**: large scale deployment of C-ITS in complex urban areas
- **GALILEO FOR MOBILITY**: implementation of a MaaS ride sharing service

COMPASS4D

- **Co**operative **M**obility **P**ilot on S**a**fety **a**nd **S**ustainability **S**ervices **for D**eployment
- **Years**: 2013 – 2015
- 33 partners
- 7 pilot sites



Pilot sites

compass4D

COMPASS4D -*Services*

Road Hazard Warning

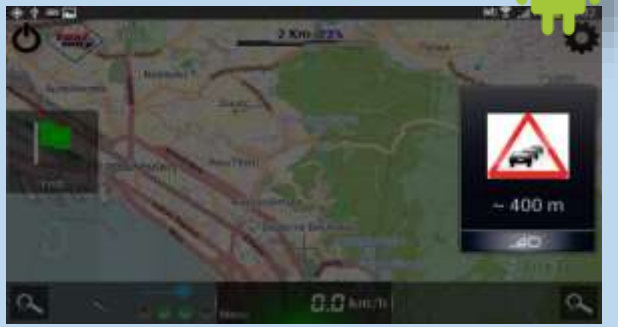
Red Light Violation Warning

Energy Efficient Intersection

- 500 vehicles (50 of them are trucks)
- Larger benefits for heavy vehicles (both in terms of fuel and emissions reduction)
- Business models based on fleet operators, willing to pay for the services

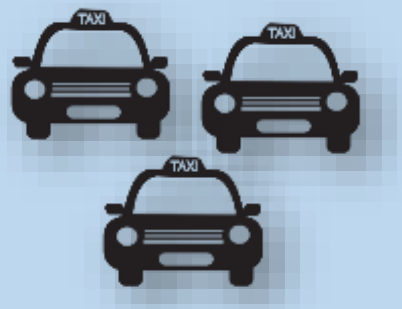
COMPASS4D – *Thessaloniki Pilot*

API



Real time data along Tsimiski

- 12 controller / 14 intersections
- Expected time to change

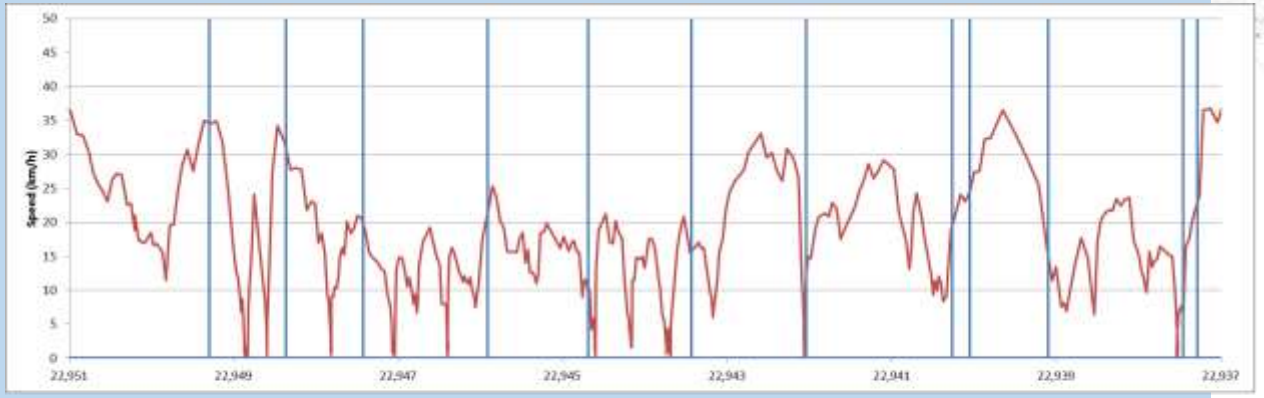


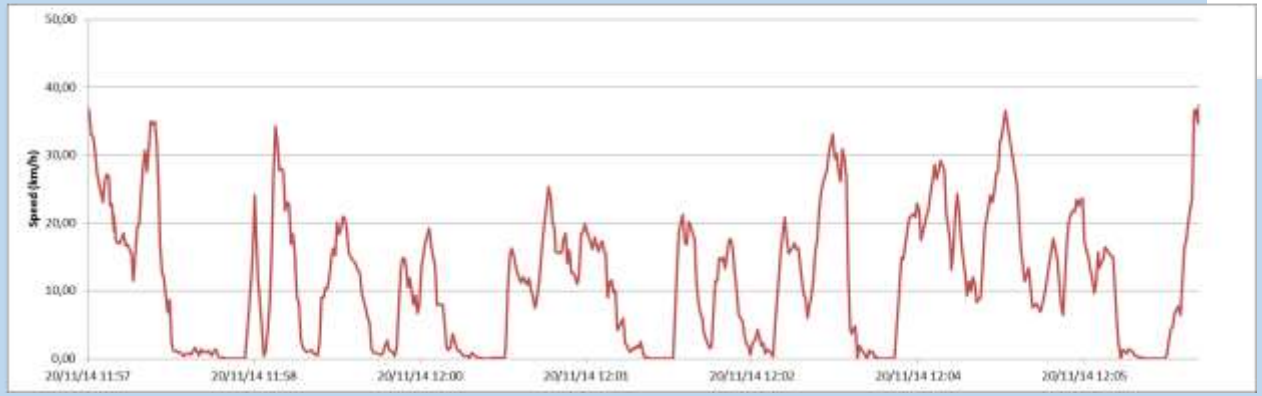
150 taxis participating in the pilot

compass4D

COMPASS4D data collected / evaluation

- Speed advice service
- Road hazard warning service





COGISTICS

- **Co**operative **M**obility **P**ilot on S**a**fety **a**nd **S**ustainability **S**ervices **for D**eployment
- **Years**: 2014 – 2016
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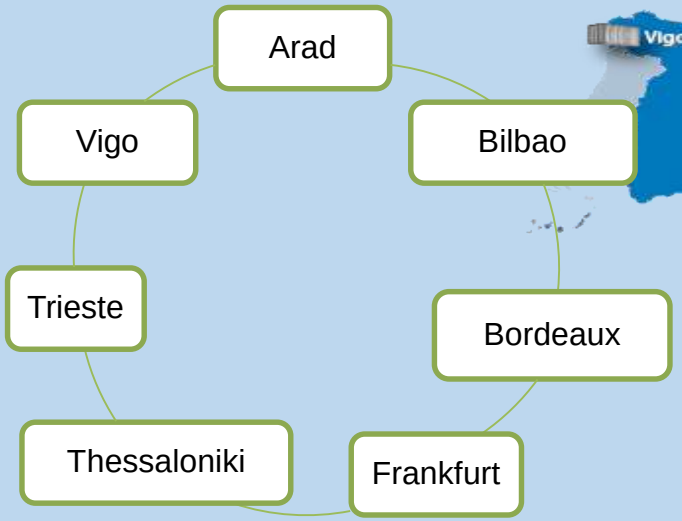


Pilot sites

COGISTICS

Cooperative logistics for sustainable mobility of goods

OPEN ARCHITECTURE FOR INTEROPERABLE CARGO, VEHICLE AND INFRASTRUCTURE

- Real-time adaptive connectivity
- Open federated system-of-systems approach

- Intelligent truck parking areas management
- CO2 estimation and monitoring
- Eco-drive support
- Cargo Transport Optimization
- Priority and speed advice

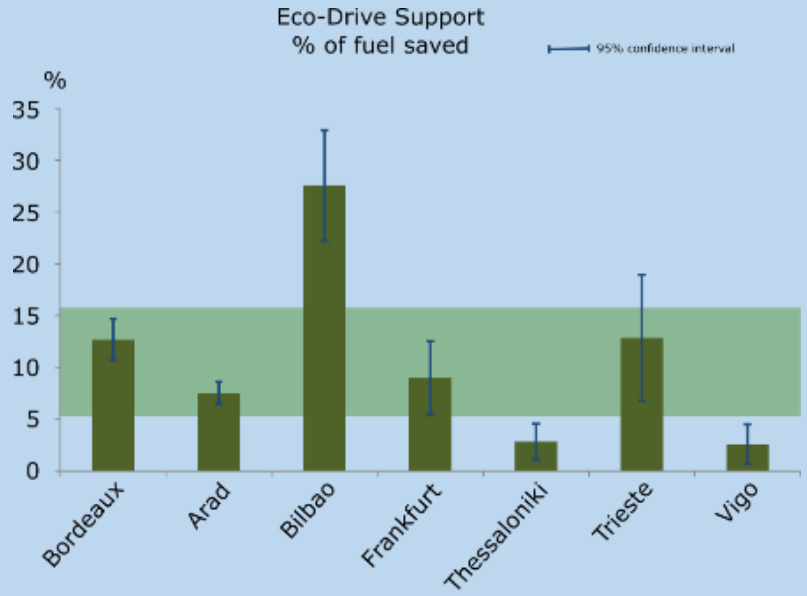
COGISTICS – *Thessaloniki Pilot*

Cooperative mobility services for freight

CO2 footprint estimation and monitoring	Eco-drive support & speed advise	Proof of delivery
• Provided around the port area of Thessaloniki • 4G • Fleet of 10 trucks	• Provided around the port area of Thessaloniki and the city centre • 4G & DSRC G5 • Fleet of 10 trucks	• Provided around the port area of Thessaloniki and the city centre • 4G • Fleet of 10 trucks • 100 intelligent cargo units

CO-GISTICS Deploying Cooperative Logistics

COGISTICS data collected / evaluation



5 - 16% fuel consumption reduction

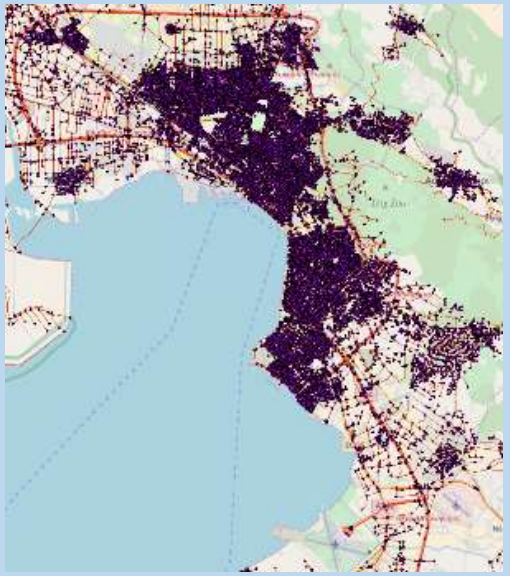
Emissions reduction: 49g/CO2 per intersection approach
Travel time reduction: 10%

C-Mobile

C-ITS Services

- **Large-scale real-life deployment**
  - Road Works Warning
  - Road Hazard Warning
  - GLOSA
  - Flexible Infrastructure
  - In-vehicle Signage
  - Mode and Trip Time Advice
  - Probe Vehicle Data
- **Limited scale real-life deployment**
  - Warning System for Pedestrians
- **Proof of Concept deployment**
  - Emergency Vehicle Warning
  - Signal Violation Warning
  - Green Priority
  - Cooperative Traffic Light for Pedestrian

Geographical Coverage



C-MOBILE

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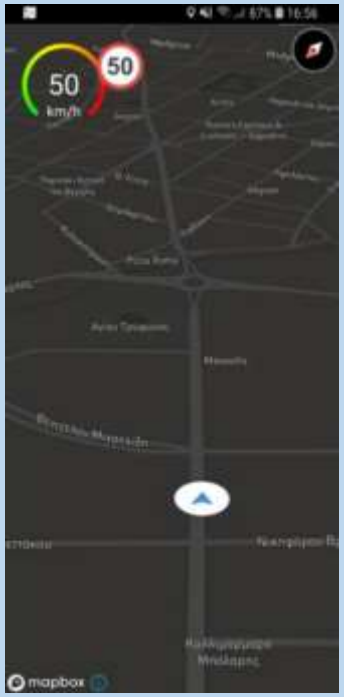
CERTH App

- Provision of multiple integrated C-ITS services



C-MOBILE

Safer-LC

- **Multimodal Cooperative Service**
- **Goal**: improve safety and minimize risk by developing a fully-integrated cross-modal set of innovative solutions and tools for the proactive management and design of level-crossing infrastructure.
- **H.I.T.'s role**
  - Implementation, execution and evaluation
  - Leader of the Thessaloniki's pilot site
- **Year:** 2017

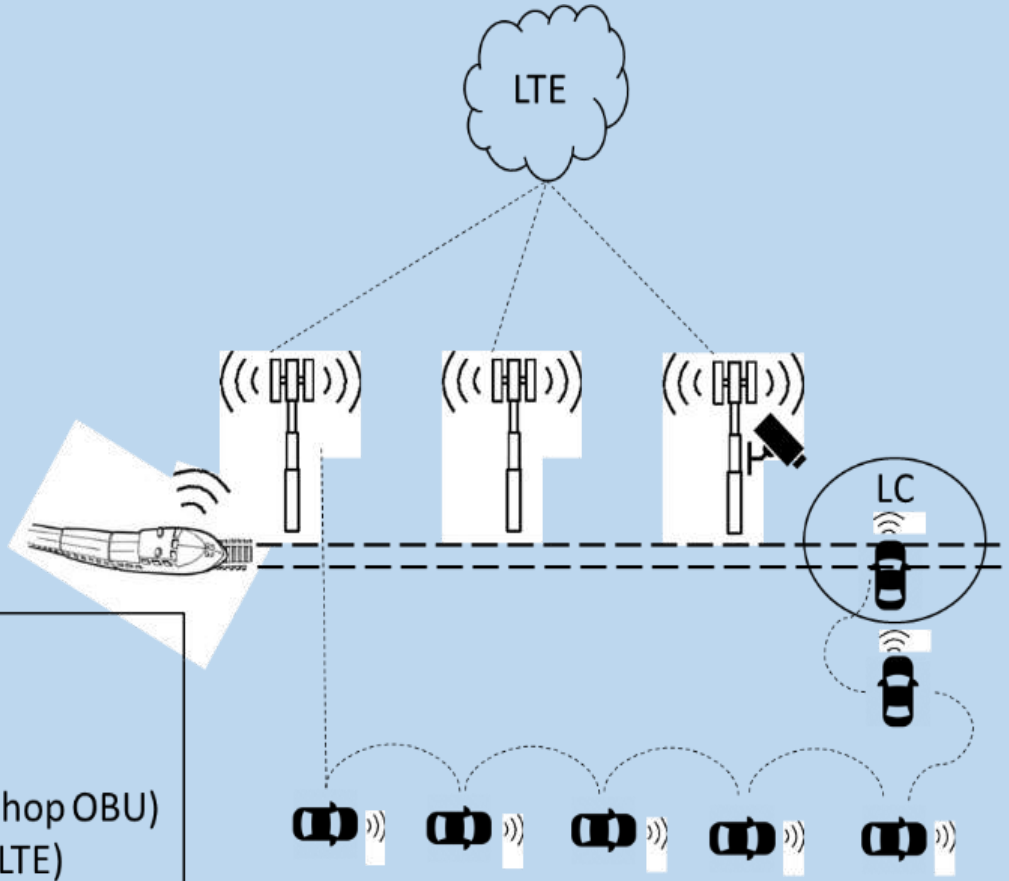
SAFER-LC

Aachen test site

Detection
- Obstacle (Camera / image analysis)
- Obstacle (V2X - CAM)
- Train approaching (V2X - CAM)

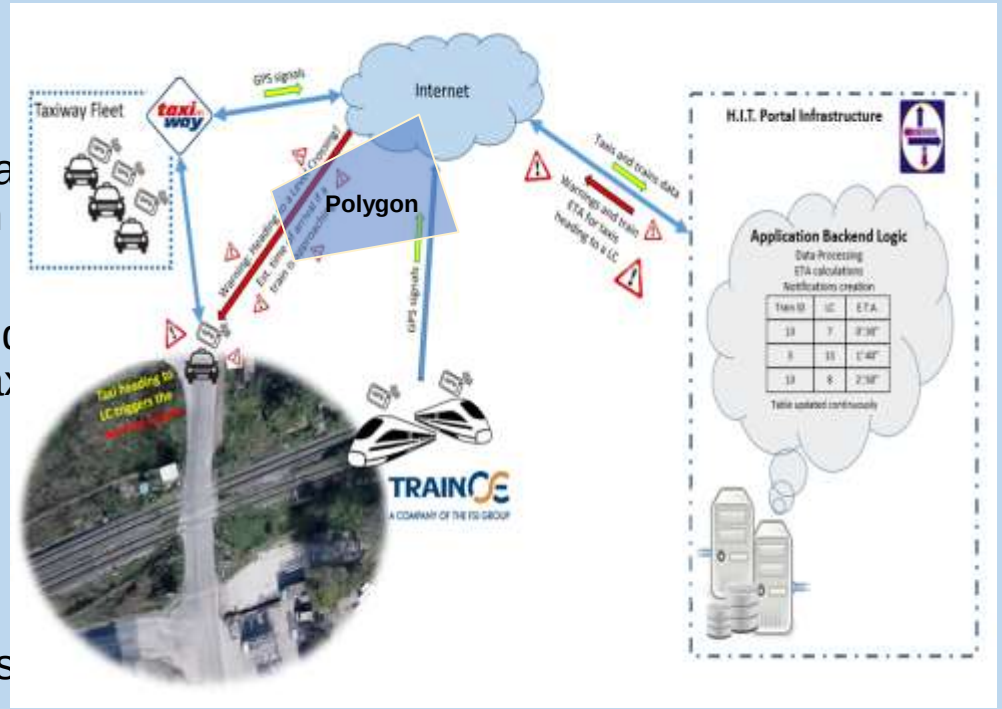
Communication to train and road vehicles
- Obstacle (V2X / RSU - LTE)

Communication to road vehicles
- Train approaching (V2X - DENM / multi-hop OBU)
- Train approaching (V2X - DENM / RSU - LTE)



Safer-LC – *Thessaloniki Pilot* (1)

- **Idea**: real-time alerts of incoming trains a the level crossings along with estimation of the time of arrival
- An mobile application was developed and installed to the on-board tablets of the tax fleet
- A polygon was assigned to each of the level crossings
- The ETA of a train at a level crossing is calculated using artificial neural networks based on historical data
  - Mean absolute error of 5 seconds for trains up to 1000 meters from the level crossing



System architecture

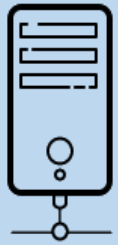
SAFER-LC

Safer-LC – *Thessaloniki Pilot* (2)

1. Taxi enters a LC polygon

2. Safer-LC app executes in the background and asks server for the ETA (if any)

HTTP GET



3a. Server computes and sends the ETA to the app

HTTP POST

FCD

3b. Taxi's GPS data sent and stored while in the polygon

4. App displays the alert along with a warning sound

***FCD:** Floating Car Data

SAFER-LC

Galileo for Mobility

- GALILEO 4 Mobility will aim at supporting the introduction of GALILEO technology within the Mobility as a Service (MaaS) context, by analysing the needs in terms of geolocation of the different stakeholders involved and demonstrating it the benefits of GALILEO through pilot demonstrators of shared mobility services.

GALILEO FOR MOBILITY

Introduction to Mobility as a Service

What is MaaS

- Users pay for the transport service and not for the means of transport

MaaS components:

- Car sharing
- Bike sharing
- P2p car rental
- Multimodal transport
- Autonomous transport systems
- Smart parking systems
- Smart payment systems
- Road user charging

Services similar to MaaS:

- Netflix
- AirBnb
- UBER
- Facebook
- Instagram
- Alibaba

Galileo for Mobility

Galileo is **Europe's own global navigation satellite system**, providing a **highly accurate**, **guaranteed global positioning service** under civilian control. Galileo is interoperable with GPS and Glonass, the US and Russian global satellite navigation systems.

Benefits for Mobility as a Service (**MaaS**):

- ✓ **Increased availability**
- ✓ **Better accuracy**
- ✓ **Lower Time-To-First-Fix**

	Availability	Positioning accuracy	Timing accuracy	Integrity message	Robustness vs. spoofing	Detection of GNSS interferences
Safety critical - traffic and safety warning	> 99.5%	< 3 metres (horizontal)	< 1 second	Required	Robustness vs. spoof-ing threats required	Required
Safety critical - automated driving	> 99.9%	< 20 cm (hori-zontal) < 2 metres (vertical)	< 1 micro second	Required	Robustness vs. spoof-ing threats required	Required
Payment critical	> 99.5%	< 3 metres (horizontal)	< 1 second	Required	Authentica-tion message required	Required
Regulatory critical	> 99.5%	< 5 metres (horizontal)	< 1 second	Required	Authentica-tion message required	Required
Smart mobility	> 99.5%	< 5 metres (horizontal)	< 1 second	Required	Authentica-tion message required	Required

GALILEO FOR MOBILITY

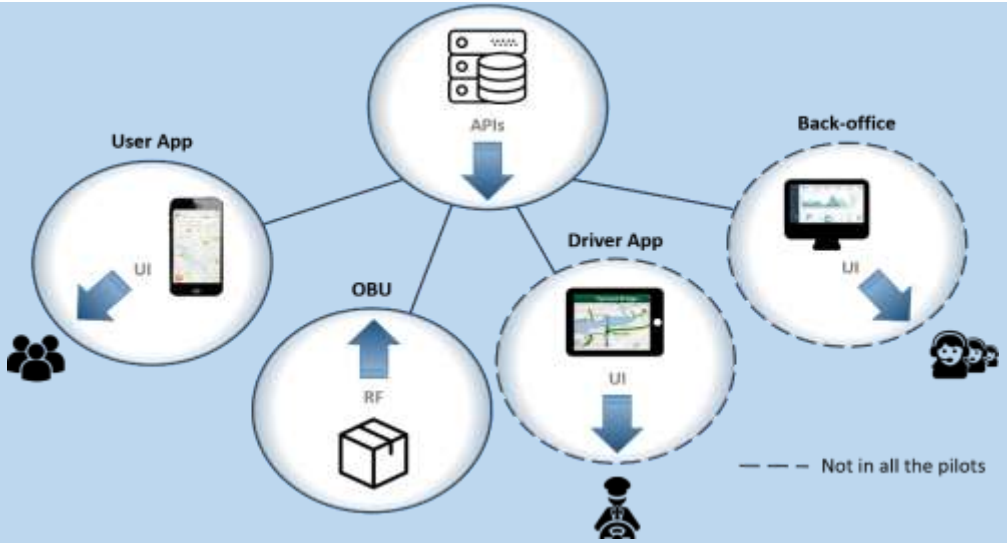
Pilots Overview

Mode / service	Public Transport	Shared / pooling vehicles	MaaS aggregator
Motorbike		MaaS Aggregator	MaaS Aggregator
Car		Vehicle sharing	MaaS Aggregator
Bicycle		Vehicle sharing	
Taxi	Shared taxis		
Bus	Public Transport On-Demand Driverless Shuttle Bus		

GALILEO FOR MOBILITY

Proposed MaaS Solution

The **back-end** acts as the main intelligence and the point of government that rules the whole service.
The **user app**, the gateway between the end-user and the service.
The **On-Board Unit (OBU)** a data provider transmitting the GALILEO geolocation of the vehicle in real-time.



The **driver app**, used mainly to display the necessary trip information to the driver.

A **third party back-office**, an interaction point for operators or service administrators to be involved in the service management.

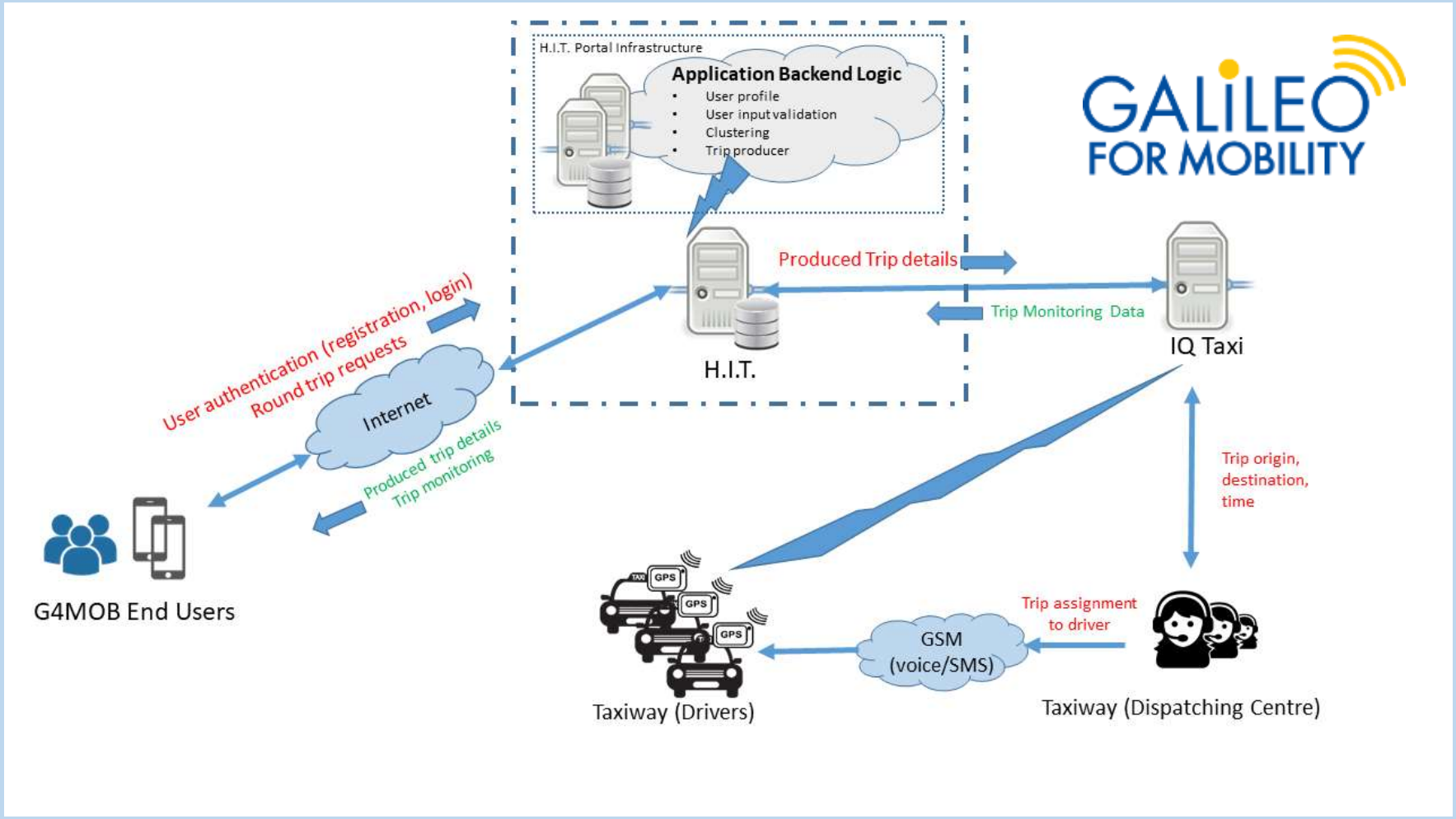
GALILEO FOR MOBILITY

Galileo For Mobility – Pilot

- The Taxi sharing service will provide a comfort and cost-effective “home to work” and “home to recreation” solution to residents of the Municipalities of Thermi and Kalamaria, while reducing the traffic congestion at the city center.
- **Start Date of the pilot**: May 2019

GALILEO FOR MOBILITY

Galileo For Mobility – Pilot



General System Architecture

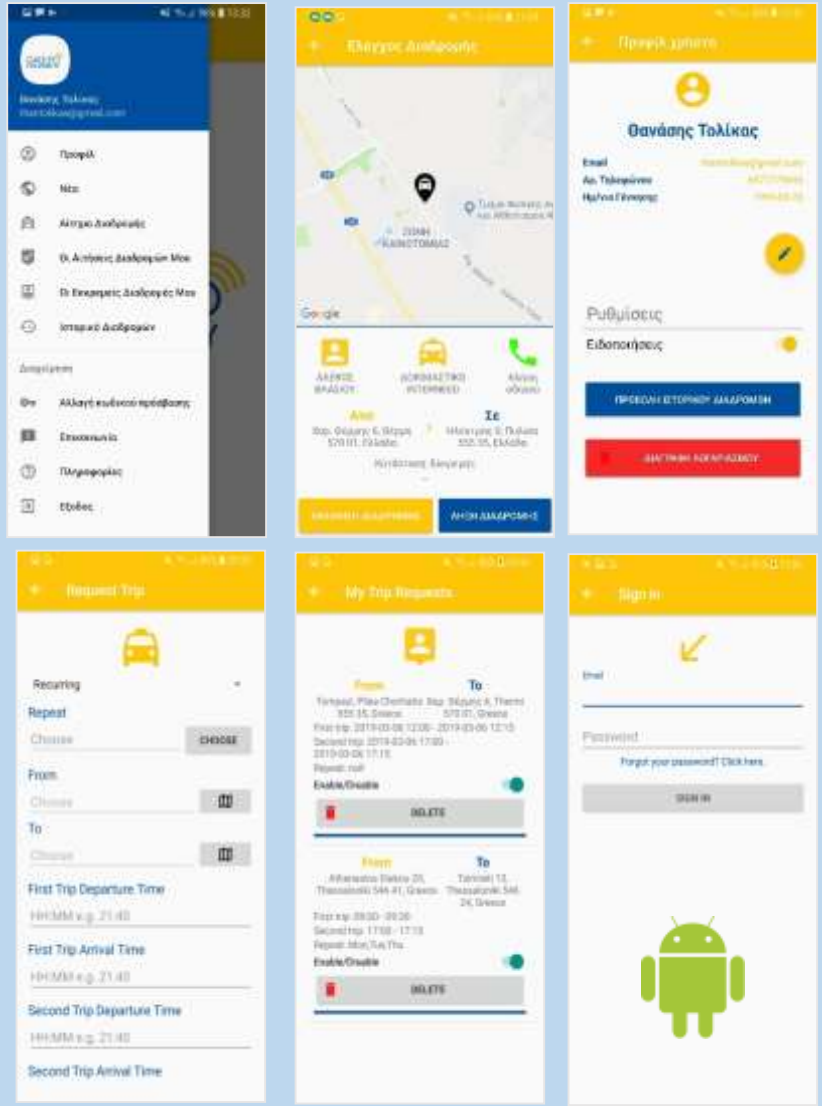
Galileo For Mobility – Pilot

Mobile Application

This application aims to assist the shared taxis pilot execution by providing an easy way to request shared taxi trips.

The functionalities include:

- Log in / Registering
- Requesting round trips (recurring or one time)
- Enabling/Disabling/Deleting a round trip request
- Monitoring round trips in map view
- Accessing the trip history
- User profile (viewing and editing)
- Misc. user management functions (password reset, log out e.t.c.)
- Logging Floating Car type of Data (coordinates, speed, time, orientation e.t.c.)



GALILEO FOR MOBILITY

iBikeShare

- **Goal**: Improve bike-sharing operations in Thessaloniki by upgrading the current processes and applications
  - Upgrade existing mobile application
    - Implementation of gamification techniques
    - Easier bike renting process
  - Deploy state of the art algorithms in order to:
    - Forecast demand value
    - Extract optimal bike station locations
    - Implement asset utilization tools
    - Pricing policy modification tool

THANK YOU!