Dirección Gral. de Tráfico

INSPIDE

SAFER-LC

Innovative solutions to enhance the safety of level crossings for road and rail users.

MID-TERM CONFERENCE

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Madrid, FFE premises

Level Crossing protection integration into connected car tecnologies

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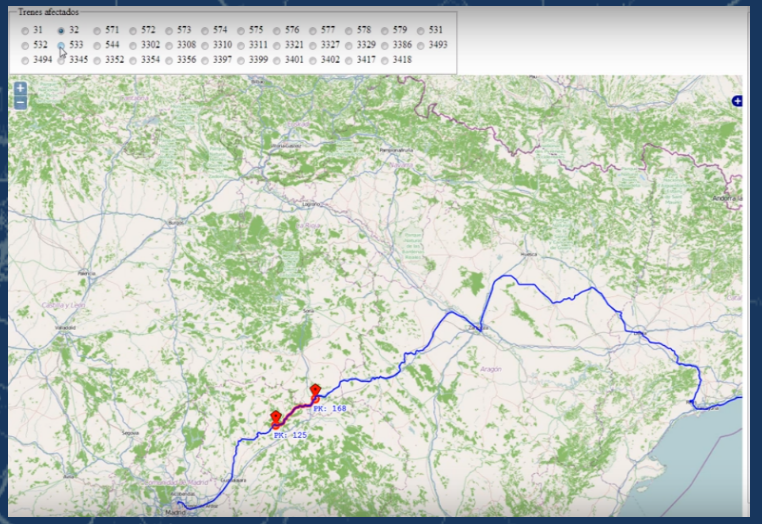

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Focused on Geospatial analisys

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Problem definition

The goal is to solve the problem of warning to drivers in advance to take precautions when they are approaching a level crossing

Avoid accidents due to the occupancy level crossing for vehicles that have been stopped on the railroad

Types of LC protection

CLASS A	Protected level crossings exclusively with fixed signals.
CLASS B	Protected level crossings with light and acoustic signals. (S.L.A).
CLASS C	Protected level crossings with half-barriers, double half-barriers or barriers, Automatic or Nailed (S.B.E., S.B.A. or S.B.E./S.B.A.).
CLASS D	Protected level crossings in Luggage Regime (Chains or Barriers or manual half-barriers).
CLASS E	Protected level crossings daycare walk Paso.
CLASS F	Step by exclusive level or Pedestrian and Livestock.

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Distribution of accidents in LC

	Accidents at LC	Num of fatalities			% of all accidents	% of all fatalities	LC accidents per millon train-km	LC fatalities per millon train-km
		Passengers	Staff	Third parties				
2013	479		1	280	26	26	0,12	0,07
2012	510		1	325	26	32	0,12	0,08
2011	447	6	1	277	22	26	0,11	0,07
2010	495	1	3	315	23	28	0,12	0,08
2009	493	2	1	374	22	28	0,12	0,09
2008	539		3	325	25	27	0,13	0,08

Focus on warning

Most effective is replace LC, but it is expensive, so

- Signaling its location on the road by traffic signals in a passive way.
- Closing by detecting the proximity of a train by an active way.

Goals

Notify drivers a nearby Level Crossing.

Notify to Infrastructure Managers about the interception of a Level Crossing by a vehicle when the driver indicates incidents.

Notify to Infrastructure Managers about the interception of the track, at any point, by a vehicle when the driver indicates incidents.

Improve road and railways safety,
reducing level crossing accident impact

System design

Solution based on geolocation in real time of all parts of the system and notifications to drivers and infrastructure managers,
not to replace actual systems

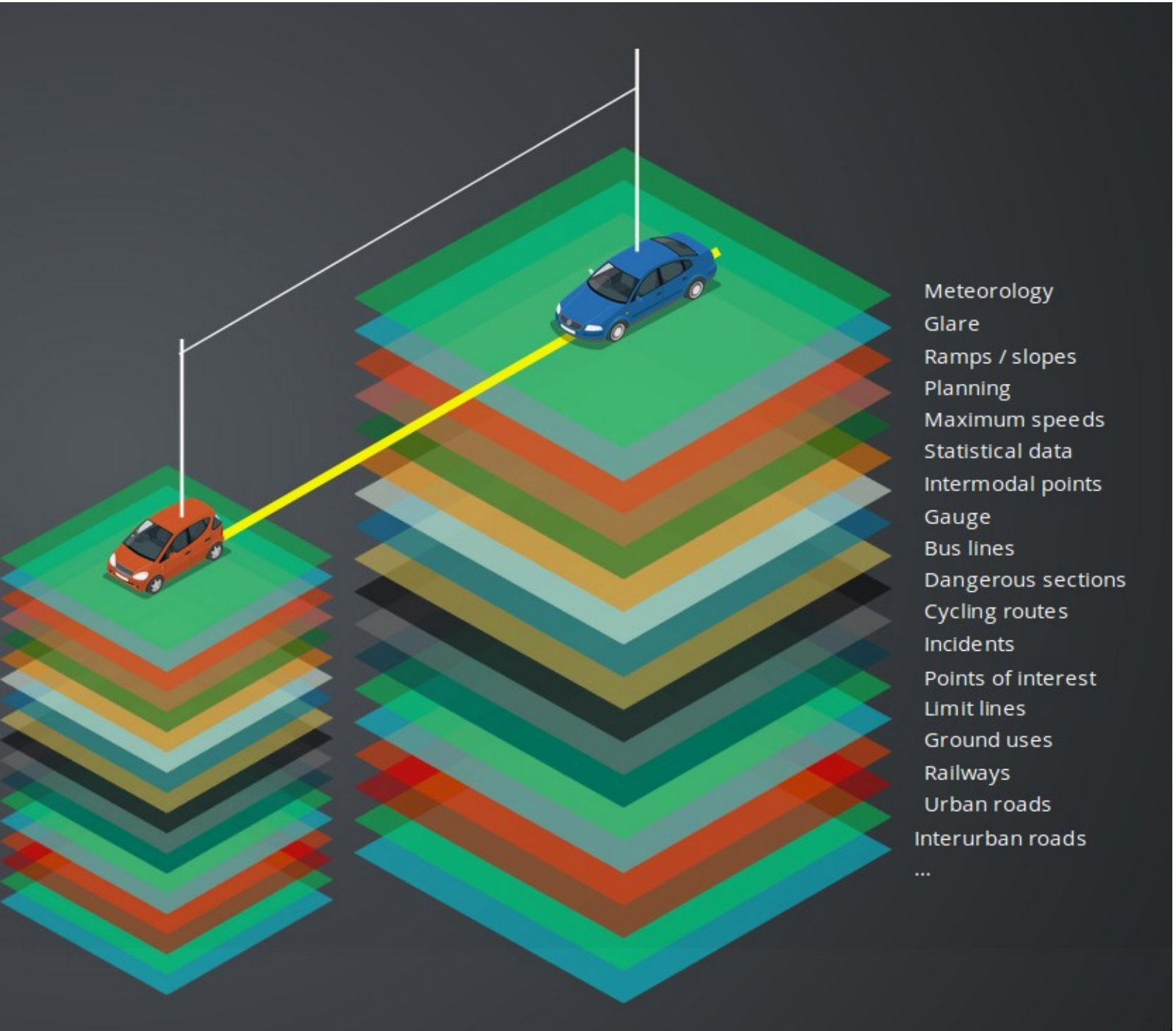
- Level Crossing facilities, regardless of type.
- Vehicles.
- Trains.
- Infrastructure managers.

ystem design

Taken advantage that connected car concept begins to take shape in all countries

Collects real-time information
Central intelligent cloud
Returns information and events

System design



Context data integrated into layers

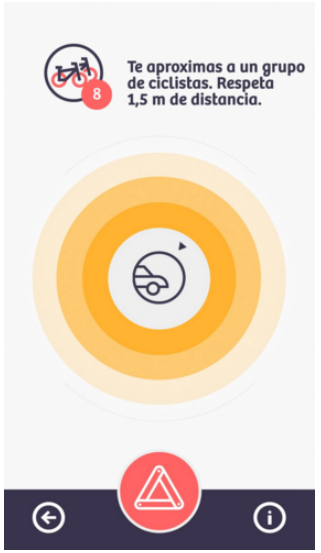
System design

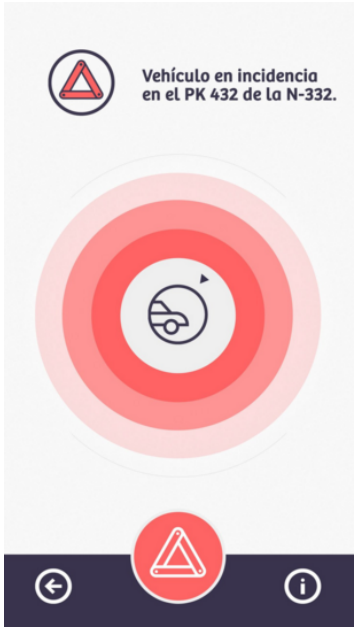
Actual system developed for Dirección General de Tráfico collects real time information about:

- Position
- Speed
- Vehicle type

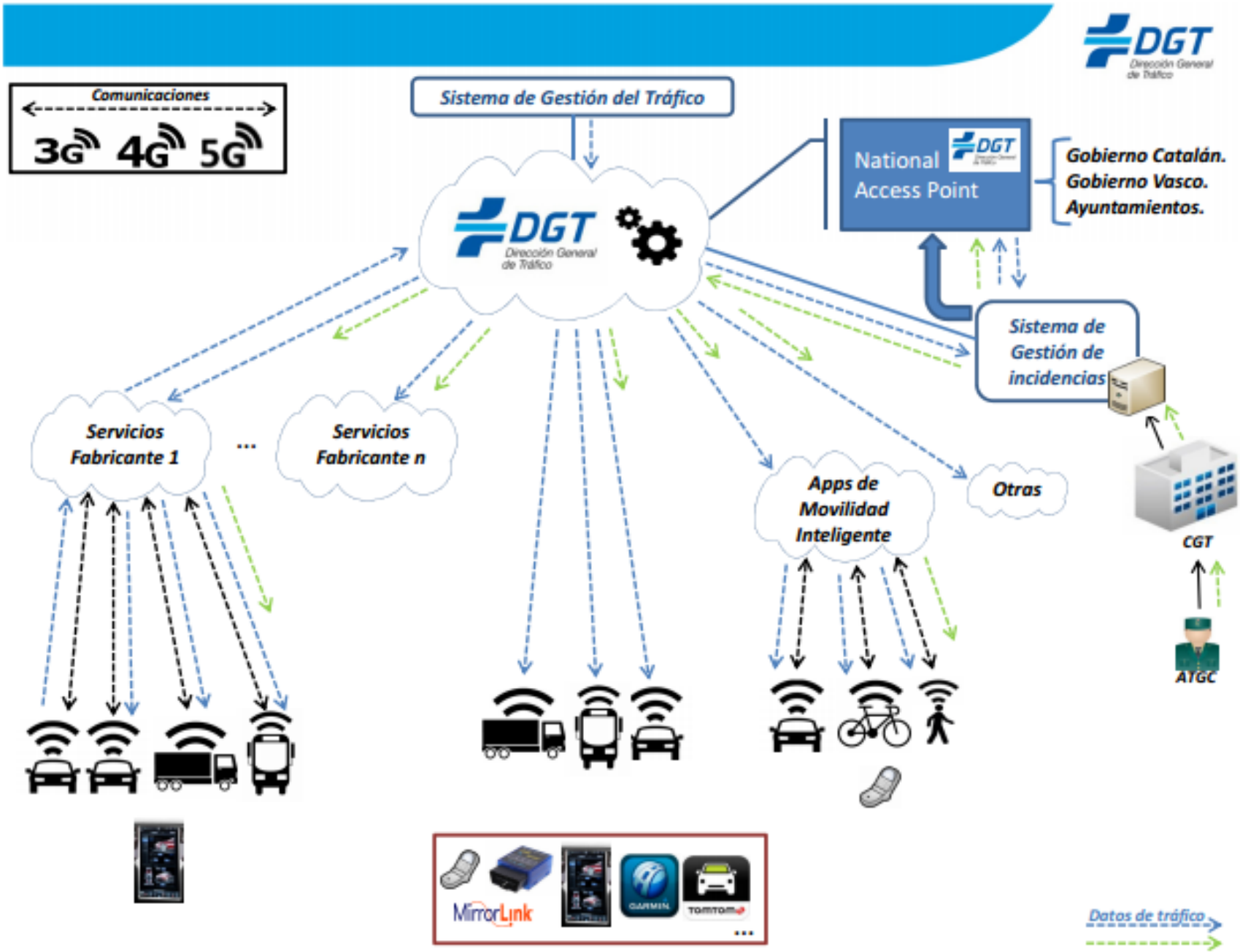
Computes driver risk and return

Real time audio an text notifications





System design – Connected Car



System design

Our on board vehicle solution

Comobity

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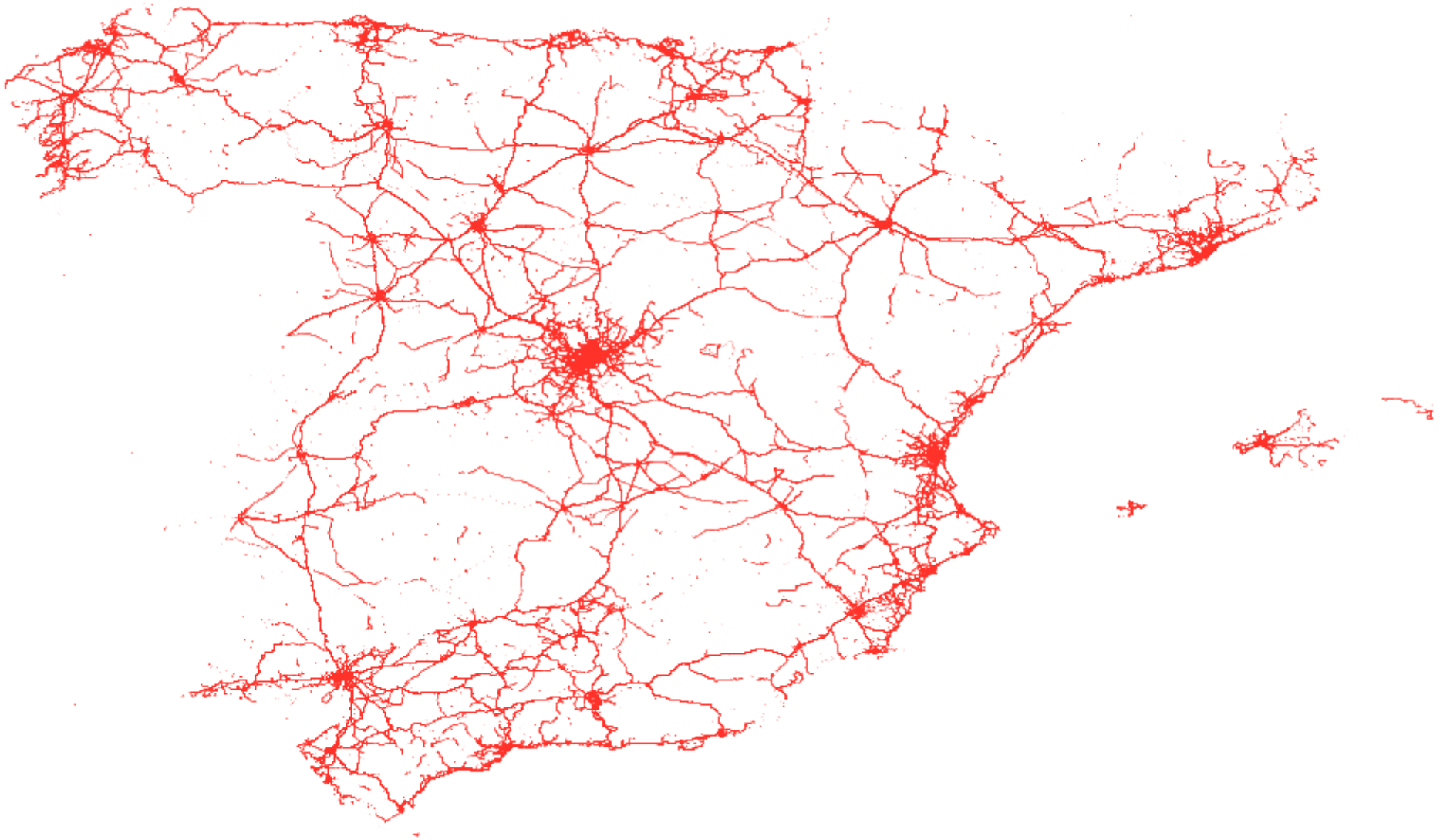
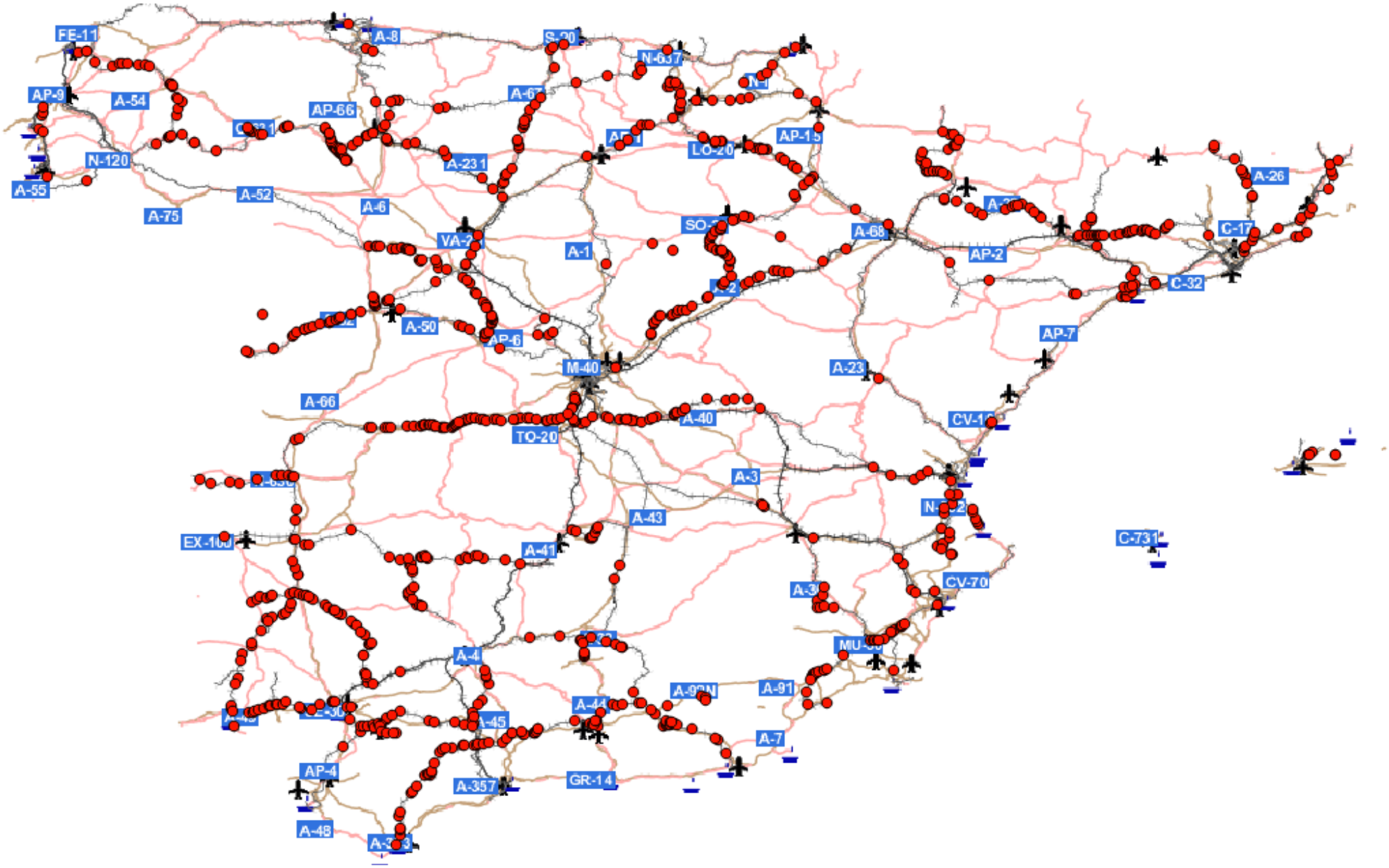
Singularity logic cloud distribution use

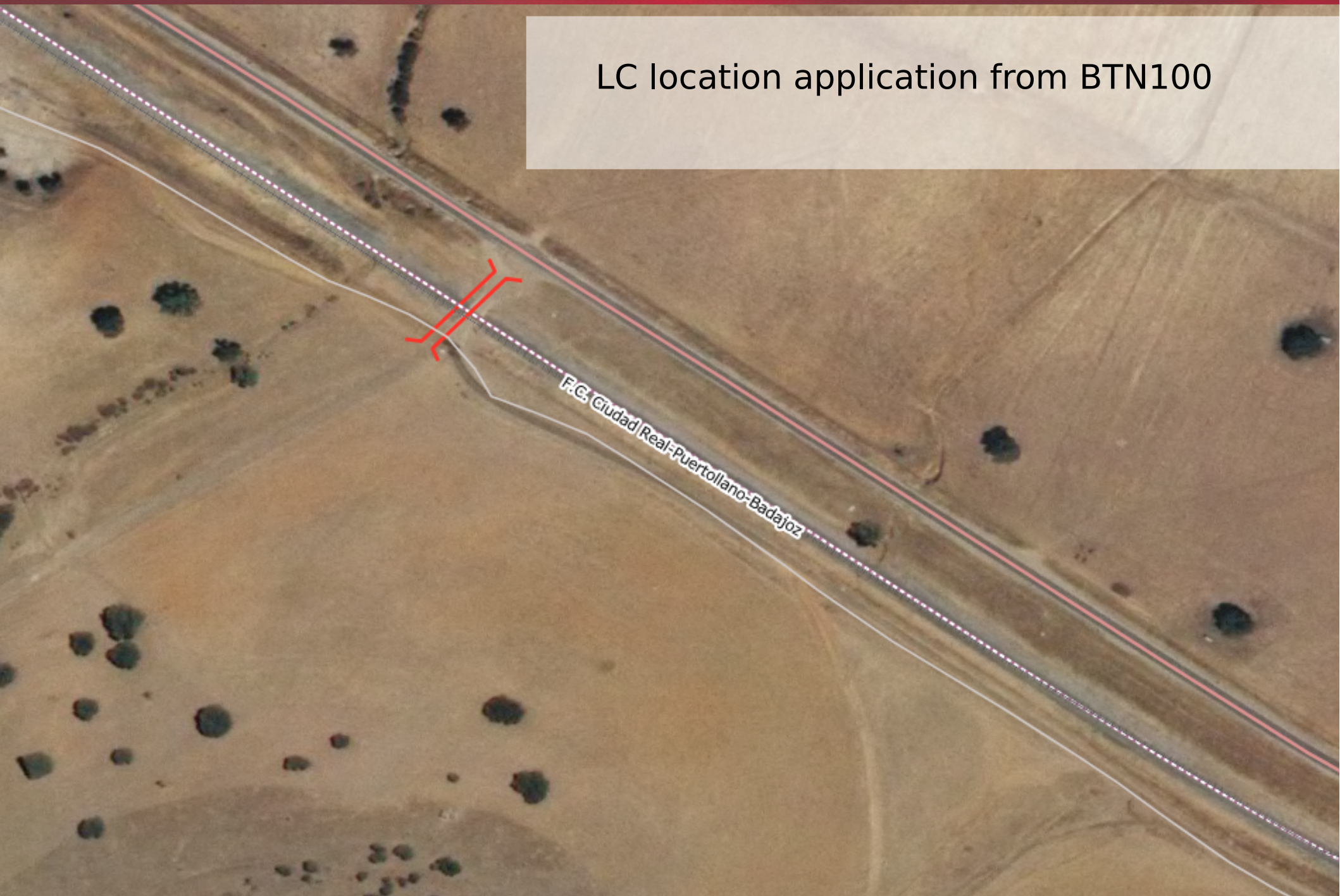


911 LC distribution on IGN Spatial Data Infrastructure



LC application

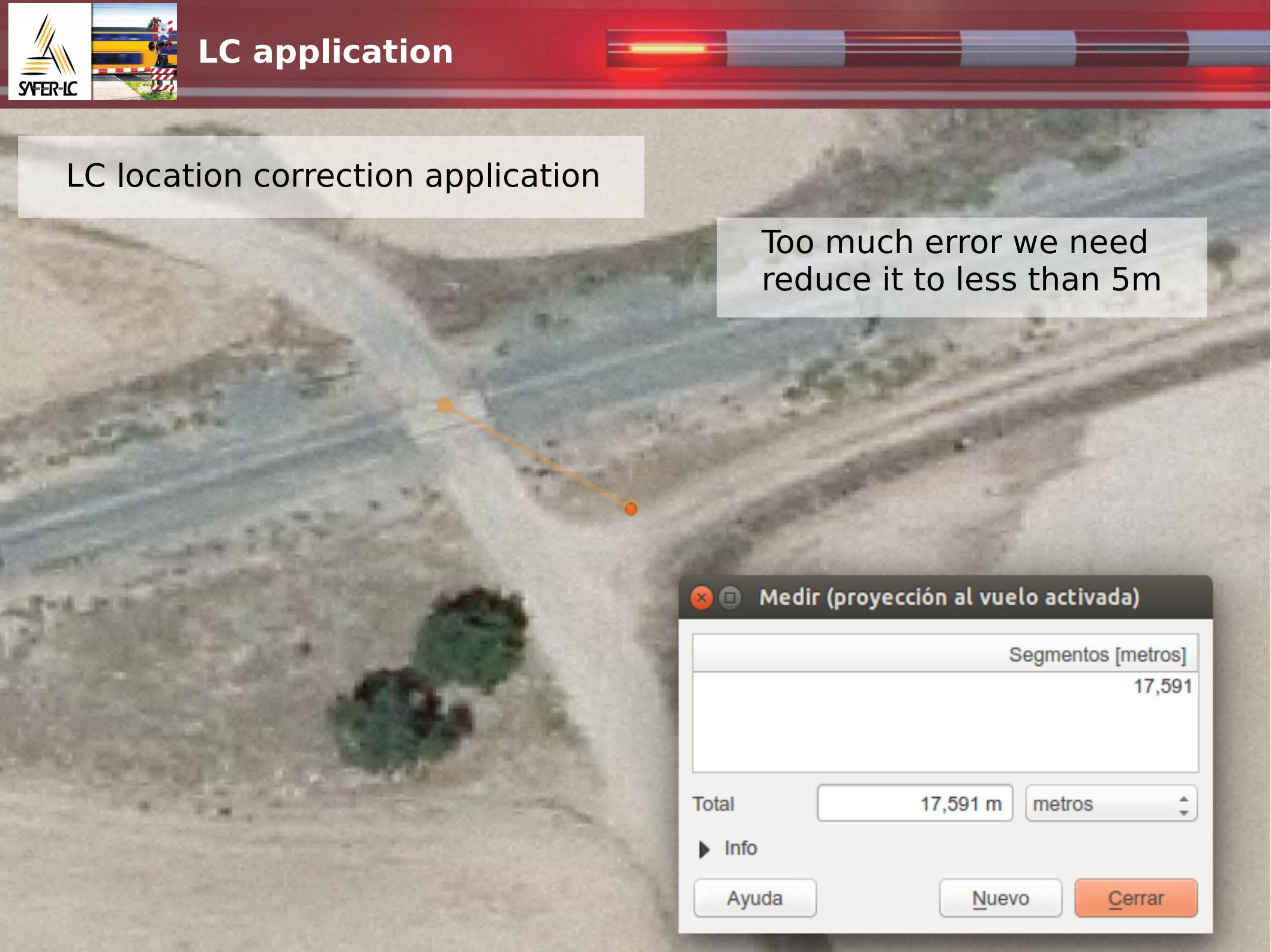
LC location application from BTN100



LC application

LC location correction application

Too much error we need reduce it to less than 5m



INSPIDE geolocation application

Georreferenciación de Pasos a Nivel

Num. PN 10 Longitud -0.5262869596481323 Latitud 38.84433709037208 Fecha Mosaico 2015-05 valido TRUE enviar

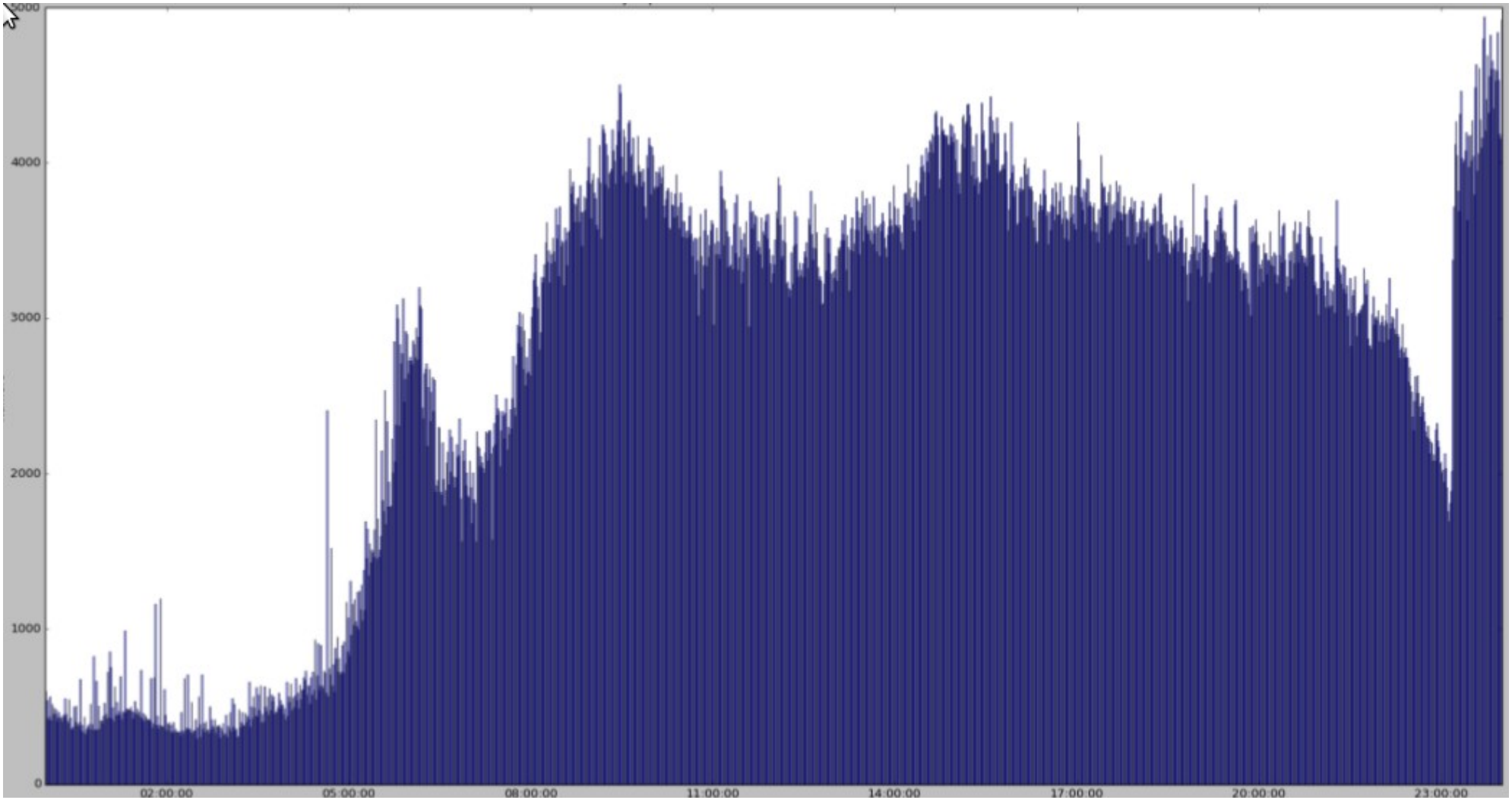
Updated locations

LC application

GPS accuracy on board better than 5m at 120 km/h

LC application

Message per second processed
178 M transactions per day
In real time



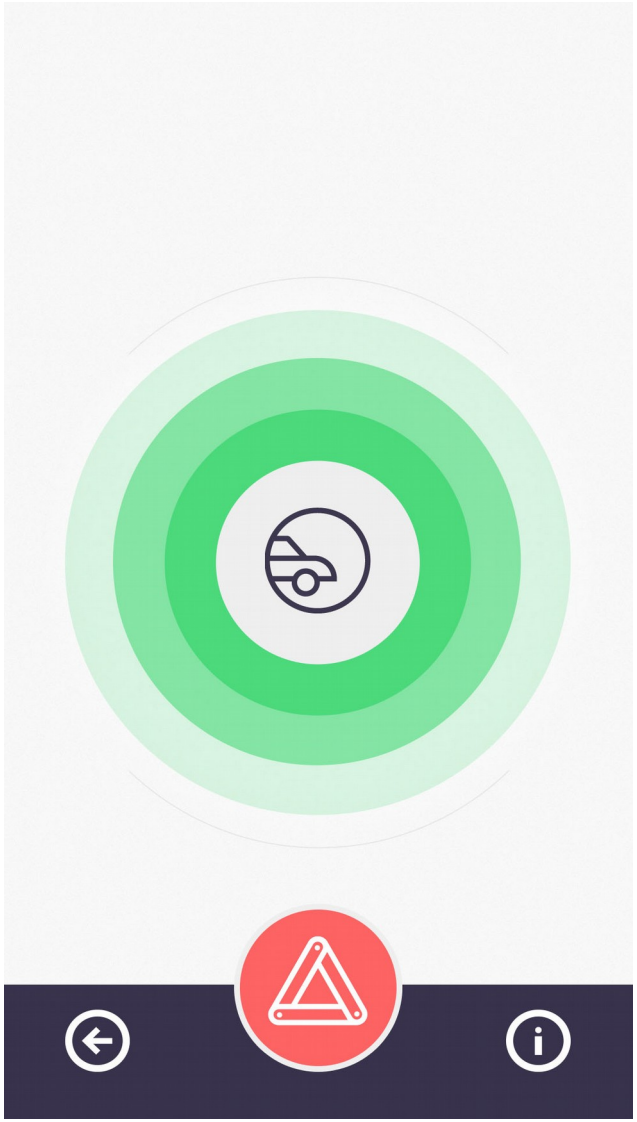
LC application

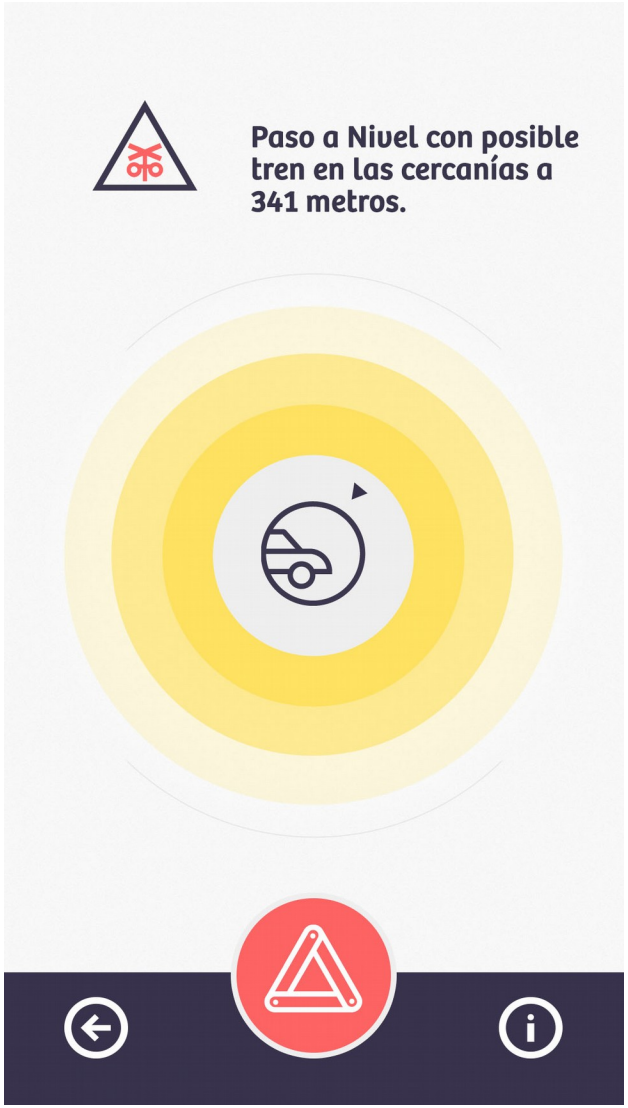
Two kind of notifications

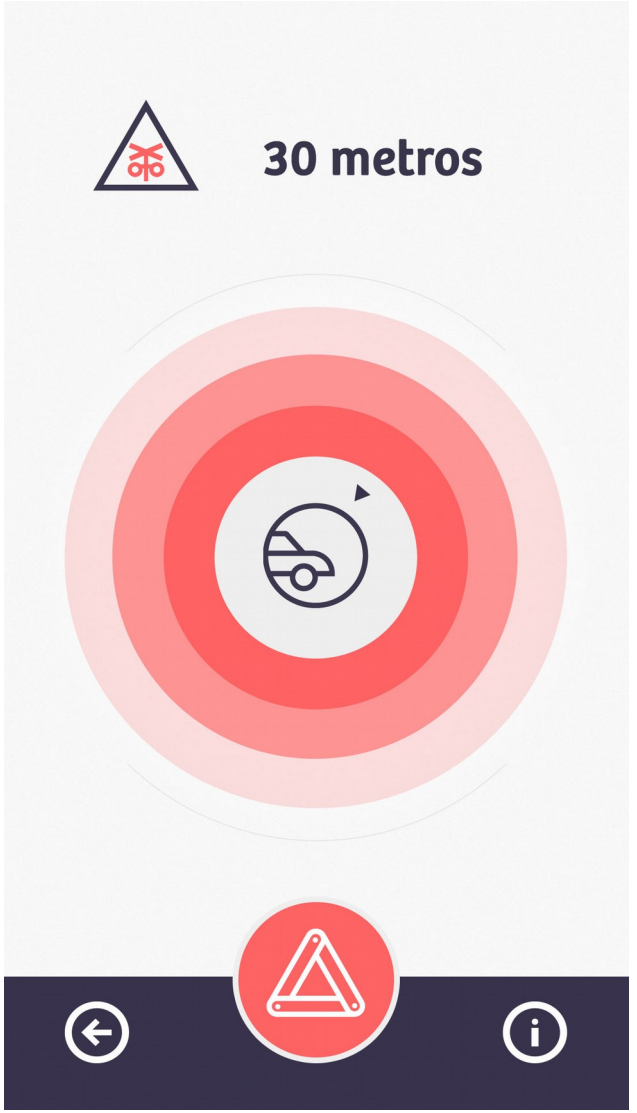
Vehicle

notifications are sent based on the vehicle speed, specifying the name of the road and where KP is located

On board notifications







LC application

Two kind of notifications

Vehicle

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LC application

Two kind of notifications

Infrastructure Manager

The position of vehicles is computed in real time, and if its driver declares an incident, the system is able to identify if he is located within the Level Crossing

Data providers

Identified 911 Level Crossings in BTN100 within the BTN100_0617P_PASO_NIVEL layer

BTN100 and BTN25.
Orthophotos PNOA.
Cartociudad.

Data providers

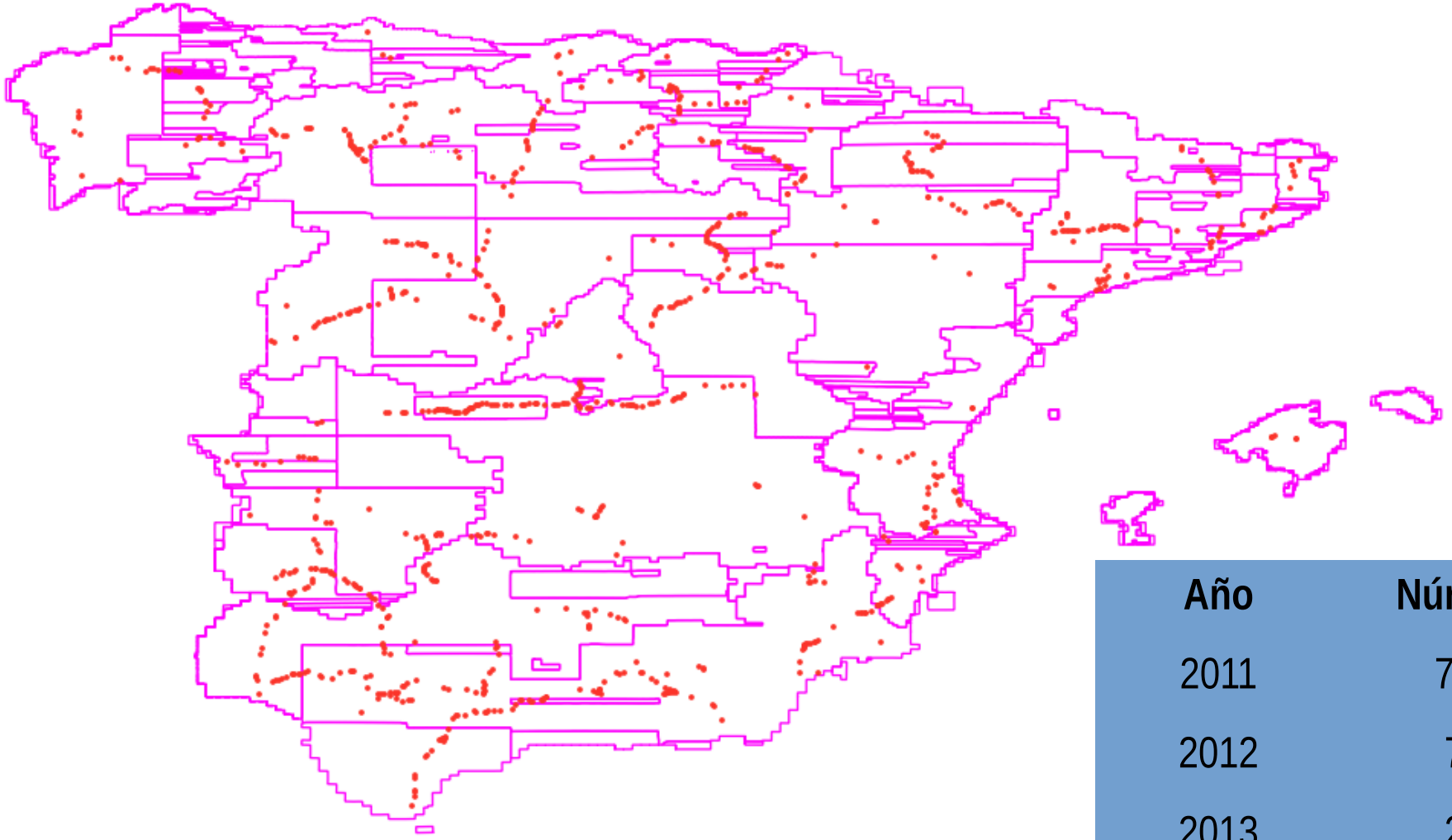
INSTITUTO GEOGRÁFICO NACIONAL

GOBIERNO DE ESPAÑA MINISTERIO DE FOMENTO


```
CREATE TABLE public."BTN100_0617P_PASO_NIVEL"
(
  id_0 integer NOT NULL DEFAULT nextval('"BTN100_0617P_PASO_NIVEL_id_0_seq"'::regclass),
  geom geometry(Point,4258),
  id double precision,
  id_bd double precision,
  id_codigo character varying(5),
  id_mod double precision,
  fecha_alta character varying(20),
  CONSTRAINT "BTN100_0617P_PASO_NIVEL_pkey" PRIMARY KEY (id_0)
)
```

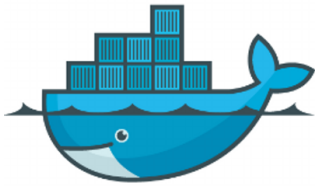
Data providers

PNOA – LC distribution



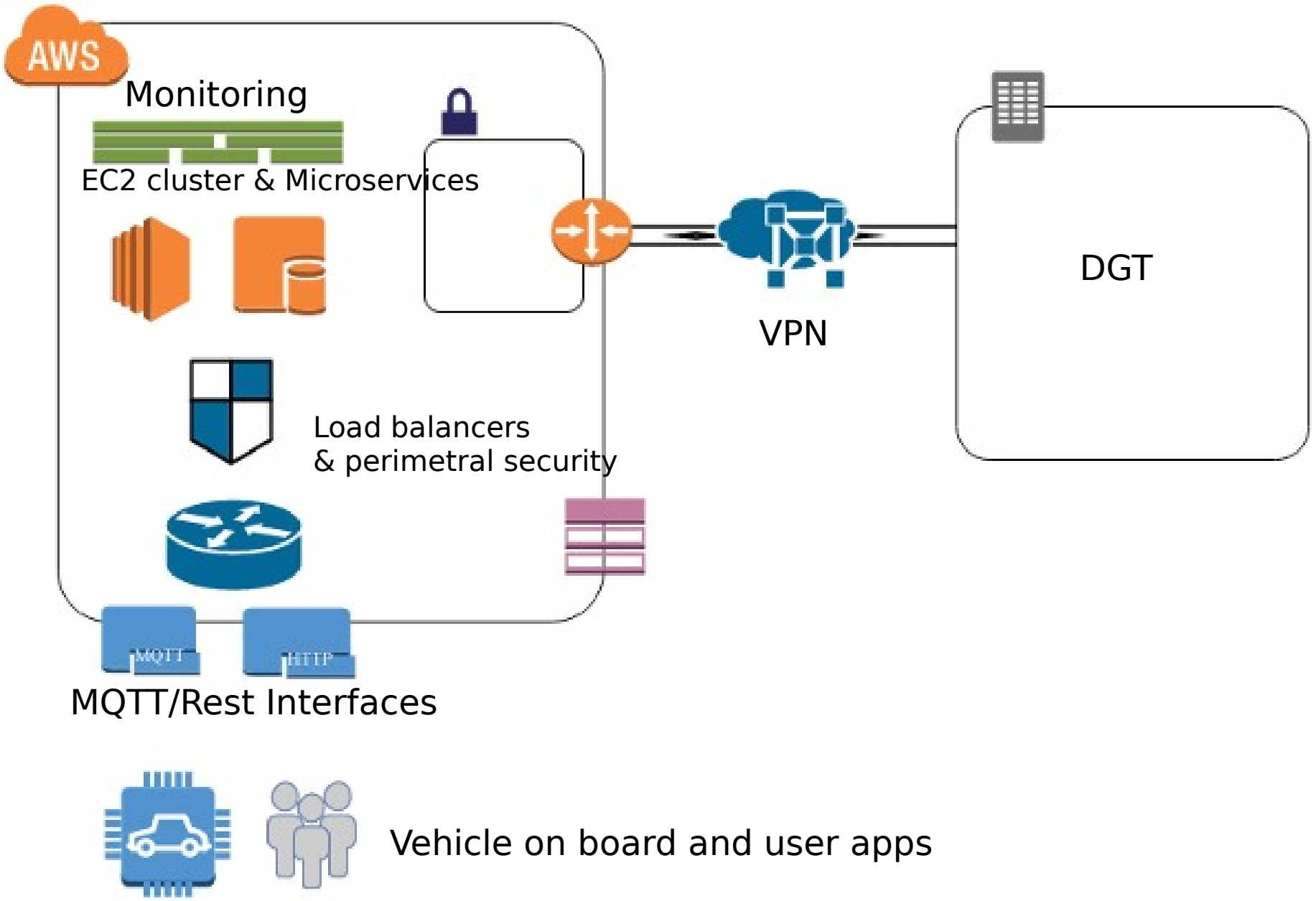
Año	Número
2011	799
2012	78
2013	29
2014	5

Used tools

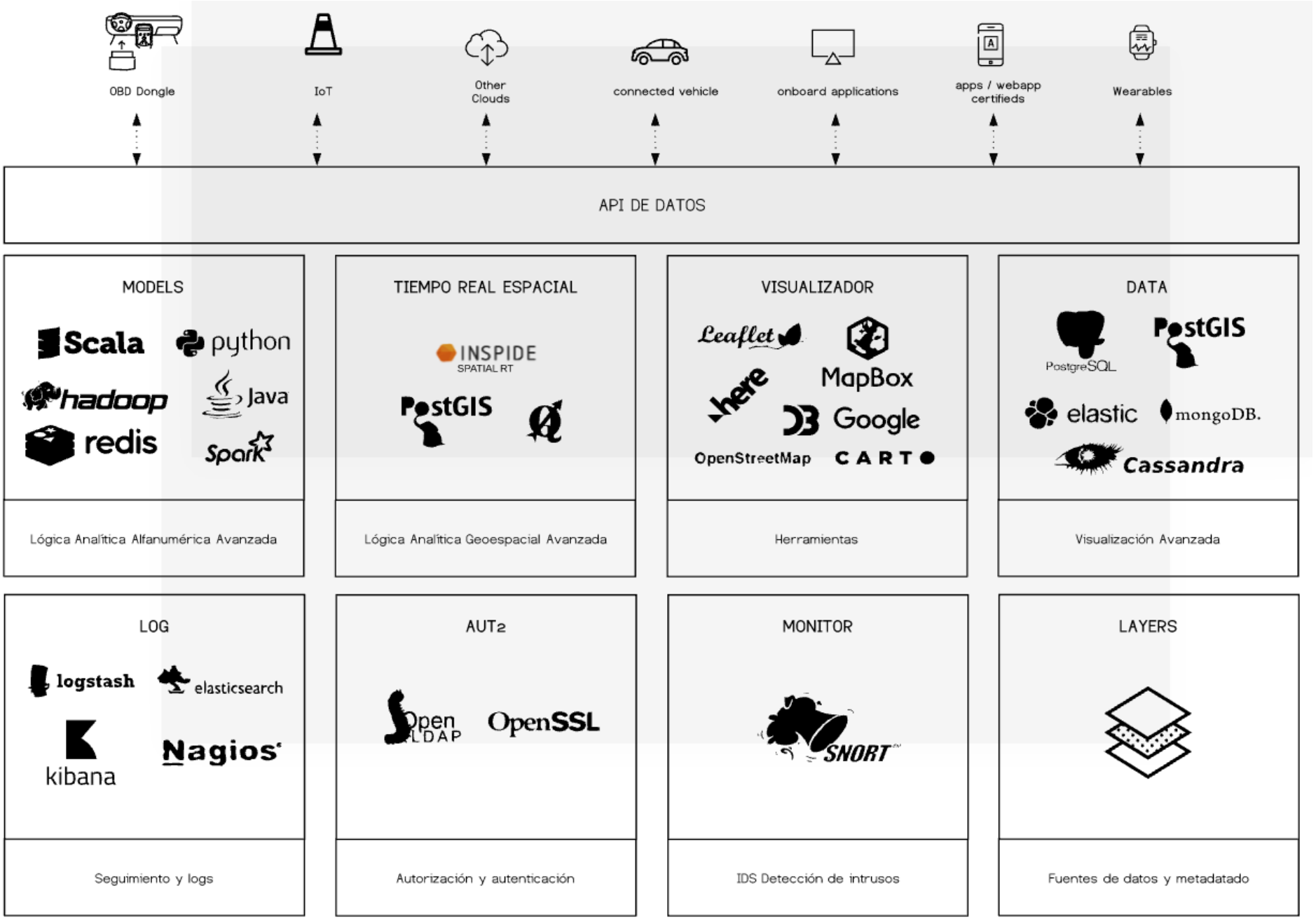


Linux operating system installed over the Amazon AWS cloud.
PostGIS database.
Python and Java.
Docker containers to deploy microservices
Desktop tools QGIS

Final operational system - Architecture



Final operational system - Architecture



Final operational system - Results

- More than 30000 on board devices confirmed
- National road and railways coverage
- Availability to use European cartography
- National 911 Level Crossing
- System in production environment ready to send Singularity to Car
- Ready to incorporate Infrastructure Managers and Railway Undertakers into the system

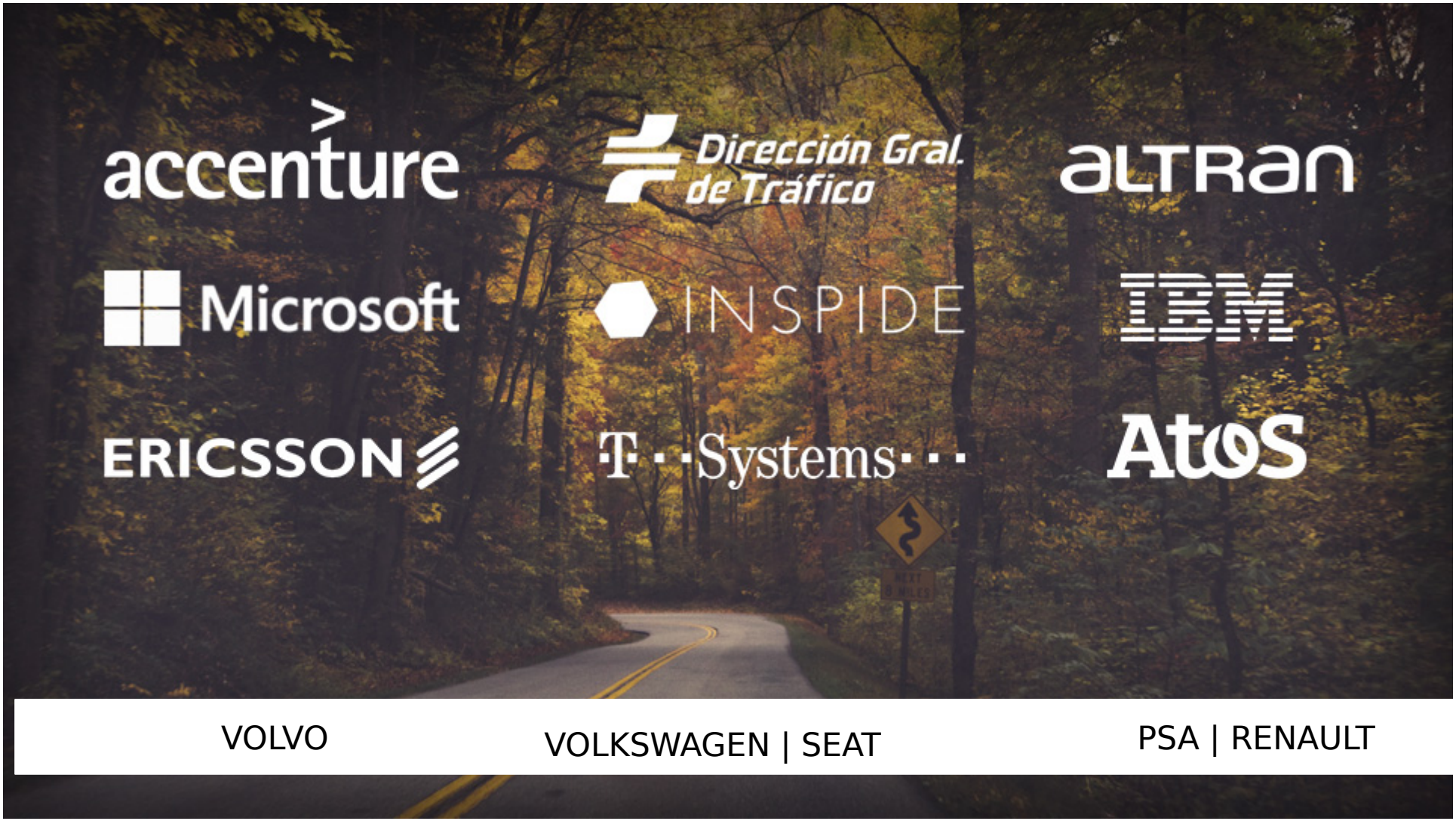
Final operational system - Results

https://play.google.com/store/apps/details?id=com.inspide.comobity&hl=es

https://itunes.apple.com/es/app/comobity/id1040076151?mt=8

Final operational system

Actually contacts with car contructors to include it on connected cars



Next steps

Improve LC location accuracy
Include train location in evaluation process
Involve Infrastructure Managers for a complete integration with their Information Systems
Improve the publication of open data about railways
Spread out the system to vehicle on board
Spread out the system to other countries
Include the logic into DGT 3,0 platform to reach 2,5 M devices

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Level Crossing protection integration into connected car tecnologies

Thank you and improve railways and road safety