



C-MOBILE

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JOSE FERNANDEZ, ANDREA BECERRA
PABLO MEJUTO / CTAG AND
BART NETTEN / TNO
TESTFEST WEBINAR /
4TH NOVEMBER 2019



TESTFEST WEBINAR 2

Co-funded by
the European Union



TESTFEST / Introduction

/ Moderator

/ **Peter Schmitting**

ERTICO, TESTFEST Coordinator

/ Speakers

/ **Pablo Mejuto**

Project Manager at CTAG

/ **Jose Fernandez**

Manager for C2X & Mobility Services at CTAG

/ **Andrea Becerra**

Manager for Cloud Computing at CTAG

/ **Bart Netten**

TNO – Evaluation Manager

TESTFEST / Notes about webinar moderation

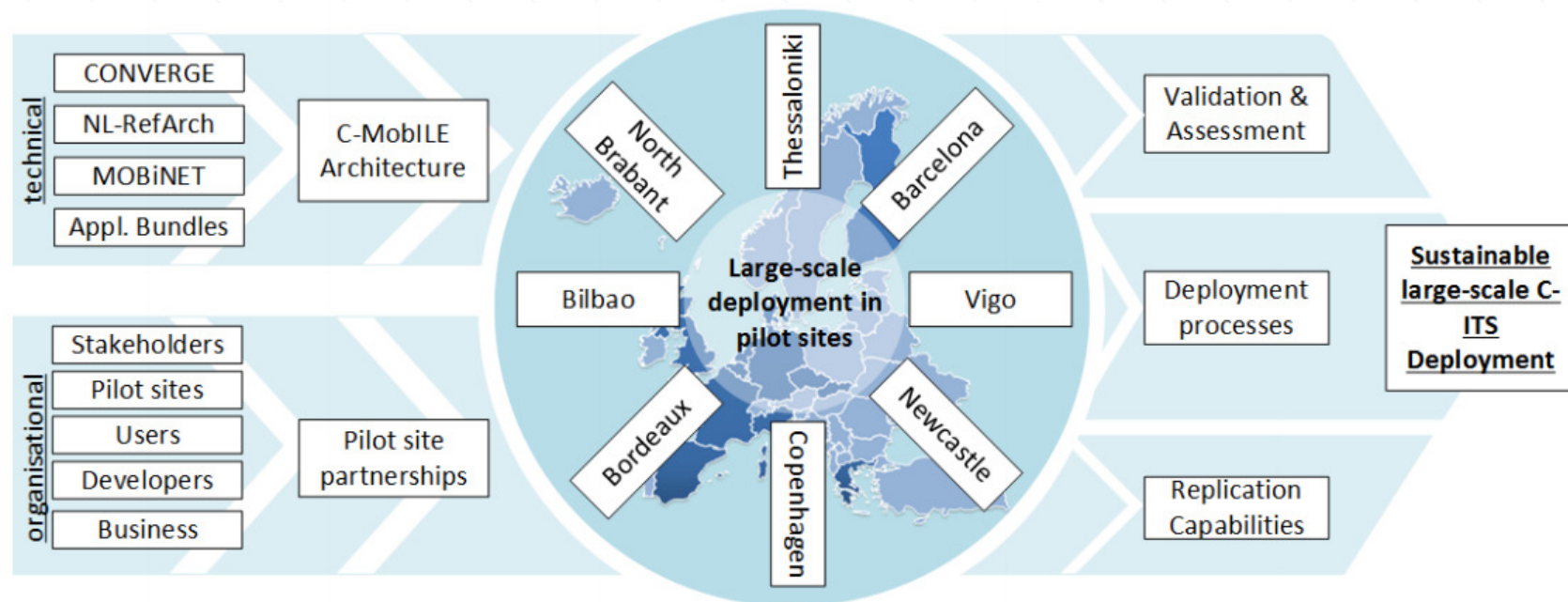
- / All participants are muted during the presentation
- / Participants can “Ask questions”
 - / Use the control panel to write your question during the presentation
 - / Ideally refer to a slide number in your question
 - / The moderator will review your question during the webinar and ask the speakers to answer them
- / Webinar will be recorded
 - / Recorded Webinar will be posted on the C-Mobile website
- / FAQs from the webinar will be captured and posted on the C-Mobile website

TESTFEST / Content of webinar

- / Introduction to C-MobILE (Peter Schmitting)
- / TESTFEST objectives (Peter Schmitting)
- / Where is it? (Pablo Mejuto)
- / Services deployed for testing (Jose Antonio)
- / Communication technologies (Andrea Becerra)
- / Geomessaging platform (Andrea Becerra)
- / Evaluation and file formats (Bart Netten)
- / Programme and schedule (Pablo Mejuto)
- / Questions&Answers (Peter Schmitting)
- / Contacts (Peter Schmitting)

TESTFEST / Introduction to C-Mobile

C-Mobile (Accelerating C-ITS Mobility Innovation and deployment in Europe)



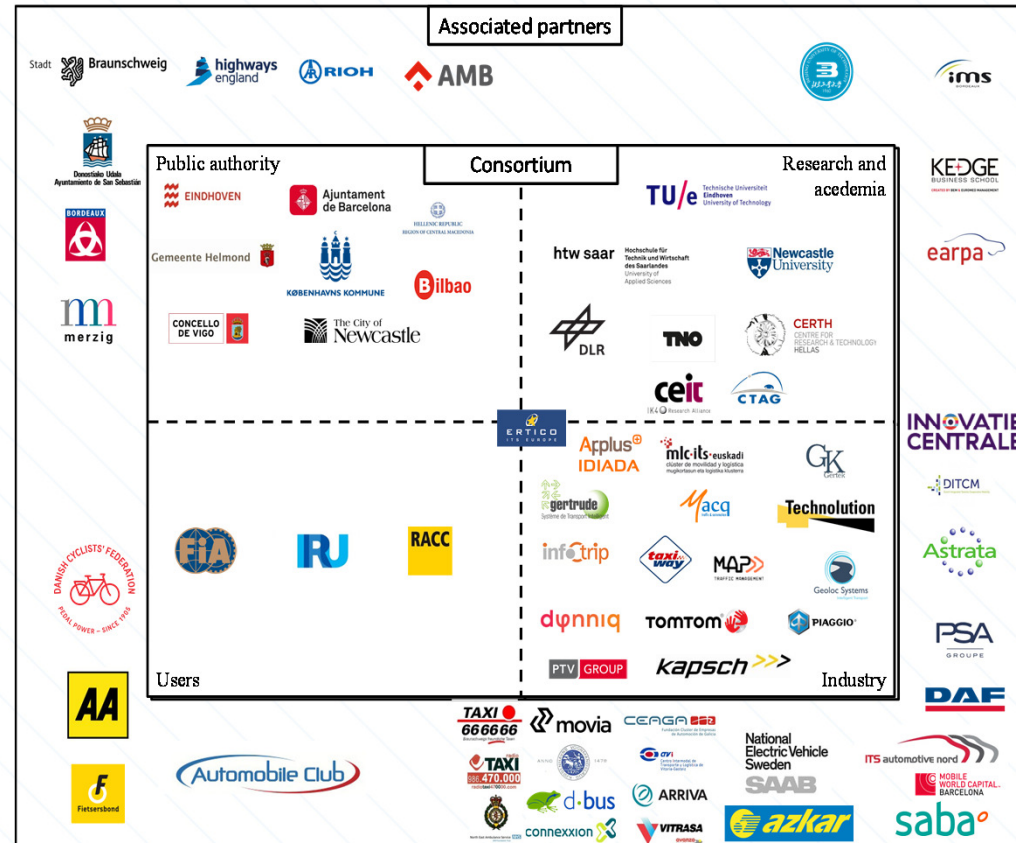
TESTFEST / Introduction to C-Mobile

C-Mobile factsheet

- EU-funded project
Horizon 2020 RIA
Grant Agreement No 723311
- Coordinator
 - Alex Vallejo, Applus+ IDIADA
- Period: 1 Jun 2017 / 30 Nov 2020
- Budget
 - total budget: € 15,059,453.42
 - total EC funding: € 12,575,000.05

TESTFEST / Introduction to C-Mobile

C-Mobile partners



4th November 2019 C-Mobile TESTFEST 2nd Webinar



TESTFEST / C-Mobile C-ITS SERVICES

Bundle 1: Urban efficiency

- Rest time management
- Motorway parking availability
- Urban Parking availability

Bundle 2: Infrastructure-to-vehicle safety

- **Road works warning**
- **Road hazard warning**
- Emergency Vehicle Warning
- Signal Violation Warning
- Warning system for pedestrian

Bundle 3: Traffic efficiency

- Green priority
- **GLOSA) / Time To red - Time To Green**
- Cooperative traffic light for pedestrian
- Flexible infrastructure
- **In-vehicle signage**
- Mode & trip time advice
- Probe Vehicle Data

Bundle 4: Vehicle-to-vehicle safety

- Emergency Brake Light
- Cooperative (Adaptive) cruise control (Urban ACC)
- **Slow or Stationary Vehicle Warning**
- Motorcycle approaching indication
- Blind spot detection / warning (VRUs)

TESTFEST / Objective and expected results

/ Objective

- / To check the actual interoperability of **all C-Mobile devices** intended to be used in the context of the large-scale pilots
- / To check the interoperability of devices from non-C-Mobile participants
- / Prove the correct transmission of service information through ITS-Gr and cellular channels

/ Expected Results

- / C-Mobile information is understood by all participating devices
- / Information from Vigo server is correctly understood by *other* applications

TESTFEST / Where it is?

/ CTAG facilities (2nd & 3rd Dec)

- / Polígono Industrial A Granxa Calle A, parcelas 249-250
E-36475 Porriño (Pontevedra) Spain

- / **GPSCoordinates:** N42° 06.13' W08° 37.05'

/ CTAG Surroundings (2nd & 3rd Dec)

- / 30km from Portugal
- / 120km from Santiago

/ City of Vigo (4th Dec)

- / North west coast of Spain
- / > 300.000 inhabitants
- / Leads the shipbuilding sector in Spain
- / PSA factory and suppliers (Tier 1 and 2)
- / Connections via airport and touristic seaport



TESTFEST / Start of the TESTFEST

/ CTAG Facilities

- / Polígono Industrial A Granxa Calle A, parcelas 249-250
E-36475 Porriño (Pontevedra) Spain
- / GPSCoordinates: N42° 06.13' W08° 37.05'

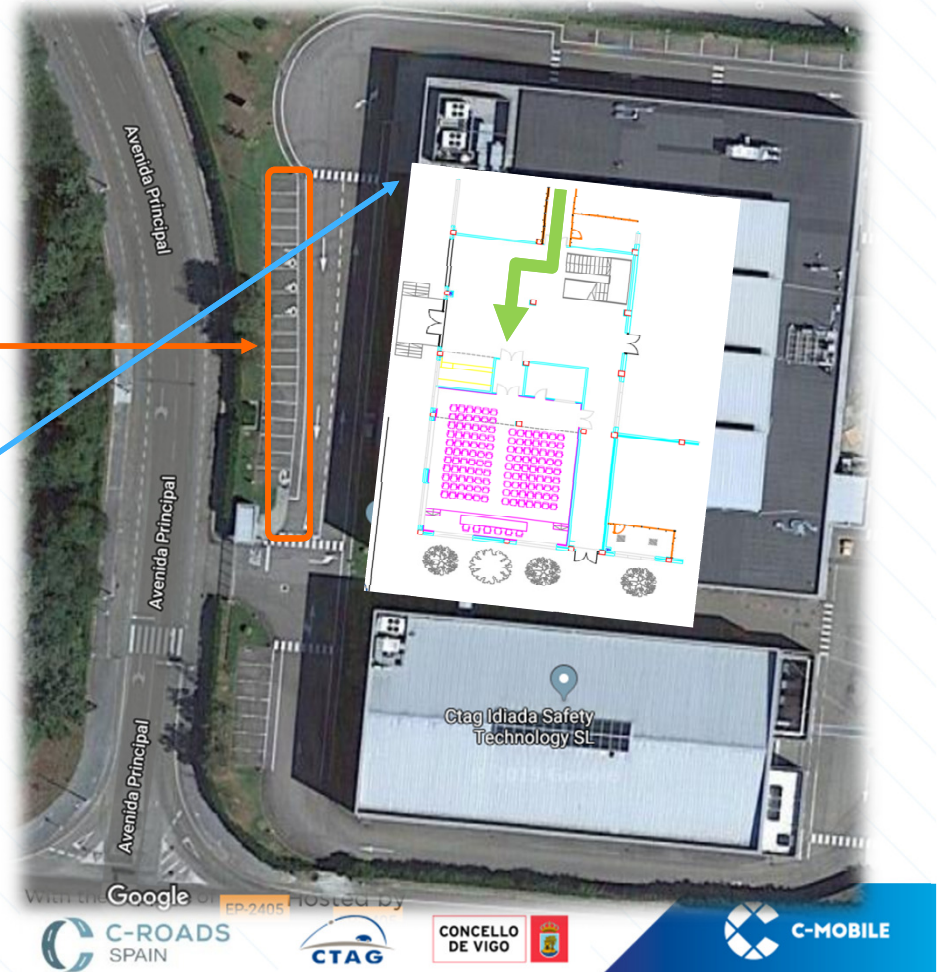
/ Parking slots

- / Reserved for participants
- / Limited

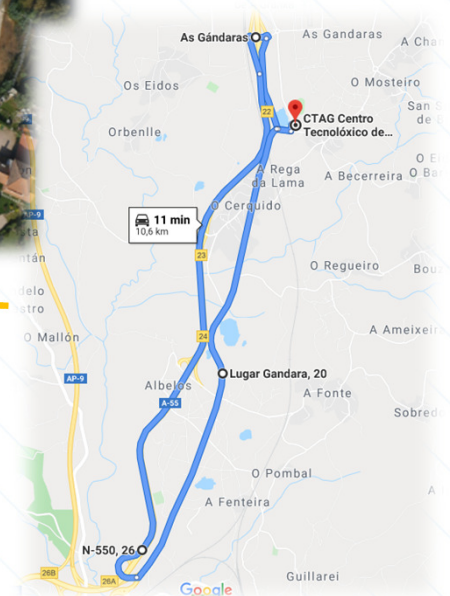
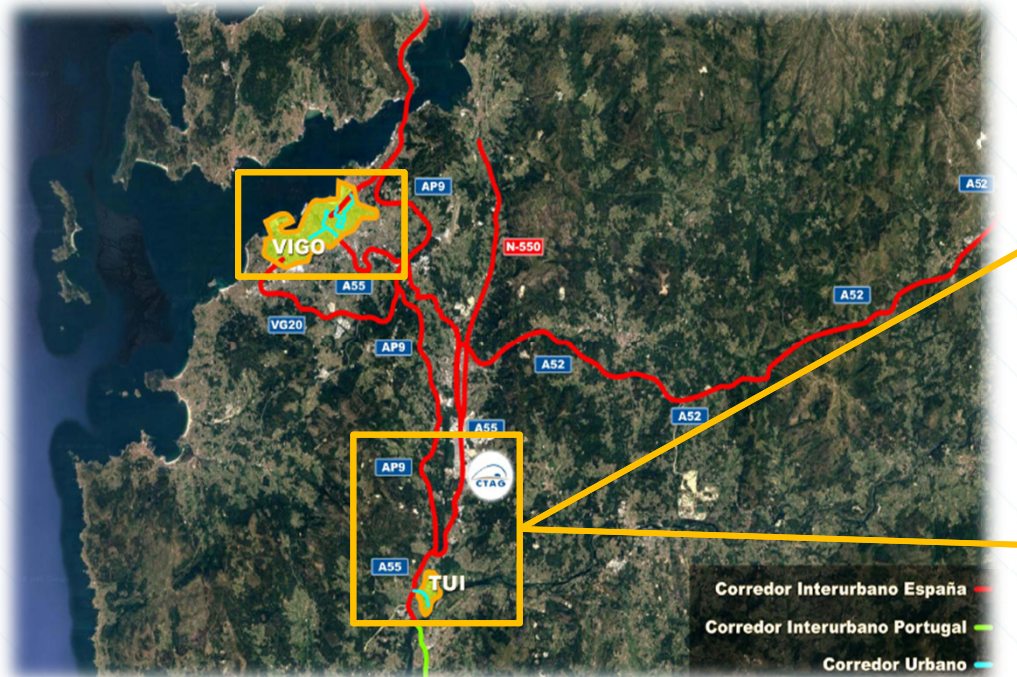


/ Process at your arrival (see map)

- / Park your car in the indicated area.
- / Go to reception → Register
- / Go to the Briefing area



TESTFEST / Testing areas



/ Siscoga Corridor

- / >150 Km, Urban (Vigo), Interurban roads and motorways (AP9, A52, A55)
- / 120 RSUs

TESTFEST / Testing areas - CTAG Test Track



/ Services

- / GLOSA (Real events, Controlled environment)
- / RHW (Simulated events)
- / RWW (Simulated events)

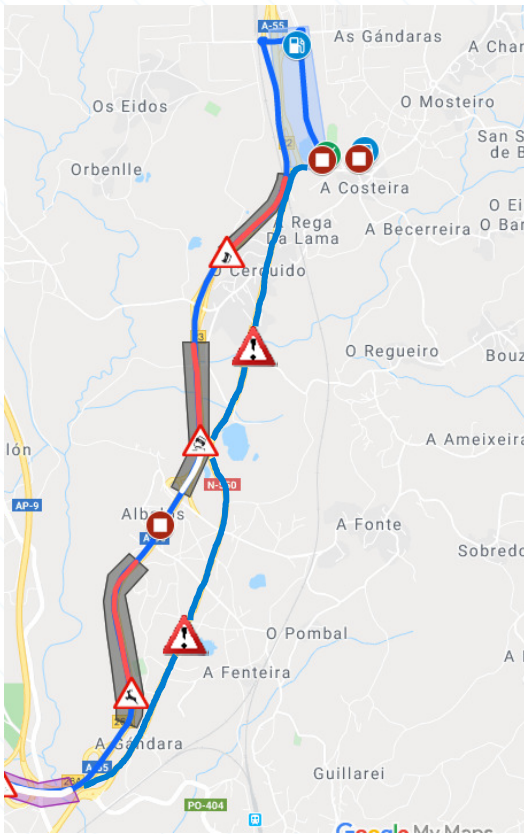
/ Exterior ring for testing

- / 1 cooperative traffic light
- / 1 or 2 warnings

/ Access protocol

- / Will be explained each day in the briefing session
- / All participants need to sign up an **Access form** in advance
- / Safety vest is mandatory!
- / Low speed (<40km/h)!

TESTFEST / Testing areas - CTAG Surroundings



/ Services

- / RHW (Simulated events)
- / RWW (Simulated events)
- / SSVW (Simulated events)
- / IVS (Simulated events)

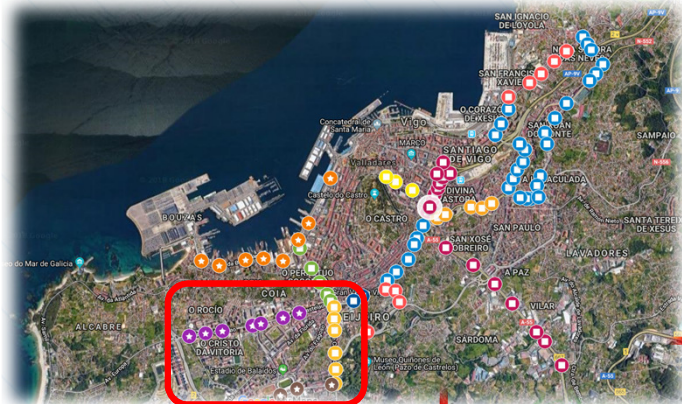
/ Type or roads

- / Interurban road (N-550)
- / Motorway (A-55)

/ Route

- / CTAG – A55 – N-550 - CTAG
- / CTAG - N-550 -A55 - CTAG

TESTFEST / Testing areas - Vigo City

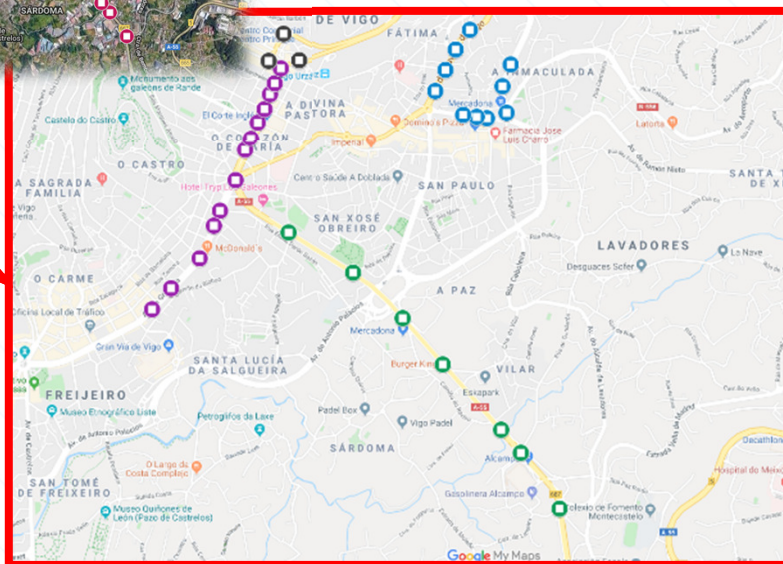


/ Services

- / GLOSA (Live conditions)
- / RHW (Live conditions)
- / RWW (Live conditions)

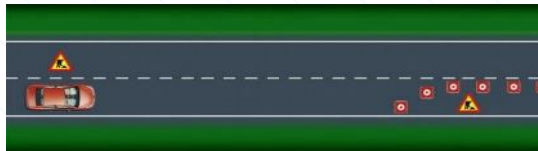
/ Route

Avenida de Madrid – Plaza America-
Avenida de Madrid

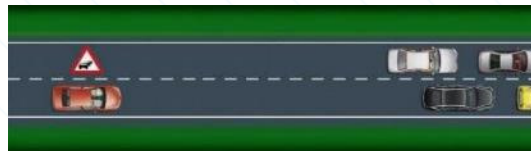


TESTFEST / Services deployed for testing

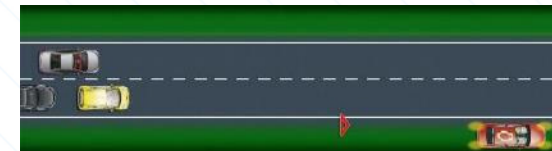
Road Works Warning (RWW)



Road Hazard Warning (RHW)



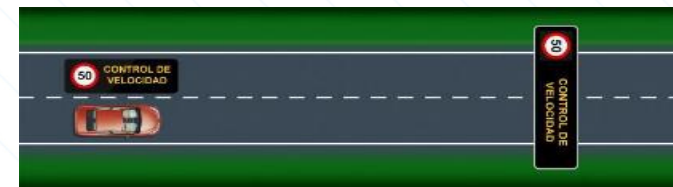
Slow or Stationary Vehicle Warning (SSVW)



Time To Red/Time To Green (TTR/TTG)



In Vehicle Signage (IVS)



TESTFEST / Services deployed for testing

/ Description

Provision to road users of information about a zone on the road that contains, at some point, the neutralization of part of a lane or a lane closure (but without road closure) due to a planned mobile work site.

/ Objective/Benefits

Main objective is to get a more attentive and adjusted driving while approaching and passing a work zone or road operator vehicles in operation by providing in-car information and warnings about road works, changes to the road layout and applicable driving regulations, helping to avoid sudden braking or steering / swerving manoeuvres, thereby improving traffic safety and reducing the severity of accidents.

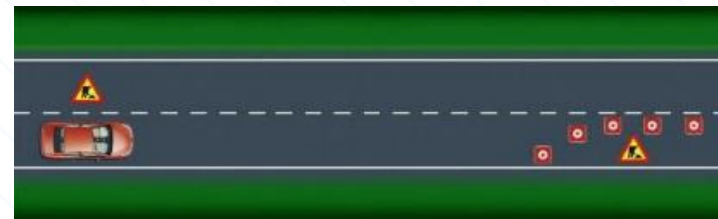
/ Communication channels

ETSI ITS G5 and cellular

/ Test environment

CTAG surroundings

Road Works Warning (RWW)



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TESTFEST / Services deployed for testing

/ Description

Provision to road users of information related to a series of potentially hazardous events on the road, where the approaching road users gets information and therefore warning about the location and type of hazard they are approaching.

/ Objective/Benefits

Main objective is to get a more attentive driving while approaching and passing a hazardous location by providing in-car information about these hazards, including location and type of hazard, remaining distance to location, duration of the events creating the hazard and lane and speed advice, minimizing risk to collisions/accidents then enhancing overall road safety and resulting in less incidents / injuries / fatalities amongst road users.

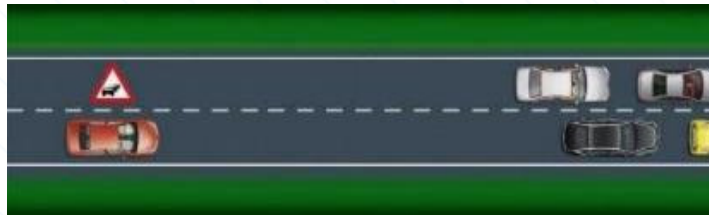
/ Communication channels

ETSI ITS G5 and celular

/ Test environment

CTAG surroundings

Road Hazard Warning (RHW)



TESTFEST / Services deployed for testing

/ Description

Provision to road users of information related to slow or stationary/broken down vehicles ahead which may represent obstacles in the road.

/ Objective/Benefits

Main objective is to get a more attentive driving while approaching to a zone where slow or stationary/broken down vehicles are detected by providing in-car information about these vehicles, minimizing risk to collisions/accidents (mostly rear-end) the enhancing overall road safety and resulting in less incidents / injuries / fatalities amongst road users.

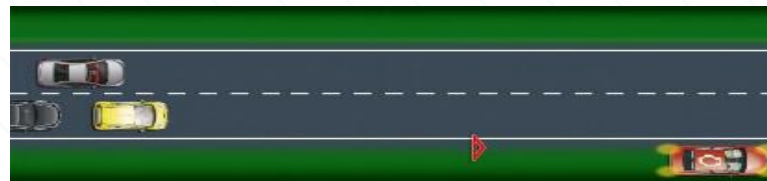
/ Communication channels

Cellular

/ Test environment

CTAG surroundings

Slow or Stationary Vehicle Warning (SSVW)



TESTFEST / Services deployed for testing

/ Description

Provision to road users approaching and passing traffic light controlled intersections, on the current phase as well as upcoming phase(s) and the moment these are expected to start and end.

/ Objective/Benefits

Main objective is to enable road users to adapt their approach speed due to left time till next phase of the incoming traffic light then minimizing sudden stops, acceleration and deceleration for better safety and sustainability.

/ Communication channels

ETSI ITS G5 and celular

/ Test environment

City of Vigo and CTAG Test Track

Time To Red/Time To Green (TTR/TTG)



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TESTFEST / Services deployed for testing

/ Description

Provision to road users of information related to actual, static or dynamic (virtual) road signs via in-car systems (virtual VMS or free text).

/ Objective/Benefits

Main objective is to increase attentive driving by augmenting awareness for road signage as they are provided directly in the vehicles where it can potentially be displayed throughout its entire validity, targeting information to specific vehicle types or to individual vehicles.

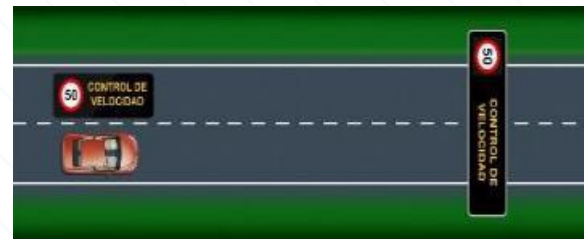
/ Communication channels

ETSI ITS G5 and celular

/ Test environment

CTAG surroundings

In Vehicle Signage (IVS)



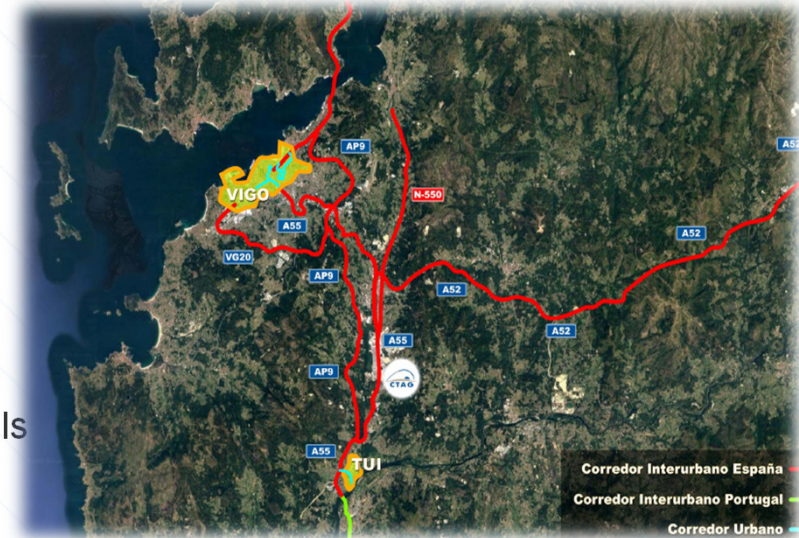
TESTFEST / Communication technology

/ ITS-G5

- / SISCOGA Corridor
 - / Urban: City of Vigo
 - / CTAG Surroundings
 - / CTAG Test track

/ Cellular

- / CTAG Geomessaging Platform: Geoserver channels



TESTFEST /Connection using ITS-G5

/Standards for facilities and security layers

CTAG Test Track & Test Circuit	Vigo City
DENM --> ETSI EN 302 637-3 v1.2.1 CAM --> ETSI EN 302 637-2 v1.3.1 MAPEM/SPATEM/IVIM --> ETSI TS 103 301 v1.1.1	DENM --> ETSI EN 302 637-3 v1.3.1 CAM --> ETSI EN 302 637-2 v1.4.1 MAPEM/SPATEM/IVIM --> ETSI TS 103 301 v1.2.1 Security based on ETSI TS 102 941 1.3.1 and ETSI TS 103 097 1.3.1
DENM --> ETSI EN 302 637-3 v1.2.1 CAM --> ETSI EN 302 637-2 v1.3.1 MAPEM/SPATEM/IVIM --> ETSI 103 301 v1.1.1 Security based on Authentication and Authorization by JWT (JSON Web Token)	DENM --> ETSI EN 302 637-3 v1.3.1 CAM --> ETSI EN 302 637-2 v1.4.1 MAPEM/SPATEM/IVIM --> ETSI 103 301 v1.2.1 Security based on Authentication and Authorization by JWT (JSON Web Token)

→ Message Profiling according to C-Roads release 1.3

TESTFEST /Connection using ITS-G5

/Other relevant standards and considerations for ITS G5

/ Access layer

- / ETSI EN 302 571 V2.1.1 (2017-02) - Intelligent Transport Systems (ITS); Radiocommunications equipment operating in the 5 855 MHz to 5 925 MHz frequency band
- / ETSI EN 302 663 V1.3.0 (2019-05) Intelligent Transport Systems (ITS); Access layer specification for Intelligent Transport Systems operating in the 5 GHz frequency band

/ Networking and Transport layer

- / ETSI EN 302 636-4-1 V1.3.1 (2017-08) Intelligent Transport Systems (ITS); Vehicular Communication; Geonetworking; Part 4 Geographical addressing and forwarding for point-to-point and point-to-multipoint communication; Sub-part 1: Media-Independent Functionality
- / ETSI EN 302 636-5-1 V2.1.1 (2017-08) Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 5:Tr Transport Protocols; Sub-part 1: Basic Transport Protocol

-> **Message Profiling according to C-Roads release 1.3 (also valid for cellular)**

/ -> Info to be provided to use PKI

- / CanonicalID: Unique equipment identify (16 characters max.)
- Public Technical Key: Public Key (Hex Dump of SubjectPublicKeyInfo as defined in RFC 5480)
- Key Curve: Public key curve type (not mandatory)
- Permissions: AID, SSP, ...

TESTFEST / Connection using cellular technologies

/ Connection with cellular communication (Andrea Becerra)

/ Geomessaging platform

/ Registration

/ Geoserver

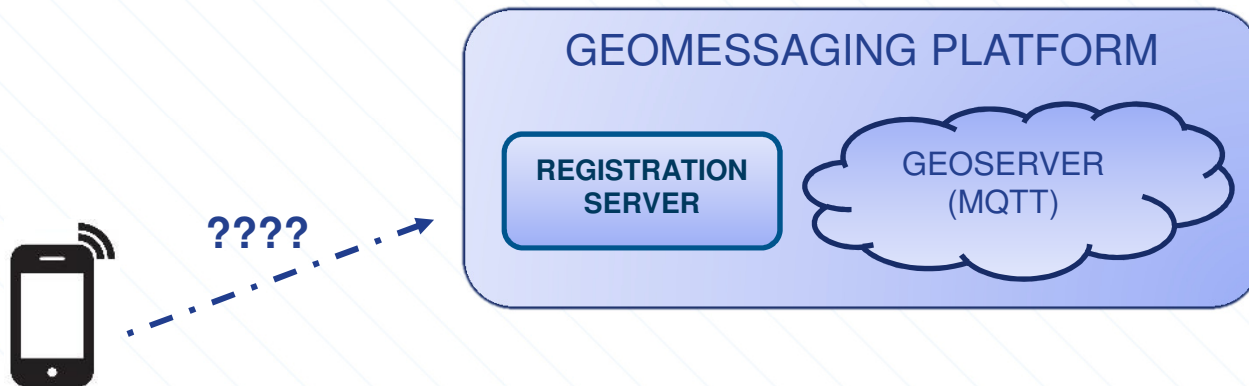
/ Hardware requirements

/ Software requirements

TESTFEST / Connection using cellular technologies

/ Geomessaging platform

- / Geomessaging platform provides the **cellular communication** to get access to the C-ITS Services and information.
- / It is deployed in a CTAG server and it is compound of two **main parts**:
 - / **Registration Server**: It validates the device credentials to allow access to the Geoserver messages by providing a token.
 - / **Geoserver**: MQTT broker where messages are published in the corresponding channels. The client applications will subscribe to the proper channels.



TESTFEST / Connection using cellular technologies

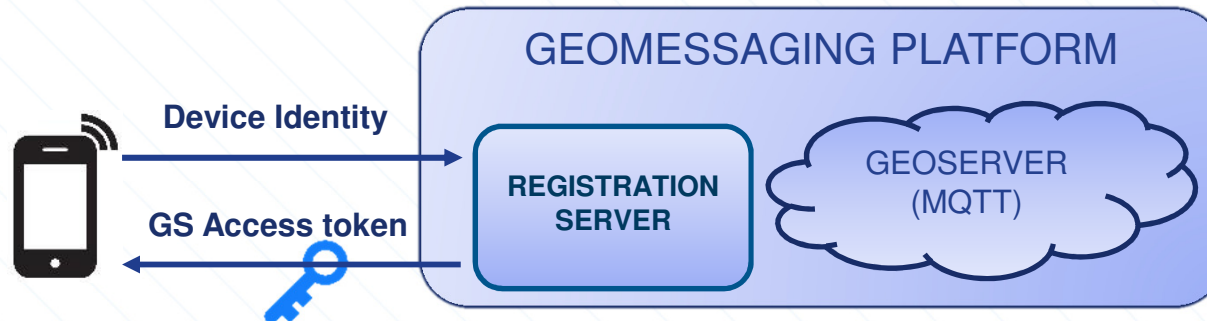
/ Registration Server

/ C-MOBILE members

/ Will bring their own application as it is interoperable with CTAG's Registration Server.

/ Others participants with no client app

/ CTAG can provide the latest client .apk to install in an android device.

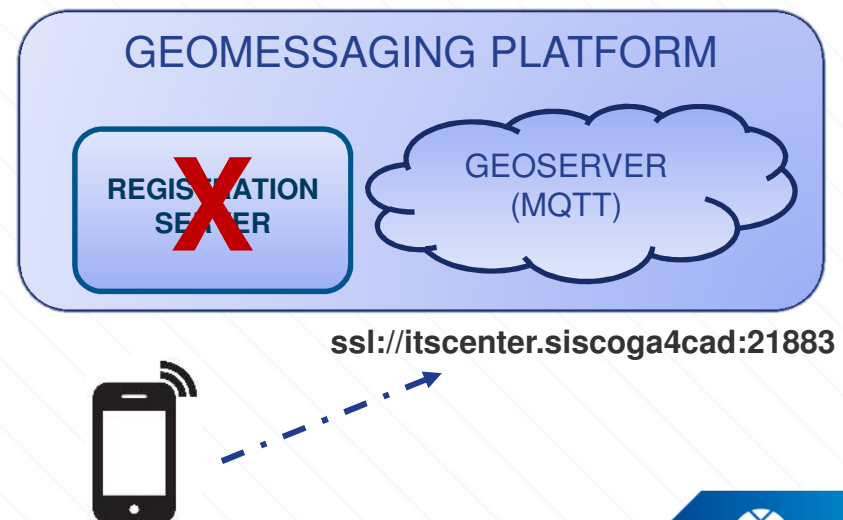


TESTFEST / Connection using cellular technologies

/ Geoserver connection

/ Others participants with their own client app

- / Registration steps will be omitted, and a user id and password will be provided to connect straight to the Geoserver.
- / Broker address: **ssl://itscenter.siscoga4cad:21883**
- / User: **testfest** pass: **testfest**



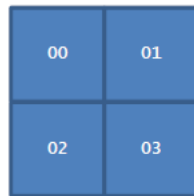
TESTFEST / Connection using cellular technologies

/ Geoserver quadtree

/ Geoserver topics to subscribe to, will follow the structure: `its_center/<message_type>/<quadtree>/`

/ **Quadtree:** It determines the zone that the device will subscribe to. It acts as a geographical filter.

The size of a quadtree (tile) is determined by the zoom level. Zero level encompasses the whole world. Each additional zoom level splits the tile into four new tiles.



Zoom 12:

CTAG and surroundings: `its_center/denm/0/3/1/3/3/2/2/1/3/3/2/3/#`

Vigo City: `its_center/denm/0/3/1/3/3/2/2/1/3/3/2/1/#`

A tile in a quadtree is represented by a string of numbers, where each number identifies one quarter of a tile split into four new ones.

References: https://en.wikipedia.org/wiki/Tiled_web_map

<http://www.maptiler.org/google-maps-coordinates-tile-bounds-projection/>

TESTFEST / Connection using cellular technologies

/ Geoserver topics

/ Geoserver topics to subscribe to, will follow the structure:
its_center/<message_type>/<quadtree>/

/ Zoom 12:

Vigo city: `its_center/denm/0/3/1/3/3/2/2/1/3/3/2/1/#`

CTAG surroundings: `its_center/denm/0/3/1/3/3/2/2/1/3/3/2/3/#`

/ **Message types: denm, cam, map, ivi, spat**

/ * For **spat** messages, it is necessary to add the **intersection id** at the end of the topic:

`its_center/spat/<id>`

CTAG test track: `its_center/spat/802`

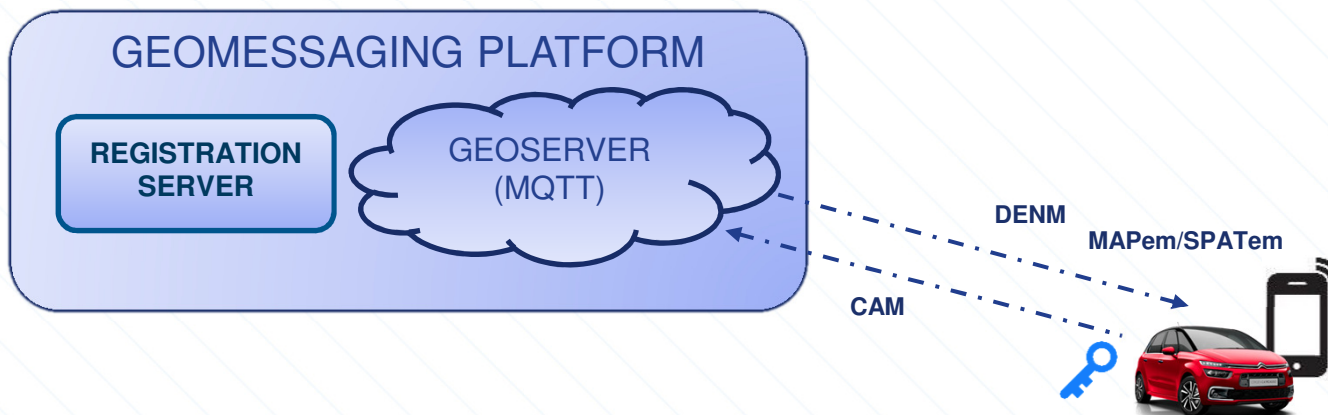
** Intersection ids for testing GLOSA in Vigo city can be provided for who is interested in.*

/ **Quadtree:** It determines the tile (zone) the device will subscribe to.

TESTFEST / Connection using cellular technologies

/ Geoserver

- / Devices already registered (that got a **valid token**), will be able to **access** the **geoserver channels**.
- / All devices will be considered as **common road users**, what means that they won't have special permissions.
 - / **publish** CAM messages
 - / **subscribe** to MAPem/SPATem/IVIm/DENM/CAM messages.
- / Special permission are for emergency Vehicles, pólice, etc, ... who are able to not only Publish CAM, but also other cooperative messages



TESTFEST / Connection using cellular technologies

/ Geoserver denm & ivi topics

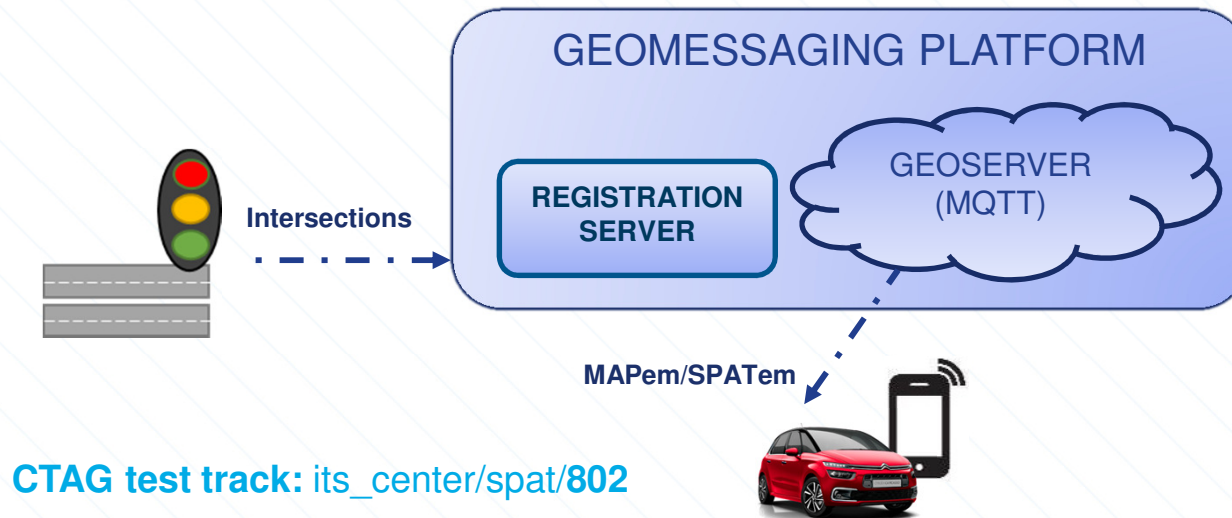
- / **Traffic events** such as Traffic Jams, Road Works, or any **Road Hazard** in general, are gathered from the **Traffic Management Centers**: DGT for Interurban events, and Vigo City Council for Urban Traffic events.
- / **Events** are **encoded** and **published** by the Geoserver as **DENMs or IVIs** (to the ETSI Standard)



TESTFEST / Connection using cellular technologies

/ Geoserver MAP & SPATS topics

- / **Intersections** information is received by the devices as MAP (Static) and SPAT (Dynamic) messages



TESTFEST / Connection using cellular technologies

/ Hardware requirements

Cellular communications to Geomessaging platform

- / To install CTAG C-Mobile client application: Android device with minimum android version Nougat 7.0
- or
- / Android device with a client app installed.

TESTFEST / Connection using cellular technologies

/ Software requirements

- / **C-Mobile** client applications must fulfill the requirements related to:
 - / Registration server: latest changes agreed in week 44
 - / Geoserver messages exchange: No changes for months

TESTFEST / Validation of Interoperability

/ Objective

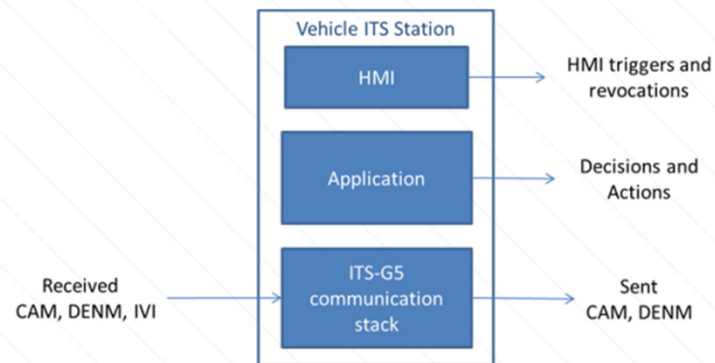
- / Quantitative checks that devices are interoperable with RSU and Geomessaging platform

/ Interoperable

- / C-Mobile information is understood by all participating devices
- / Prove the correct transmission of service information through ITS-Gr and cellular channels

/ Analysis of log data

- / Warnings and information on the HMI
- / Event detection & interpretation by application
- / Received messages via ITS-G5 or cellular communication



TESTFEST / Log Data

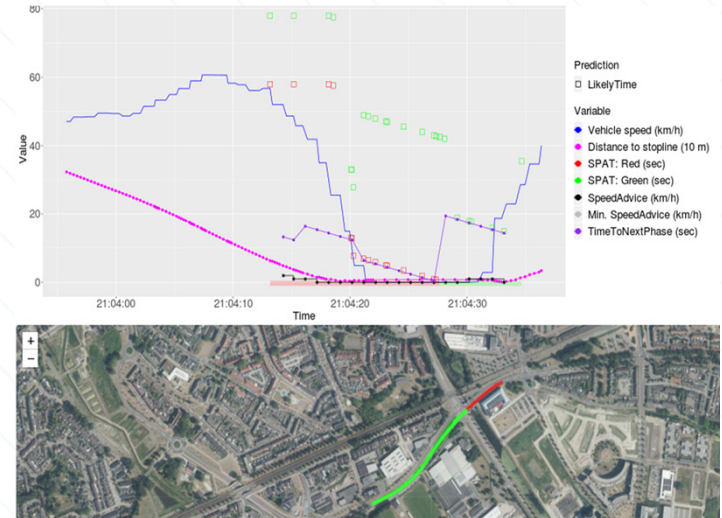
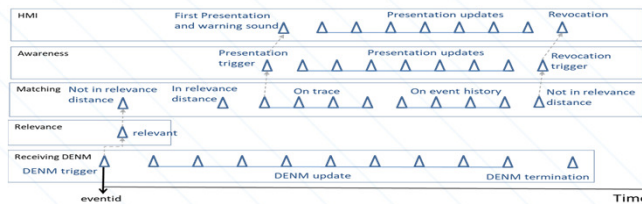
/ Upload log data to Central Test Server (CTS)

- / sftp: to partner folder
- / Optional to non-C-Mobile participants

/ C-Mobile log format version 0.7.10

- / All analysis results will be shared with participants
- / Specifications on <https://c-mobile-project.eu/testfest/>
- / Specifications on <https://ada1.tno.nl/logformats>

- / Same as used in  



TESTFEST / Programme and schedule

Hour	Monday December 2 (CTAG facilities)	Tuesday December 3 (CTAG facilities)	Wednesday December 4 (City of Vigo) → (CTAG facilities)
08:30	Registration	Site open at 08:30	Site open at 08:30
09:00	Welcome, briefing, Safety instruction	Briefing Safety instruction	Briefing
10:00	Test setup	Test session 3	Test session 5
11:00	Test session 1		
12:00	Test session 1		Final de-briefing and wrap up
13:00	Lunch break	Lunch break	Site closure at 13:00
14:00	Test session 2	Test session 4	
15:00			
16:00			
17:00	De-briefing	De-briefing	
18:00	Site closure at 18:00	Site closure at 18:00	

TESTFEST / Questions&Answers

- / Do we have to be present Monday till Wednesday?
 - / No. The safety instruction on Monday, December 2 however is mandatory. Plus we strongly advise to take part in the desk and lab-testing on Monday before entering open road testing (Monday afternoon - Wednesday).
- / We want to participate in the TESTFEST to test with our On Board Unit (OBU) and/or mobile device(s). Is it mandatory to bring our own test vehicle as well?
 - / We cannot provide test vehicles for participants. Participants can rent vehicles at local rental companies. However, if you come with OBU/mobile device only, you have to bring along all the needed equipment such as antenna, cables, adaptors, power supply, etc.
- / Is it mandatory to share out test data (like log files)?
 - / No. C-MOBILE partners will however share their data. Any data from other participants will be very much appreciated. Logging specifications will be provided.

TESTFEST / Contacts

/ For contact

/ **Overall organization and test site**

/ p.schmitting@mail.ertico.com

/ pablo.mejuto@ctag.com

/ **Services, Its-G5/Cellular communication, server access**

/ andrea.becerra@ctag.com

/ jose.ternandez@ctag.com

/ **Result evaluation, trace file formats**

/ bart.netten@tno.nl

/ Further information

/ C-Mobile: <http://c-mobile-project.eu/testfest/>



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THANK YOU

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