Dublin — June 20-23, 2022

# Supporting 5G automated mobility services at European cross borders

Roberto Fantini – TIM Maurizio Cecchi – Institute PIIU

**GLOBAL VISION:** 

IoT TODAY AND BEYOND



### **Project Overview and Objectives**

The Bologna-Munich Corridor: ~600 Km across IT-AT-DE, interconnecting two-major industrial poles

Elaborating and evaluating the **benefit of 5G and** related Services for Automated Driving in real-world conditions

Ensuring Service Continuity in different cross-border scenarios, enabling CCAM and SAE Level 4

Assessment of essential 5G KPIs for vehicle and MEC-based services to pave the road for European Mobility



#### **Automated Vehicles Use Cases**

**Veek** Dublin — June 20-23, 2022



#### **IN-LANE MANEUVERS**

Red Car intends to change lane to exit









Red Car decides to stay in lane and replan the exit.



## **5G CARMEN pilots**

Dublin — June 20-23, 2022

2 preparatory local pilots: Munich, Trento

2 target cross-border pilots: Italy- Austria (Brenner), Austria-Germany (Kufstein)

Integration and functional tests on both local pilot and cross-border sections completed

Demonstration in cross border scenarios and KPI evaluation ongoing







#### **5G Coverage along the corridor** Italian coverage and Brenner Pass

Dublin — June 20-23, 2022

TIM has established 5G coverage along the A22 Brenner highway by installing 5G base stations in two sites. Brennero Pass

Along A22 highway in the area between the toll stations of San Michele all'Adige and Egna (near Trento).

Both sites are part of the **TIM commercial 5G network** 

Non Stand Alone (NSA) network architecture (Option 3x)

80 MHz of 5G Spectrum @3.7GHz.

**Dedicated APN** with dedicated connectivity to the MEC platform installed in the TIM laboratories





#### **5G Coverage along the corridor** German and Austrian coverage at Kuffstein



Magenta Austria and Deutsche Telekom have launched their 5G NSA networks in 2019.

From the section A93 north of the **border Kiefersfelden/Kufstein**, over the A12 to the city of **Innsbruck**, and along the A13 **up to the Brennerpass/Brennero**, several sections close to cities and towns **already support 5G NR coverage** 

NSA mode, either in **3.x GHz** (Austria) or refarmed **2.1 GHz** bands (Germany).



The **deployment of 3.x GHz 5G NR** sites was completed in 2021 **for Kiefersfelden/Kufstein** (one site each at the border) **and the Brennerpass** (one site).

#### Cross-border improvements in 5G-CARMEN Fast Network Reselection

## The cross-border network situation will often remain separated, thus hardly seamless

Preliminary measurements at the borders showed connectivity interruptions between 11 to 96 sec

5G-Carmen introduces fast network re-selection

- Cell neighbor relations with "foreign cells" and RAN cell "Release with Redirect" procedures
  -> indicating (preferred) foreign cells directly (discarding lengthy frequency scan)
- The session interruption is minimized to <1s in laboratory tests and ~3s in field test

Feature available DE<->AT, AT->IT



Dublin –

**o** Week

June 20-23, 2022



**Local Break Out (LBO)** eliminates the **Home Routing problem** by delegating routing directly to the Visited Packet Gateway (PGW)

Although **defined at the 3GPP level**, is currently **not present in commercial roaming agreements** as many of the following aspects **are** not defined, that is:

#### **Charging procedures**

**Access Point Name (APN) harmonization** 

In the scope of the **5G-CARMEN** project, **LBO** in roaming is currently being implemented but with limitations in terms of APN, charging and scalability (limited to a few subscribers).



#### Latency comparison between 5G-CARMEN SIM and traditional SIM



#### Multi-Access Edge Computing (MEC)

Dublin — June 20-23, 2022

**Edge cloud instances** have been **deployed** in **all three countries** for the 5G-CARMEN project: one in Turin, one in Vienna and one in Munich.

- The three MECs host the message brokers and service instances for the trialed use cases and are interconnected to handle properly cross-border scenarios.
- MEC services and resources are orchestrated and managed through a secure Edge Orchestration (EO) platform.





## Dedicated APN has been used with optimized routings to reach the MEC platform



Latency measurement performed in 4G coverage



Dublin — June 20-23, 2022

## Thank you!

**Find more:** https://5gcarmen.eu/

