5G for CAM @ Cross-border Corridors:
Challenges towards Deployment

5G-MoBiX Workshop – PT-ES Cross-border Corridor

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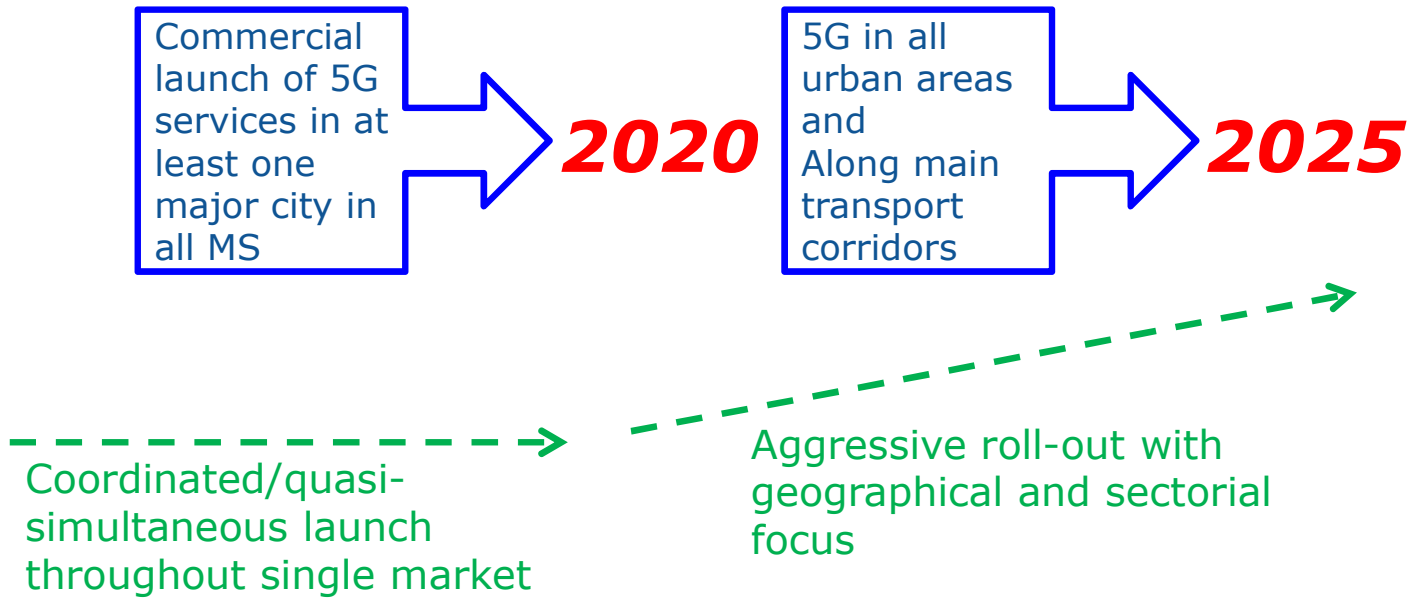
5G FOR CONNECTED AND AUTOMATED MOBILITY

5G Action Plan

- *Coverage of major transport corridors (not only road!) by 2025*



First 5G for CCAM Call

- *ICT-18 call on 5G for cooperative, connected and automated mobility was launched in 2017*
- *The objective was to identify the problems and barriers and provide a blueprint towards* ***accelerating the deployment of 5G for CAM in cross-border scenarios, and in general in areas where there would be no business case and therefore deployment would not happen, or where there are identified mild market failures and therefore deployments risk being substantially delayed****.*

3 projects launched in Nov 2018

Cross-border corridors:

- *5GCroCo Metz-Luxembourg-Merzig(-Saarbrücken) corridor (FR-LU-DE)*
  - **https://5gcroco.eu**
- *5G-CARMEN Brenner corridor (DE-AT-IT)*
  - **https://www.5gcarmen.eu**
- *5G-MoBiX Porto, PT to Vigo, ES corridor plus Thessaloniki, EL to Istanbul, TU corridor*
  - **https://www.5g-mobix.com**

➢ *quite distinct scenarios!*

Combined budget of €63M
Covering over 1000 km of highways
Crossing 8 borders

OPEN ISSUES

Technological, but not only…

Objective

- *Seamless roaming of CAM services, on top of other (including eMBB) data services*

- *This is a different kind of roaming!*
  - **Best-effort is NOT enough!**

- *And it comes with a price!!!*

➢ *C-V2X, together with D2D, to save lives, as well as to provide relevant Mobility services, on top of advanced eMBB and IoT services*

Coverage

- *Uninterrupted coverage of sparsely populated areas to deliver high data rate (~Mbit/s per vehicle), URLLC (0.1-1 ms) -type services will be **extremely expensive**, requiring dense deployment of cells, and it is difficult to see return on investment*
  - **Shared infrastructure?**
  - **National Roaming?**
- *In any case, it will require fibre infrastructure along at least the major highways!*
  - **Gigabit Society package, 2017**

Real-time services

- *Critical CAM services require real-time connectivity and this is not possible with the majority of current deployments*
- *Considerable investments will be required*

Challenges towards deployment in Cross-border Corridors

- *Technological (5G Radio, Core and MEC, 3GPP releases and equipment timelines; Road infrastructure instrumentation and ITS C&C; Vehicle equipment);*
- *Business models (Telco MNOs vs Automotive OEMs vs Road Operators);*
- *Legal and regulatory (from GDPR to access to data);*
- *Security, reliability, availability and liability.*

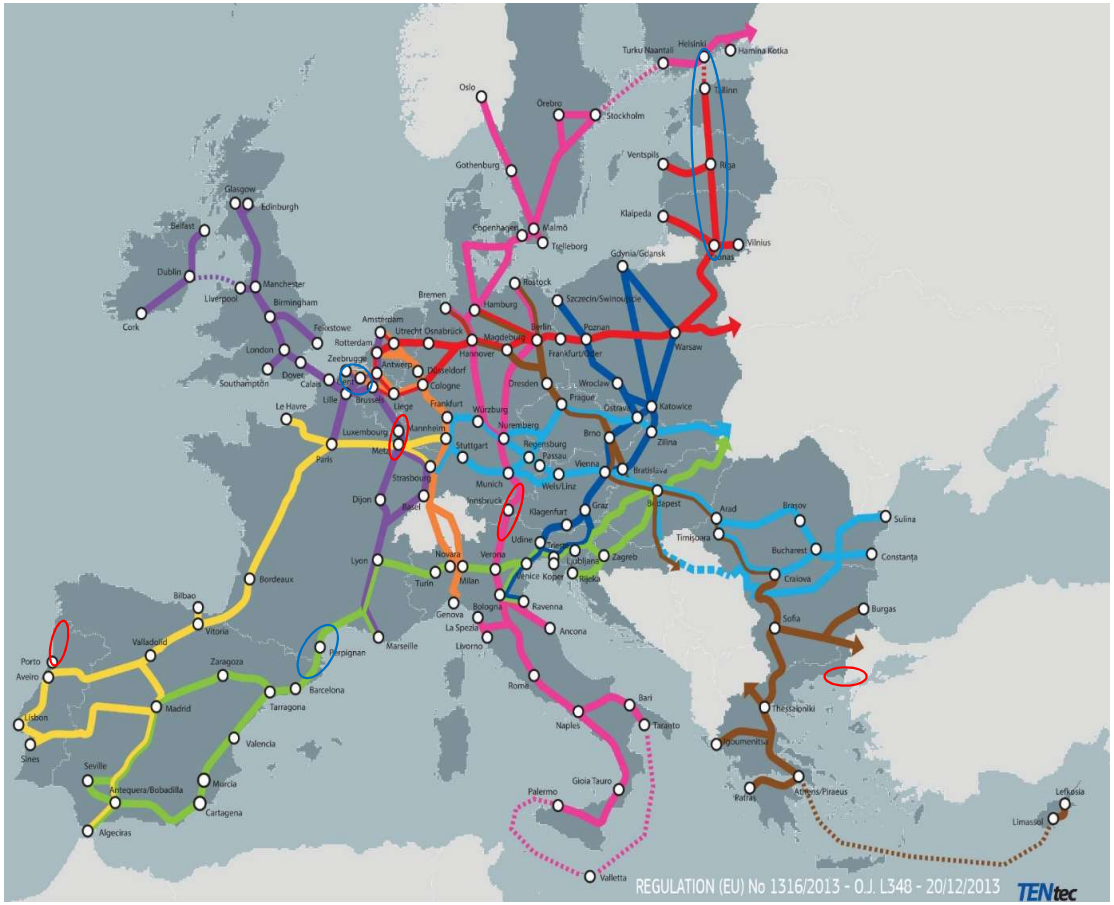
Second 5G for CAM call

- *ICT-53 was launched in 2020, aiming both at **automotive and rail** cross-border corridors*

- *4 new projects to be launched in Sep 2020 (~40M€)*

EU-funded Cross-border Corridors

>100M€



European Commission

5G CROSS-BORDER CORRIDOR DEPLOYMENT

CEF Digital 2021-2027

Third Mobility Package

CAM Communication 17 May 2018

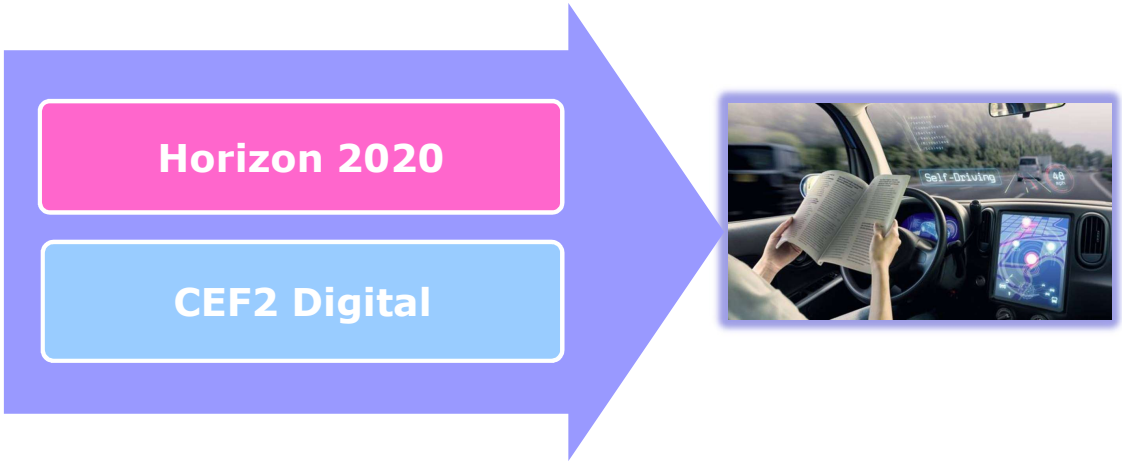
- To make Europe a leader in the deployment of CAM

- Objectives of public interest:
  - Enhanced road safety
  - Lower transport emissions
  - Reduced congestion

- Work with Member States and stakeholders for large-scale testing and pre-deployment of 5G cross-border corridors

EU funding of 5G corridors

From large-scale testing and pre-deployment…



… to large-scale deployment

Connecting Europe Facility - Digital

- *The European Commission proposed, in the context of the preparation of the next **Connecting Europe Facility Digital** (CEF Digital), a major **public financing support** action **for accelerating private investments** in 5G infrastructure along highways known as **"5G Corridors"**, intended to enable Connected and Automated Mobility solutions.*

- *It is expected that public funding for the **5G corridors** will amount to a significant part of the €3 billion requested by the Commission for CEF Digital.*

STRATEGIC DEPLOYMENT AGENDA

Automotive

5G Strategic Deployment Agenda

- *The 5G PPP partnership board has tasked the **5G PPP automotive working group**, in cooperation with key stakeholders such as the GSMA, 5GAA, 5G PPP V2X projects and 5G PPP cross-border projects, to develop a common **Strategic Deployment Agenda** (SDA), which defines the **roadmap** with implementation recommendations of **deployment and geographical role out** towards establishing pan-EU 5G Corridors for for Connected and Automated Mobility (CAM)*

https://5g-ppp.eu/

Potential Societal Benefits

Long term vision for the society

- Safe ride (no road accidents)
- Efficient ride (minimize door to door time for travel; not need to drive; no/limited traffic jams; reduced environmental pollution)
- Connected ride (infotainment)

+

Economic competitiveness at a global scale

➢ ***Shared Vision!***

Developing a CAM ecosystem in Europe

Achieving this vision**, and the associated economic and social case for smart mobility using 5G, will require Europe to **shape** a complex **connected car ecosystem involving many different stakeholder communities

CAM needs a system approach on EU level in order to achieve adoption in vehicles, which should at least specify data interworking between vehicles, infrastructure and the supporting ecosystem

Key Drivers for accelerating infrastructure rollout

- ***Standards**: Whereas 5G systems for CAM will go well beyond the scope of C-ITS, progress made in the context of 5G corridors may be important elements for advancing C-ITS standardization and implementation towards more elaborated functionalities*
- ***Regulatory innovation**: co-investment, sharing options, access-related regulatory schemes. Maintaining regulatory flexibility*
- ***Access and data sharing**: safety reasons, non-discriminatory, environmental purposes*
- ***Network slicing***
- ***Cybersecurity***
- ***Spectrum**: coordination between deployment of 5G infrastructure for CAM and more generic 5G coverage obligations*

5G Corridors: the plan

Pan-EU 5G corridors for Connected and Automated Mobility

5G Action plan: uninterrupted 5G coverage by 2025

Private investment with public funding of cross-border and "challenge" areas

Large-scale testing using Horizon 2020 (> €100M)

Large-scale deployment using CEF Digital (up to €1B) + other public funding sources

5G Strategic Deployment Agenda for CAM

- *Elaborated with the participation of stakeholders, the SDA aims at maximising public and private investments by:*
  - Defining deployment priorities and roadmaps
  - Identifying appropriate cooperation models and investment strategies
  - Advising on most suitable regulatory incentives

➢ ***Input for CEF pillar of the Smart Networks and Services partnership***

STRATEGIC DEPLOYMENT AGENDA

Rail

5G FOR VERTICALS

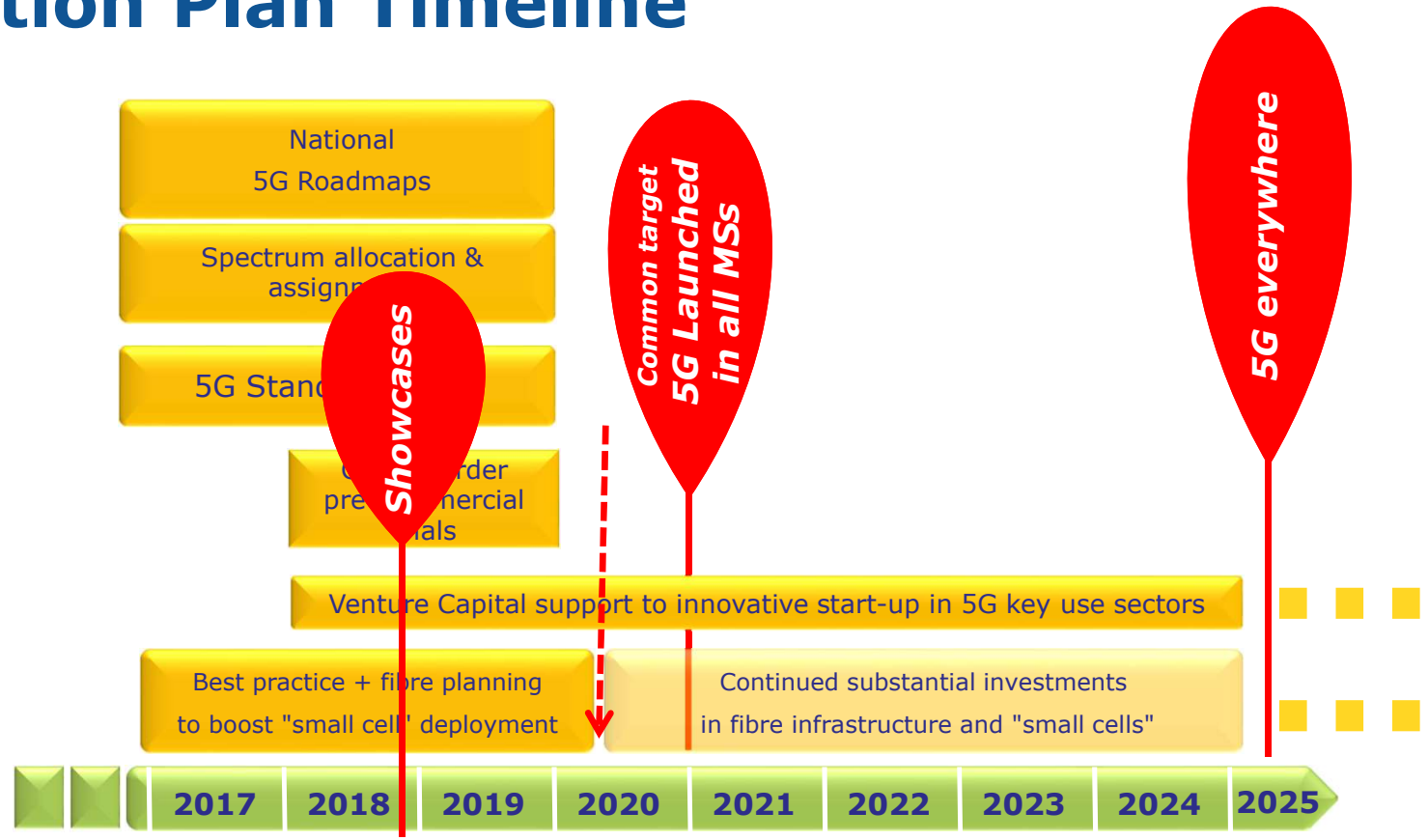
CONTINUED INVESTMENTS IN FIBRE INFRASTRUCTURE

5G is part of the Broadband priority

- ***5G requires Broadband**, and namely "pervasive" fibre availability*
- *Telecom Package – 14 Sep 2016*
  - **COM(2016) 587 - Connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society**
  - **COM(2016) 588 - 5G for Europe: An Action Plan**

    Action 4 — [Member States, Industry and other stakeholders] 5G national roadmaps, Set roll-out and quality objectives for the monitoring of the progress of key fiber and cell deployment scenarios and facilitate denser cell deployment

5G Action Plan Timeline



We are here!

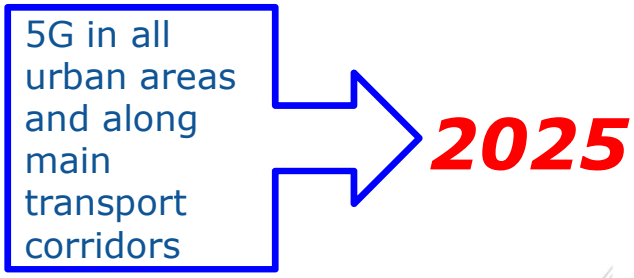
European Commission

PREPARATION FOR CROSS-BORDER DEPLOYMENT

Current status of, and plans for, cross-border deployment

- *Current deployment (BS, Core) = Baseline*
- *5G deployment plans without CAM, as per the licensing conditions = evolving Baseline*

- *What is further required to deliver CAM?*
- *But faster than in the 5G Action Plan and focusing on the Cross-border segments as a way to expedite coverage across major Trans-European Transport corridors*



Traffic Requirements

- *Traffic requirements from the Automotive sector*
  - **Evolving in time (new advanced services @ DG MOVE)**
  - **1 Mbit/s ? 10 Mbit/s ? 100 Mbit/s? [different classes of services?]**
  - **Peak vs Average?**

    The penetration of connected cars is VERY LOW and will remain LOW for many years!

    The data "collected" by the vehicles will not be sent RAW! In fact, only relevant information (abnormal behaviour, localization, etc) will be sent. It is "only" a question of who is paying for it: will the owners of the vehicles be willing to pay to send data of no interest to them? Would the OEMs be willing to pay?

    By the same token, the traffic generated will most likely be bursty – you only send when there is something wrong (push) or of interest to someone (pull).

Traffic Requirements

- *MNO non-CAM Traffic projections*
  - **eMBB and other traffic**

    long-term (2030) estimation of <100Mbit/s per car of eMBB data?

    It will again be bursty and opportunistic, i.e., when near a Base Station

- *Road operator traffic in terms namely of instrumentation of the infrastructure for C-ITS and beyond*
  - **Mainly HD-cameras to support ITS control centres**
  - **BUT… they know what is the average/peak automotive traffic density in the critical segments (incl cross-border)**

Traffic Constraints

- *Much lower data rate in the Uplink than in the Downlink (without MIMO)*

EXPLOITATION PLANS

*Projects are expected to provide **reasoned plans** towards 5G deployment in cross-border scenarios*

Objective

- *To propose target cross-border corridor coverages with associated ramp up strategies, depending on the various scenarios for cross-border segments*
- *Base line planning (without CAM)*
- *Delta deployment for CAM*
  - **Length of Cross-border segments**
  - **Base Station density**
  - **Backhaul provision**
  - **Power provision**
  - **Towers/Lamp-posts**
  - **MEC**
- *3- and 5-year ramp up strategy*

Objective

- *Start a discussion on the required investments from MNOs, Road operators, and the Automotive sector*
  - **Roles/Involvement of Stakeholders**
  - **Cooperation models!!!**

- *Cost reducing solutions*
  - **Sharing Infrastructure? From backbone to …**
  - **National Roaming?**
  - **Others?**

Mechanism

- *Targeted contributions from different players in each project in the context of the preparation for the trials/demos and of long-term exploitation*
  - **Checking existing studies/information**

- *Discussions among the projects, building upon their different cross-border scenarios and baseline conditions*

- *Where appropriate, launch targeted studies,* ***extending beyond current project beneficiaries***

Business / Market / Ecosystem towards long-term Exploitation

- *Use Case-based relationships among players*
- *Two projects had planned Business Model deliverables in April, the other (5GCroCo) is already available*
  - **What is the status?**
- *Joint workshop in October?*

Future-Proof Deployment planning

- *Next Steps*
  - **1-pager "template" (with vehicular traffic, data traffic (CAM and non-CAM) per classes of service) for Sensitivity Analysis!**
  - **Identification of resources, potentially requiring sub-contracting**
- *Commission will provide input from the IDATE study concerning coverage of low-density/rural/peripheric areas*

Thank you!

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