5G-PICTURE

5G **P**rogrammable **I**nfrastructure **C**onverging disaggregated ne**T**work and comp**U**te **RE**sources

Presenter: Jesús Gutiérrez
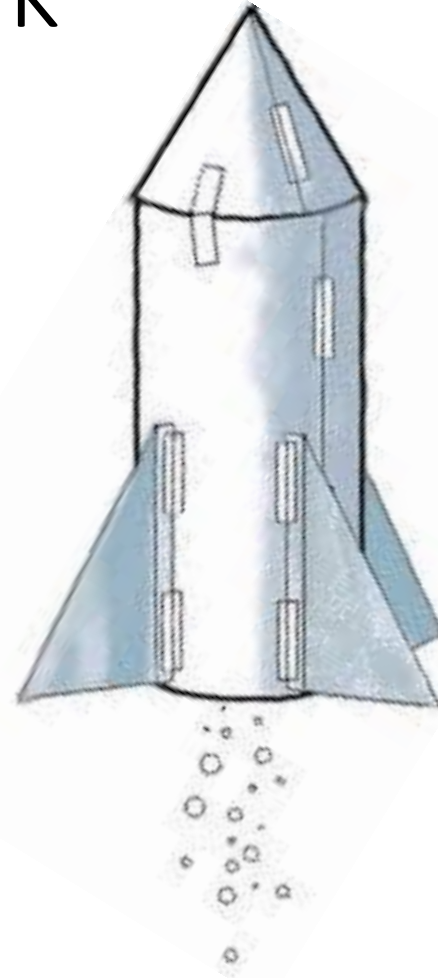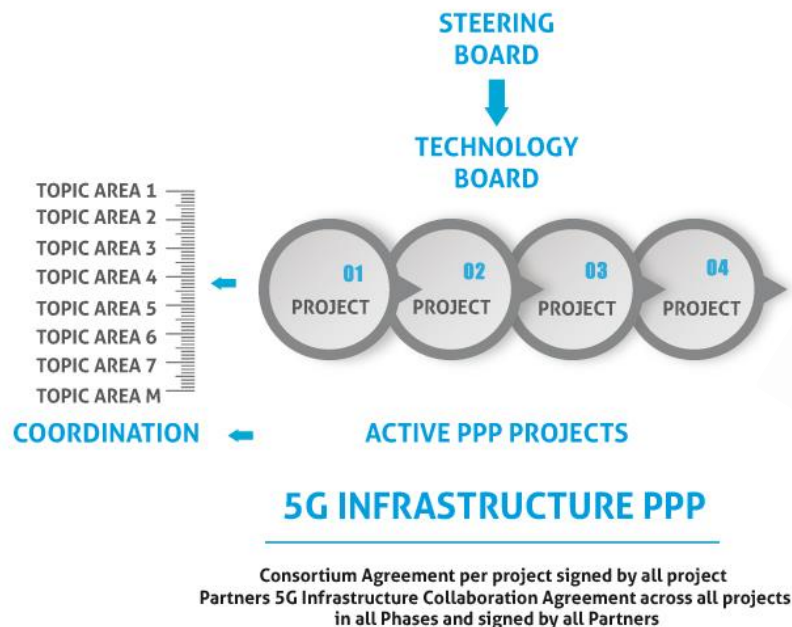
IHP Microelectronics GmbH

5G-PICTURE Introduction

5G-PPP framework, Partners, Overall concept

5G-PPP framework

- PPP Structure

https://5g-ppp.eu/

STEERING BOARD

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TECHNOLOGY BOARD

TOPIC AREA 1
TOPIC AREA 2
TOPIC AREA 3
TOPIC AREA 4
TOPIC AREA 5
TOPIC AREA 6
TOPIC AREA 7
TOPIC AREA M

01 PROJECT → **02 PROJECT** → **03 PROJECT** → **04 PROJECT**

COORDINATION ← **ACTIVE PPP PROJECTS**

5G INFRASTRUCTURE PPP

Consortium Agreement per project signed by all project
Partners 5G Infrastructure Collaboration Agreement across all projects
in all Phases and signed by all Partners

Source: European Commission

Phase III (2017-2018)

Large-scale trials

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Phase II (2016-2017)

System optimisation and trials
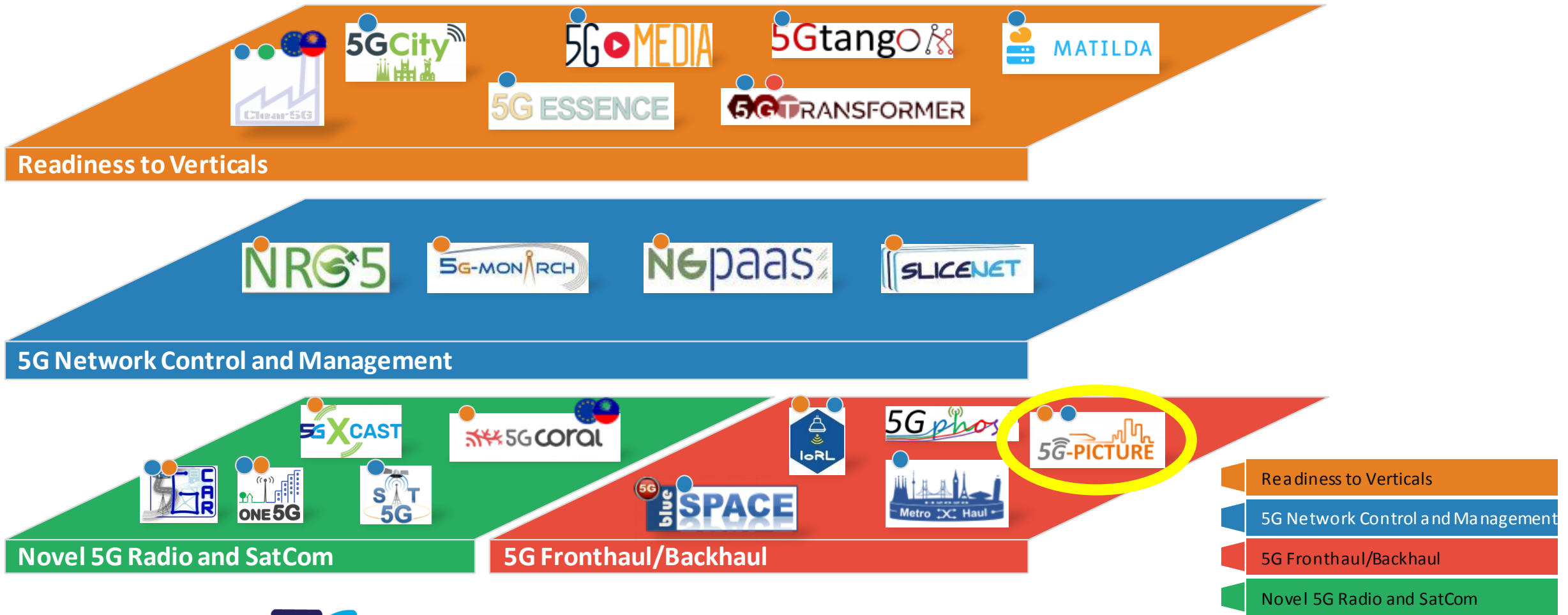
5G-PICTURE

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Phase I (2014-2015)

Research (I) work

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Ignition phase (2012-2013)

Project METIS, 5GNOW, iJOIN, TROPIC, Mobile Cloud Networking, COMBO, MOTO, PHYLAWS...

Projects Phase-II

Readiness to Verticals

5G Network Control and Management

Novel 5G Radio and SatCom   **5G Fronthaul/Backhaul**

Readiness to Verticals
5G Network Control and Management
5G Fronthaul/Backhaul
Novel 5G Radio and SatCom

Compl. EU-Taiwan 5G projects

https://5g-ppp.eu/5g-ppp-phase-2-projects/

5G-PICTURE Partners

Main Objectives

- 5G-PICTURE will design and develop an integrated, scalable and open 5G infrastructure with the aim to support *operational* and *end-user services* for both *ICT* and *"vertical" industries*

- This infrastructure will rely on a *converged fronthaul* and *backhaul* solution, integrating advanced wireless access and novel optical network domains.

- To address the limitations of current solutions 5G-PICTURE will adopt the novel concept of *Disaggregated-Radio Access Networks* (DA-RANs)

    - allows any service to flexibly *mix-and-match* and use *compute,* storage and *network resources* through *HW programmability*

    - relies on network *softwarisation* to enable an open reference platform instantiating a variety of network functions

    - adopts *slicing* and *service chaining* to facilitate optimised *multi-tenancy* operation

Technical Approach

- To address the limitations of Distributed-RAN and Cloud-RAN will develop flexible functional splits

- Adoption of the notion of DA-RAN relying on resource disaggregation
  - mixing-and-matching of resources

- Development of novel technology solutions and control & management platforms
  - enhanced network and compute HW and SW modularity and flexibility

- Creation and deployment of programmable network functions and intelligent orchestration schemes suitable to support vertical industries
  - service chaining
  - slicing & multi-tenancy
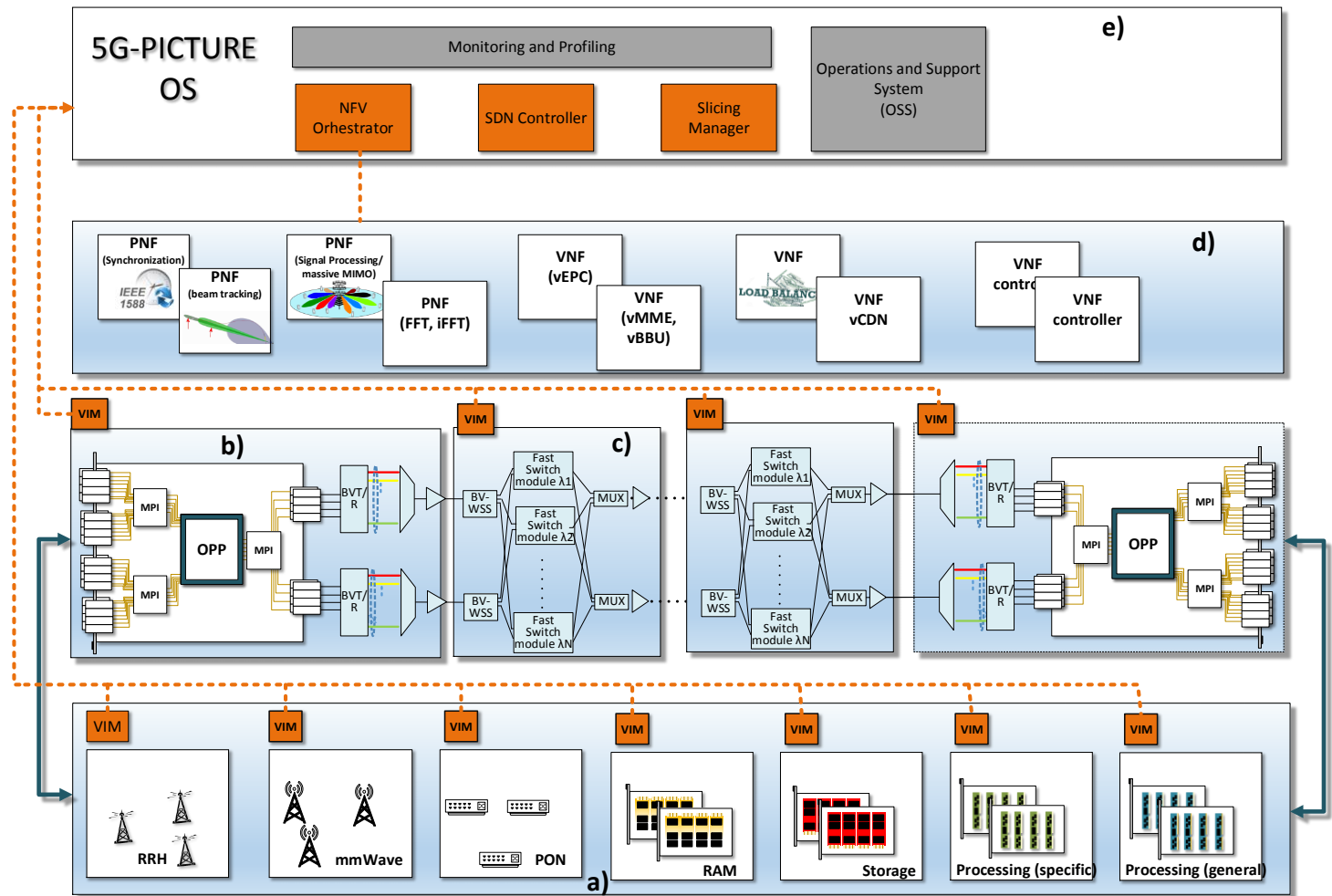
5G-PICTURE Demonstration Activities
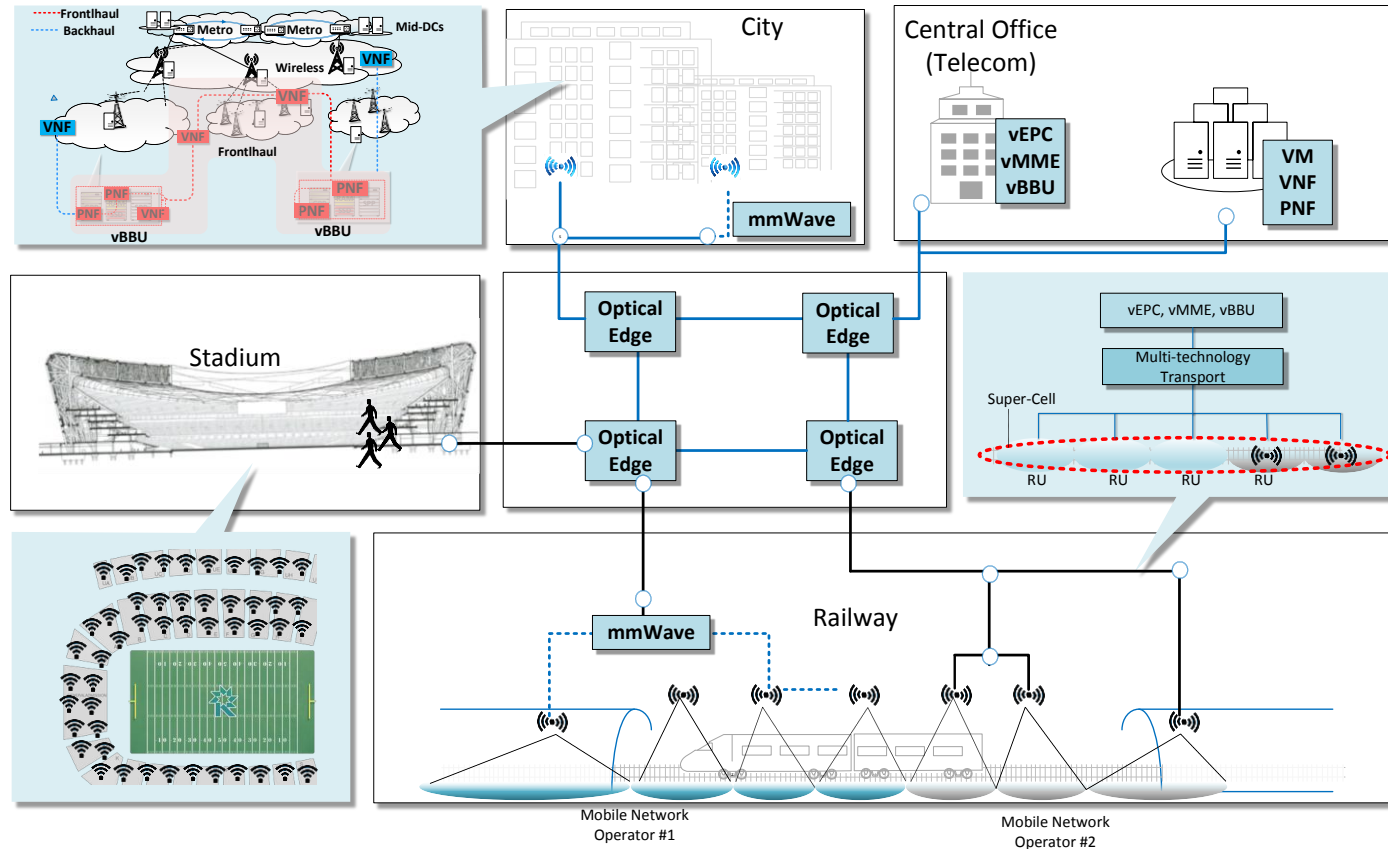
To validate the capabilities of the 5G-PICTURE three large scale experimental platforms will be deployed:

- a **5G-railway testbed** located in Spain
- a 5G-smart city testbed at Bristol (BIO) to experimentally validate the DA-RAN through the support of BH and FH services
- a 5G-stadium testbed located in Bristol to address media services for ultra-high density users

Railway use case

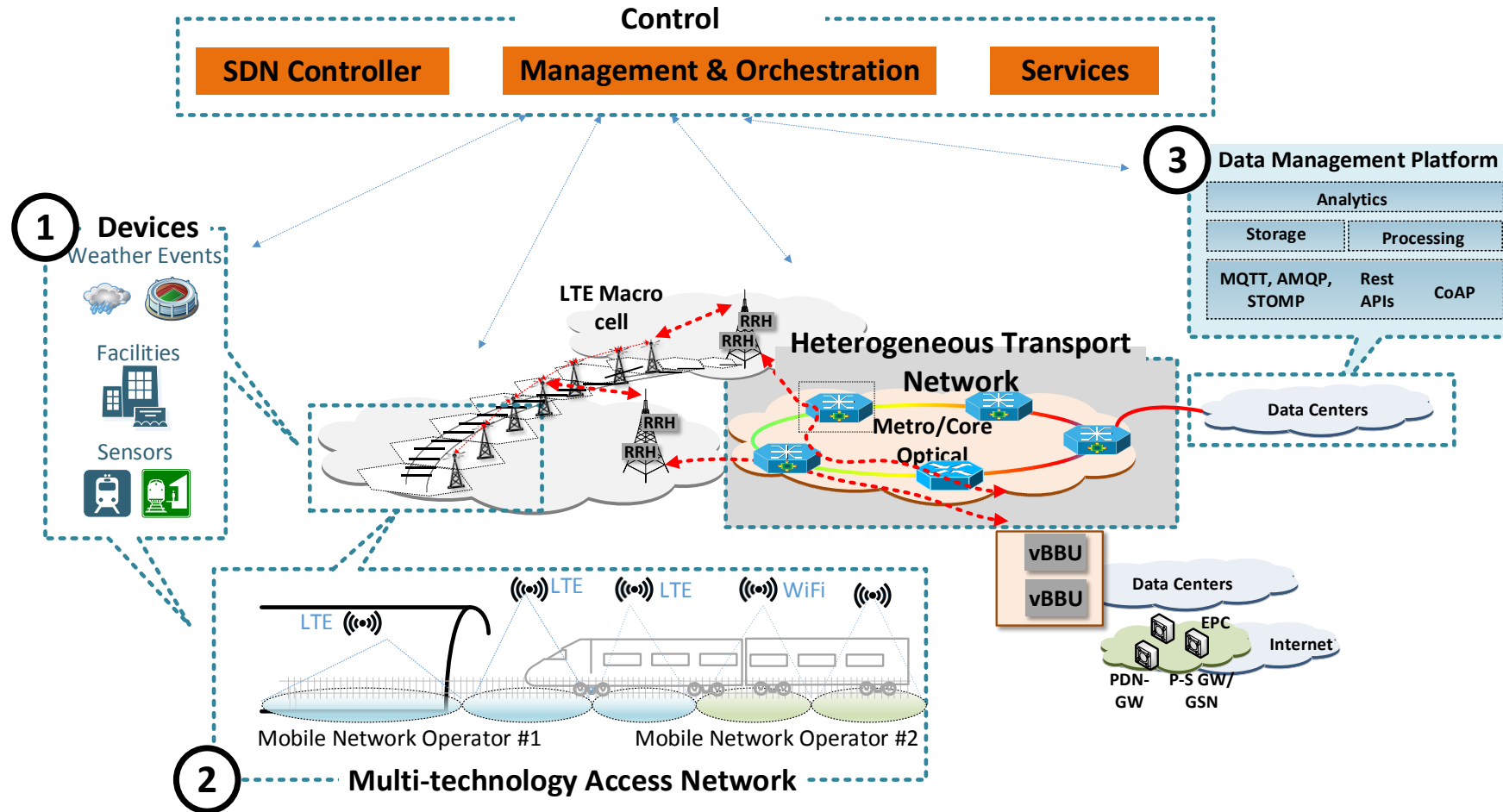Benefits of 5G, Overall architecture supporting the railway use case,
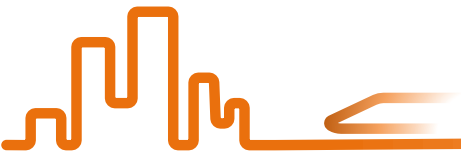
Railway Use case – Impact of 5G

- New communications architecture with tangible benefits:

  - 5G technology will demonstrate its ***suitability to build a new common infrastructure***, communication-based service support
  - A significant ***TCO reduction***
  - Enhance the ***interoperability*** between different railway signalling systems (track and train systems).
  - This new network will be neutral from each stakeholder point of view

Railway Use Case – Overall Solution

Control

SDN Controller | Management & Orchestration | Services

3 Data Management Platform
- Analytics
- Storage | Processing
- MQTT, AMQP, STOMP | Rest APIs | CoAP

1 Devices
- Weather Events
- Facilities
- Sensors

LTE Macro cell

RRH

Heterogeneous Transport Network
Metro/Core Optical

Data Centers

vBBU
vBBU

Data Centers

EPC
Internet
PDN-GW
P-S GW/GSN

LTE | LTE | LTE | WiFi

Mobile Network Operator #1
Mobile Network Operator #2

2 **Multi-technology Access Network**

- The rail use case aims at experimentally validating the 5G-PICTURE solution is terms of density, mobility and cost

Railway Use case & Demonstration

- The user case chosen for this vertical is represented by Ferrocarrils de la Generalitat de Catalunya (FGC)

- FGC encompasses both the rail infrastructure administrator role and the passenger rail operator role, including urban metro activity in Barcelona, Barcelona suburban area commuter transport and rural rail in some districts of Catalunya.

- Selected parts of their infrastructure will be available to realize this experimental demonstration

Rail Use Case - Demonstration (I)
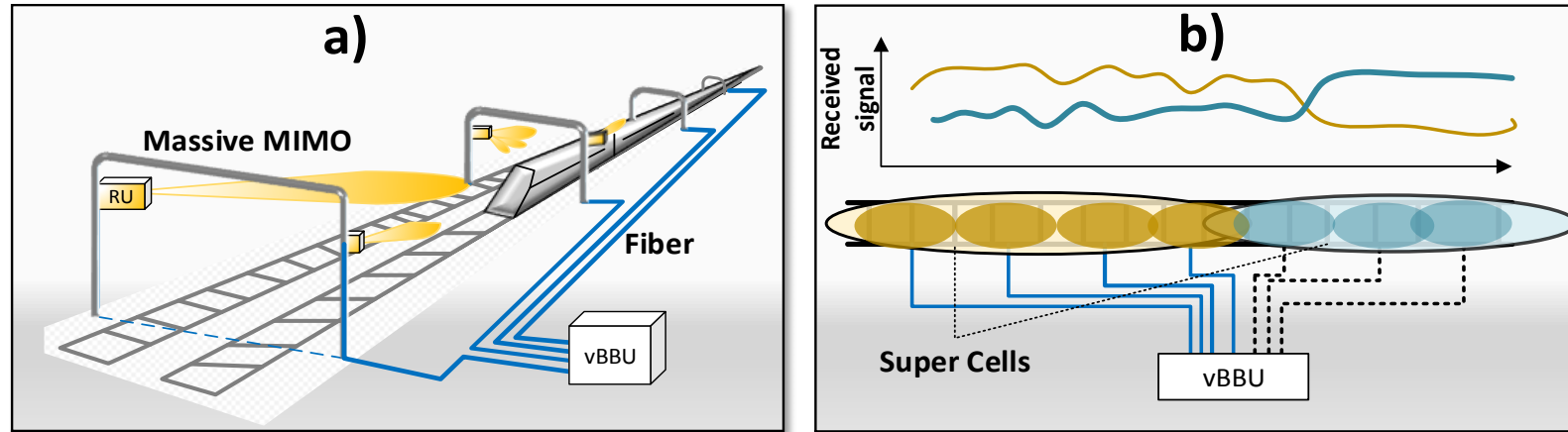
- It will exploit a 5G-railway testbed deployed across three lines of FGCs network, each one addressing different transportation needs
  - Line 1: large volume of passengers that are carried over short distances
  - Line 2: long reach transportation features using high speed trains
  - Line 3: very diverse environmental terain (including tunnels)
- To address the high density scenario, the massive MIMO mmWave RAN, enchanced with advanced beam tracking and beamforming features, will be coupled with FGCs trackside optical fiber network to interconnect the RUs with the vBBU
- This will enable efficient coordination of RUs allowing the creation of super cells thus reducing the frequency of handovers to address the high mobility requirements of Line 2

Rail Use Case - Demonstration (II)
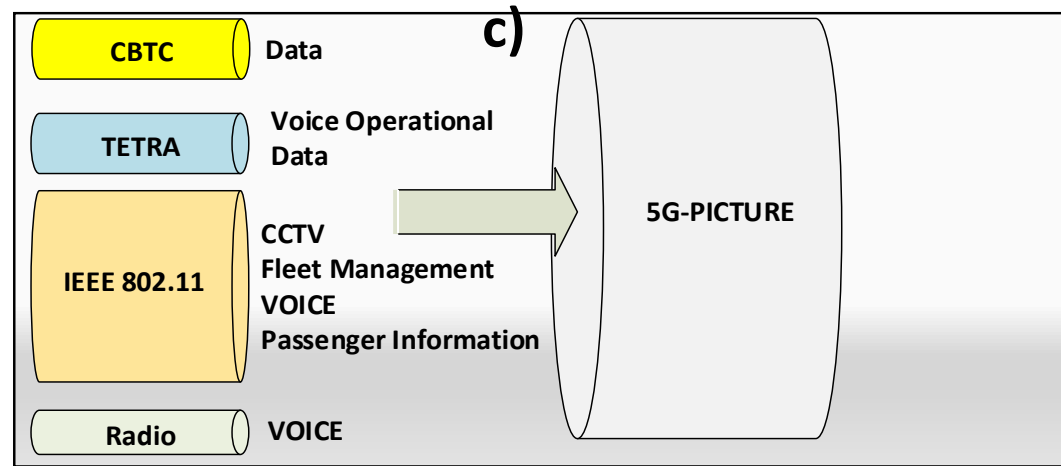
- Multi-tenant capabilities through **network slicing** that 5G-PICTURE offers, providing service continuity and **guaranteed QoS** across the track

- **Cost benefits** through sharing of a common virtual infrastructure across a variety of railway services

- **Services** currently relying on multiple technology specific communication networks will be **multiplexed over a common infrastructure**:

  - Communications Based Train Control CBTC, Voice and data between central Command & Control and driver/cabin, streaming of surveillance video inside train and along rail infrastructure, monitoring of infrastructure devices, fleet management etc,

Thanks for your attention!

5G-PICTURE Project
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