The background of the slide is a light blue illustration of a smart city. It shows various buildings, houses, and people, all interconnected by a network of white lines representing data or communication. There are icons for a satellite, a house, a city, and a car. Text labels like 'CONNECTED CITY', 'CONNECTED HEALTH', 'CONNECTED HOUSE', 'CONNECTED PEOPLE', and 'CONNECTED TRANSPORTATION' are scattered throughout the scene. The overall theme is a highly connected, intelligent urban environment.

# The 5G Infrastructure Association

## 5G Pan-European Trials Roadmap (5G-IA Trials WG)

**Prof. Panagiotis Demestichas**

**2<sup>nd</sup> Workshop on 5G Trials – 01.10.19 – Dresden**  
**(Ack: Dr Didier Bourse, Nokia, Bell-Labs, France)**

## 5G Pan-EU Trials Roadmap

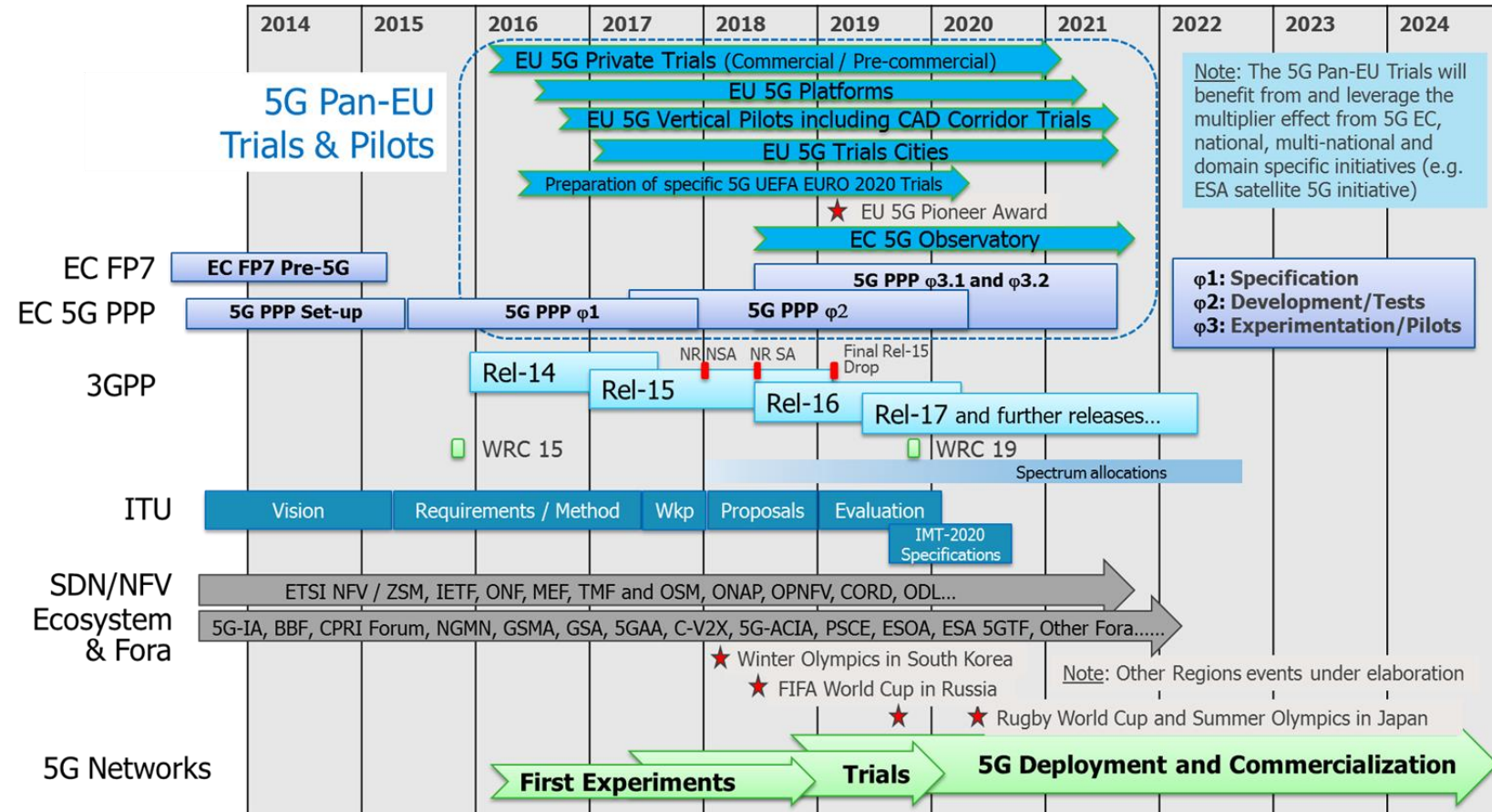
### 5G in EU (Highlights)

- 5G further **strongly boosted** in EU in 2019 (pre-commercial/commercial, trials & pilots, R&I, spectrum...)
- EU 5GAP initial targets in 2016 to have (1) the **early** 5G launch in selected areas in 2018, (2) the **commercial** launch of 5G services in at least one major city in all MSs in 2020 and (3) the **uninterrupted** coverage in all urban areas and along main transport paths in 2025 clearly on the right tracks
- Many **EU cities** strongly engaged in 5G development, trials and pilots and now step-by-step in 5G deployment. Commercial deployment to be further accelerated in specific EU cities in 2H19-2020
- EU actions further boosted with the **EC EU 5G Observatory (E5GO)** and **EC-GSMA 5G Pioneer Award**
- European 5G strategy further targeting large scale adoption of 5G by **vertical sectors**
- **EU 5G trials and pilots** supported (R&I) by 5G Infrastructure PPP incl. running Phase 2 and Phase 3 Platforms and Corridors projects and Phase 3 Vertical Pilots projects started on 01.06.19
- **First PPP 10 Trials & Pilots** Brochure released on 25.09.19 and highlighting some key PPP Phase 2 Trials & Pilots. Second Brochure targeted in 1Q20
- 5G-IA forefront at EU level, incl. on 5G Infrastructure PPP / **projects, Trials WG, Verticals** Task Force...
- EU actively moving forward on 5G with strong 5G momentum and stakeholders engagement

<https://5g-ppp.eu/5g-trials-roadmap/>

# 5G Pan-EU Trials Roadmap Roadmap Time Plan

- Pan-European Trials Roadmap – Roadmap Time Plan



<https://5g-ppp.eu/5g-trials-roadmap/>

# 5G Pan-EU Trials Roadmap

## 5G Private Trials – EU 5G Observatory (Highlights) (1)

- European 5G Observatory
  - Study started in June 2018 (<https://ec.europa.eu/digital-single-market/en/european-5g-observatory>)
  - E5GO website/online platform officially launched on 27.09.18 (<http://5gobservatory.eu/>) in the context of the 5G Techritory event organized on 27-28.09.18 in Riga (<https://www.5gtechritory.com/>)
  - E5GO Trials & Pilots XML Table
  - E5GO quarterly reports available incl. 4<sup>th</sup> report published in July 2019
  - Regular E5GO (e-mails) posts
  - E5GO Workshop organized on 17.05.19 in Brussels (<https://ec.europa.eu/digital-single-market/en/news/save-date-european-5g-observatory-europe-ready-5g>)
  - 2<sup>nd</sup> Study covering mid-2019-mid-2021

The screenshot shows the website for the European 5G Observatory. The header includes the logo and navigation links: ABOUT, OVERVIEW, MARKET DEVELOPMENTS, DEPLOYMENTS, 5G TRIALS, PUBLIC INITIATIVES, 5G SPECTRUM, and LINKS. A search icon is also present. The main content area features a paragraph about the observatory's mission and a section titled 'LATEST NEWS IN EUROPE' with four news items:

- Deutsche Telekom launched 5G services in five cities**  
Berlin, Bonn, Cologne, Darmstadt, and Munich
- German mobile strategy towards coverage improvement and elimination of white spots**  
The Minister for transport and digital
- Switzerland's Sunrise Expands 5G Coverage to 80% of Population**  
The operator expanded its 5G network coverage in 262 cities, towns, and villages
- Three UK launched 5G FWA service**  
Three became the third of UK operator to offer 5G services

<http://5gobservatory.eu/>

# 5G Pan-EU Trials Roadmap

## 5G Private Trials – EU 5G Observatory (Highlights) (2)

- EU 5G Observatory – Key Trends Actions Plan Measures (June 2019)

5G AP measures	Key trends
Announcements by operators, service providers or users	<p>5G commercial launches (network only): Elisa (Finland and Estonia) in June 2018, Ooredoo (Qatar) in May 2018. T-Mobile Austria in March 2019.</p> <p>5G commercial launches (network and end-users devices); Verizon (USA) in October 2018 (FWA), Verizon in April 2019 (mobile), AT&amp;T (USA) in April 2019, Sprint in May 2019, EE (UK) in May 2019, Vodafone Spain in June 2019, Vodafone Italy and TIM Italy in June 2019.</p> <p>South Korean MNOs in December 2018 for enterprise customers and in April 2019 for residential customers.</p> <p>No clear indication of 5G investments by mobile operators.</p> <p>5G planned launches: Japan in August 2020 (Pre-launches in 2019, notably for NTT DoCoMo autumn 2019).</p>
Promote early deployment in major urban areas and along major transport paths	<p>153 trials announced in EU-28. 33 trials in Russia, Turkey, San Marino, Switzerland and Norway.</p> <p>In 2017 and 2018, 10 digital cross-border corridors were announced and established for live tests of 5G in the EU.</p> <p>Three large-scale projects have been selected on these corridors (5G-CARMEN, 5GCroCo, 5G-MOBIX).</p>
Promote pan-European multi-stakeholder trials as catalysts to turn technological innovation into full business solutions	<p>Large trials are part of H2020 Phase 3 projects. Three projects (5G EVE, 5G-VINNI, 5GENESIS) started on 1 July 2018. They are implementing and testing advanced 5G infrastructures in Europe (EUR 15 to 20 million investment). Seven additional projects (5G-SOLUTIONS, 5G-TOURS, 5GDrones, 5G-HEART, 5GROWTH, 5G-SMART, 5G-VICTORI) focussed on trialling 5G across vertical industries started in June 2019.</p>

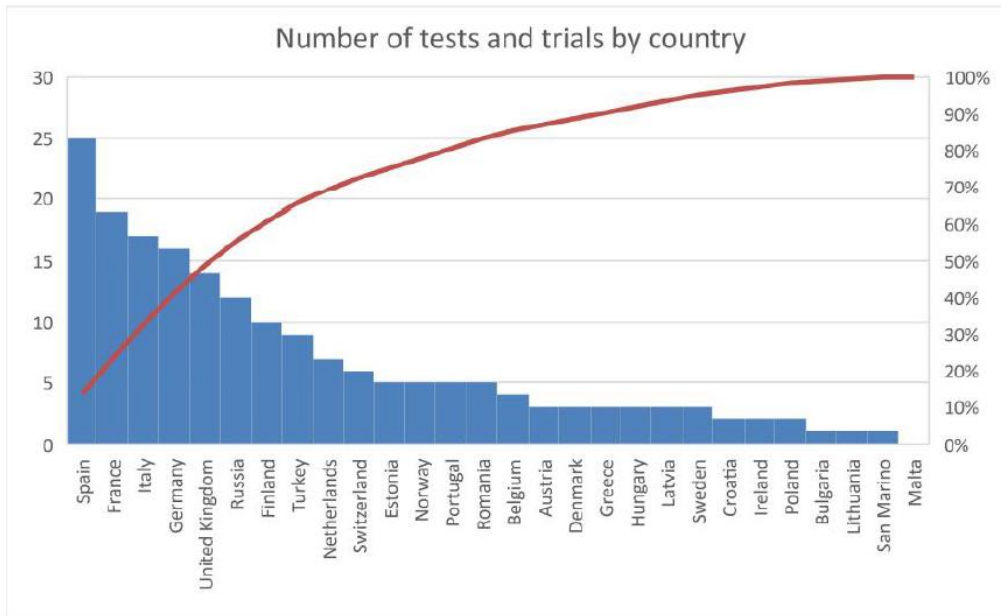
Source: IDATE DigiWorld – June 2019

E5GO – 4<sup>th</sup> Quarterly Report- <http://5gobservatory.eu/wp-content/uploads/2019/07/80082-5G-Observatory-Quarterly-report-4-min.pdf>

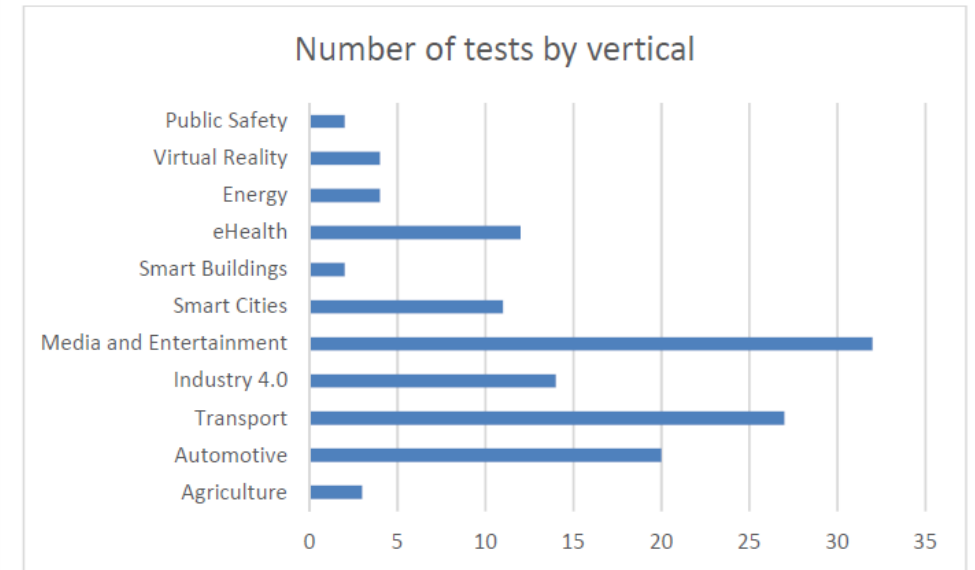
# 5G Pan-EU Trials Roadmap

## 5G Private Trials – EU 5G Observatory (Highlights) (3)

- EU 5G Observatory – EU Private Trials (June 2019)



Source: IDATE DigiWorld, June 2019



Source: IDATE DigiWorld, June 2019

# 5G Pan-EU Trials Roadmap

## 5G - MWC 2019 Awards (Highlights) (1)

- MWC 2019 - Global Mobile Awards 2019 – 5G Pioneer Award (8d)



### 8d. European 5G Pioneer Award

#### Deutsche Telekom AG for driving an ecosystem approach towards 5G commercialization



Deutsche Telekom plans a 5G roll out from 2020 as part of a significant capacity enhancement to provide high speed connectivity and differentiated services. To drive the commercial readiness of the 5G ecosystem and lay the foundation for its rollout, DT activated the first six cells with 3GPP 5G NR compliant commercial equipment in Berlin in May 2018 -achieving Europe's first 5G data connection under real-world conditions. As well as using the now expanded test bed for performance assessment of 5G NR, DT has opened up the 5G and Edge infrastructure to startups and developers for use case prototyping.

#### Judges Comments

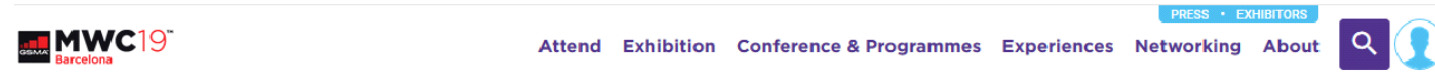
"These ground-breaking trials, and commitment for early commercial 5G service launch by 2020, are major contributions to the success of the 5G Action Plan for Europe. This operator is demonstrating true leadership in driving forward the European contribution to global advances in 5G development."

<https://www.mwcbarcelona.com/glomos/deutsche-telekom-ag-for-driving-an-ecosystem-approach-towards-5g-commercialization/>

# 5G Pan-EU Trials Roadmap

## 5G - MWC 2019 Awards (Highlights) (2)

- MWC 2019 - Global Mobile Awards 2019 - 5G Industry Partnership Award (10b)



### 10b. 5G Industry Partnership Award

#### Hamburg Port Authority, Deutsche Telekom & Nokia for First Large Scale Industrial Commercial 5G Trial



The Hamburg Port Authority (HPA), Deutsche Telekom and Nokia deployed a 5G network in the 8,000-hectare Port of Hamburg originally as a proof of concept testbed and now as an operational network. The Hamburg port is the 3rd largest container harbour in Europe. The implementation is being carried out under the auspices of the 5G-MoNArch (5G Mobile Network Architecture) project led by Nokia. The 5G network architecture is the only option for managing a complex infrastructure more efficiently and effectively than running expensive fibre. Implemented use cases range from secure automated port operations to traffic management via connected, intelligent transportation systems

#### Judges Comments

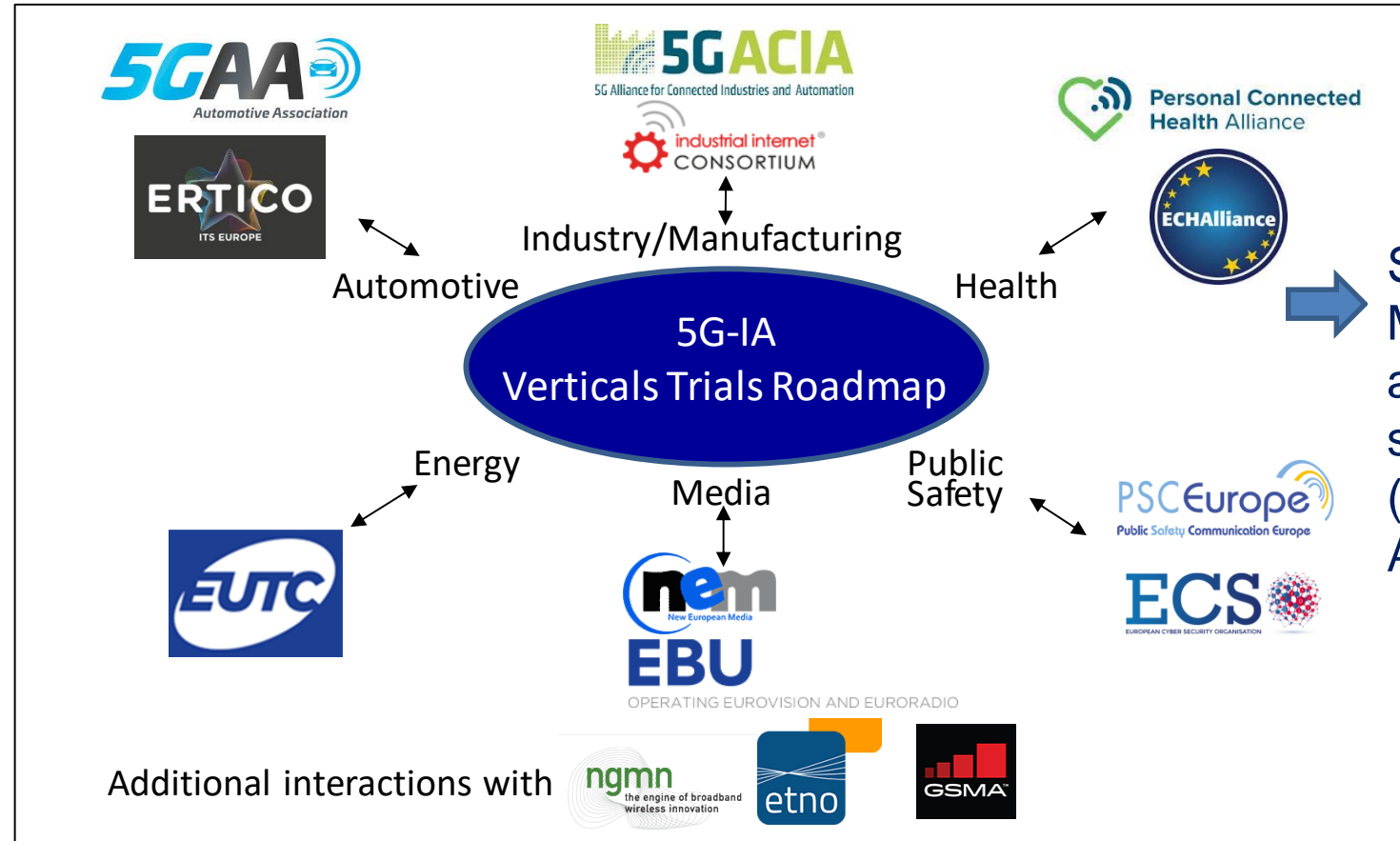
"A perfect demonstration of key 5G use cases that require URLLC, eMBB, MTC and network slicing. These use cases will improve productivity as well as provide a series of environmental and social benefits. The fact that this is a field trial and not a lab trial was very important in our scoring because network slicing can be challenging in such a complex and changing environment."

<https://www.mwcbarcelona.com/glomos/hamburg-port-authority-deutsche-telekom-nokia-for-first-large-scale-industrial-commercial-5g-trial/>



# 5G Pan-EU Trials Roadmap PPP and 5G Verticals (Highlights) (3)

- 5G Verticals Strategy – Partnerships Map – Roadmap Versions 3.0 & 4.0 (Highlights)



Specific MoUs signed and to be signed with (Verticals) Associations

<https://5g-ppp.eu/5g-trials-roadmap/>

5G PPP  
The European path towards global next generation communication network

# 5G Pan-EU Trials Roadmap

## PPP and 5G Verticals (Highlights) (4)

- 5G Verticals Strategy – Verticals Workshops (Highlights)

The screenshot shows the 5G PPP website header with the logo and navigation menu. The main content area features a blue banner for the '5G VERTICAL USER WORKSHOP'. Below the banner is a box containing the workshop title, the initiative name 'Initiative of 3GPP Market Representatives Partners (MRP)', logos for PSC Europe, SGAA, 5G IA, and 5G ACIA, and the text 'Open to other 5G Verticals'.

5G networks are intended to bring a new disrupting ecosystem, where actors such as the Vertical industries (automotive, industry 4.0, health, media, security & public safety, energy,...) will be involved alongside the telecom operators, manufacturers, SMEs and Research Institutes.

This 5G Vertical Users Workshop aimed at establishing a collaborative event for strategic dialogue between industries and 3GPP by exchanging on future needs and upcoming standard developments. The workshop as a result, aimed at producing a report shared directly to 3GPP Project Coordination Group (PCG) as a mean to stimulate and facilitate greater involvement of the 5G Vertical Users in the 3GPP process.

The workshop was held in Brussels on 12th and 13th February, 2019. Please see the agenda and the link to the presentations below:

<https://5g-ppp.eu/5g-vertical-user-workshop/>

The screenshot shows the Global 5G website header with the logo and navigation menu. The main content area features a blue banner for the '2nd 5G Vertical User Workshop Agenda'. Below the banner is a link to the agenda page: 'Home » 2nd 5G Vertical User Workshop Agenda'.

2nd 5G Vertical User Workshop Agenda	
9-10 June 2019 Rome, Italy	
Day 1	
9:30	<b>Registration &amp; Welcome Coffee</b>
	<b>3GPP Rel-17 Work on Vertical Topics</b>
	Moderators: Georg Mayer, TSG SA Chairman and Balazs Bertenyi, TSG RAN Chairman
	<i>How to boost contributions of 5G Vertical Industries to 3GPP Standardisation process.</i>
10:00	<b>Main Takeaways</b>
	<ul style="list-style-type: none"> <li>Practical guide on 3GPP working groups and processes. Release 17 for vertical industries: current schedule and work items for SA1 (services), SA2 (architecture), SA4</li> </ul>

<https://www.global5g.org/2nd-5g-vertical-user-workshop-agenda#overlay-context=user>

# 5G Pan-EU Trials Roadmap

## PPP Phase 2 Projects - Verticals Pilots & Trials (Highlights)

- PPP Phase 2 Projects Verticals Pilots & Trials (Highlights)

### 5G Infrastructure Public Private Partnership



**63 EXPERIMENTS in 38 CITIES**  
 Cities covering **Automotive, Industry, Media & Entertainment, Public Safety, Health, Energy, Smart Cities and Transport & Logistics**

Aachen (DE)	Lannion (FR)
Aalborg (DK)	Ljubljana (SI)
Alba Iulia City (RO)	Lucca (IT)
Athens (GR)	Madrid (ES)
Aveiro (PT)	Malaga (ES)
Barcelona (ES)	Montlhéry (FR)
Berlin (DE)	Munich (DE)
Bremen (DE)	Nice (FR)
Bristol (UK)	Oulu (FI)
Cologne (DE)	Paris and Paris-Saclay (FR)
Cork (IE)	Pisa (IT)
Coventry (UK)	Rennes (FR)
Detmold (DE)	Rome (IT)
Egaleo (GR)	Terni (IT)
Eindhoven (NL)	Thessaloniki (GR)
Genova (IT)	Turin (IT)
Guildford (UK)	Turku (FI)
Hamburg (DE)	Vigo (ES)
Ipswich (UK)	Watford (UK)



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### Verticals Cartography

In 2035, when 5G's full economic benefit should be realised across the globe, a broad range of industries – from transportation to entertainment and education, and everything in between – could produce up to 10.7 trillion euros worth of goods and services enabled by 5G mobile technology. Meanwhile, Europe's 5G Public Private Partnership (5G PPP) is developing new applications across a diverse set of verticals spanning proofs of concept, prototypes, demonstrations, trials, and pilots in order to validate the functionalities defined for 5G by the International Telecommunications Union (ITU) – Enhanced Mobile Broadband, Massive Machine Type Communications, and Ultra Reliable Low Latency Communications – so consumers and sector end users can really know what 5G is all about.

#### How to use the 5G PPP verticals cartography:

The use-case experiments are taking place in Europe between 2018 and 2020, with more projects coming on board in 2019. You can view the experiments by sector, country, and ITU functionality by clicking on the boxes on the right. New country locations and tests will be added in the future. Meanwhile, enjoy our 5G PPP showcase.

Download our latest fliers: [5G for Automotive Experiments in Europe](#)



#### one5G: Proof-of-Concept for Industrial areas with large factories

Boosting the capacity of mobile networks, improving their energy efficiency with 5G is the key enabling technology for time-critical, reliable process automation in factories of the future.



#### one5G: Smart-Megacity Proof-of-Concept

This 5G proof-of-concept is about enabling high performance and efficient urban services in tomorrow's smart cities.

- Agriculture and Farming
  - Automotive
  - Energy
  - Health
  - Industry
  - Media & Entertainment
  - Public Safety and Digital Divide Resorption
  - Smart Cities
  - Transport & Logistics
- Countries
- Denmark
  - Finland
  - France
  - Germany
  - Greece
  - Ireland
  - Italy
  - Netherlands
  - Portugal
  - Romania

<https://5g-ppp.eu/5g-trials-roadmap/> and <https://www.global5g.org/cartography>

# 5G Pan-EU Trials Roadmap

## PPP Phase 3 Projects - 5G Platforms (Highlights)

- PPP Phase 3 Projects 5G Platforms (Highlights)

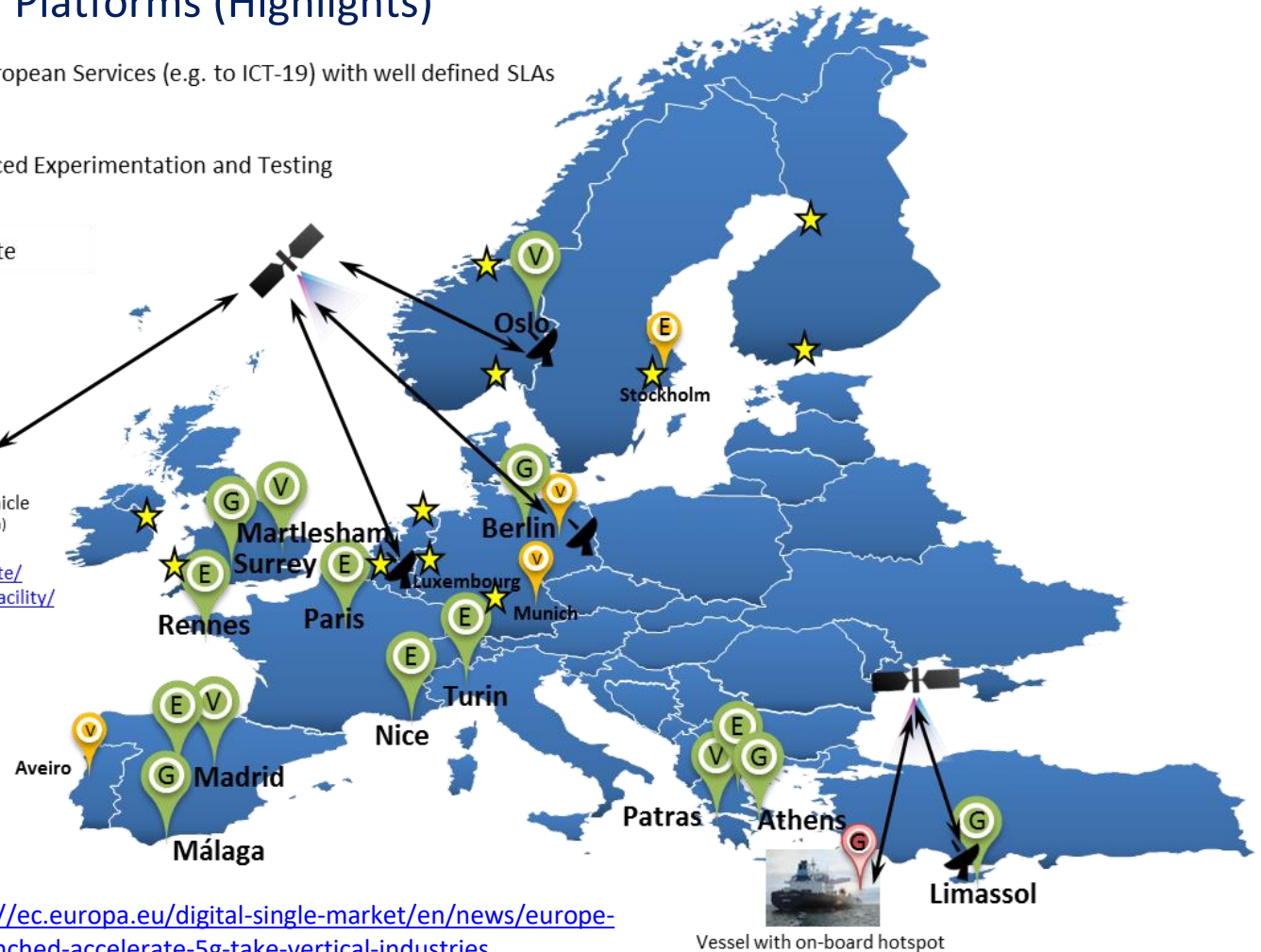
- Main Facility that offers 5G pan European Services (e.g. to ICT-19) with well defined SLAs
- Experimentation Facility for advanced Experimentation and Testing
- Moving Experimentation Facility Site

5G-Vinni  
5G-EVE  
5Genesis



5G-VINNI : <https://www.5g-vinni.eu/facility-site/>  
5G-EVE: <https://www.5g-eve.eu/end-to-end-facility/>  
5GENESIS: [www.5genesis.eu](http://www.5genesis.eu)

- Additional ICT-19 Projects  
Platforms & Nodes: Aachen, Aalto, Bristol, Brussels, Dublin, Groningen, Heroya, Kista, Oulu, Reutlingen and Trondheim



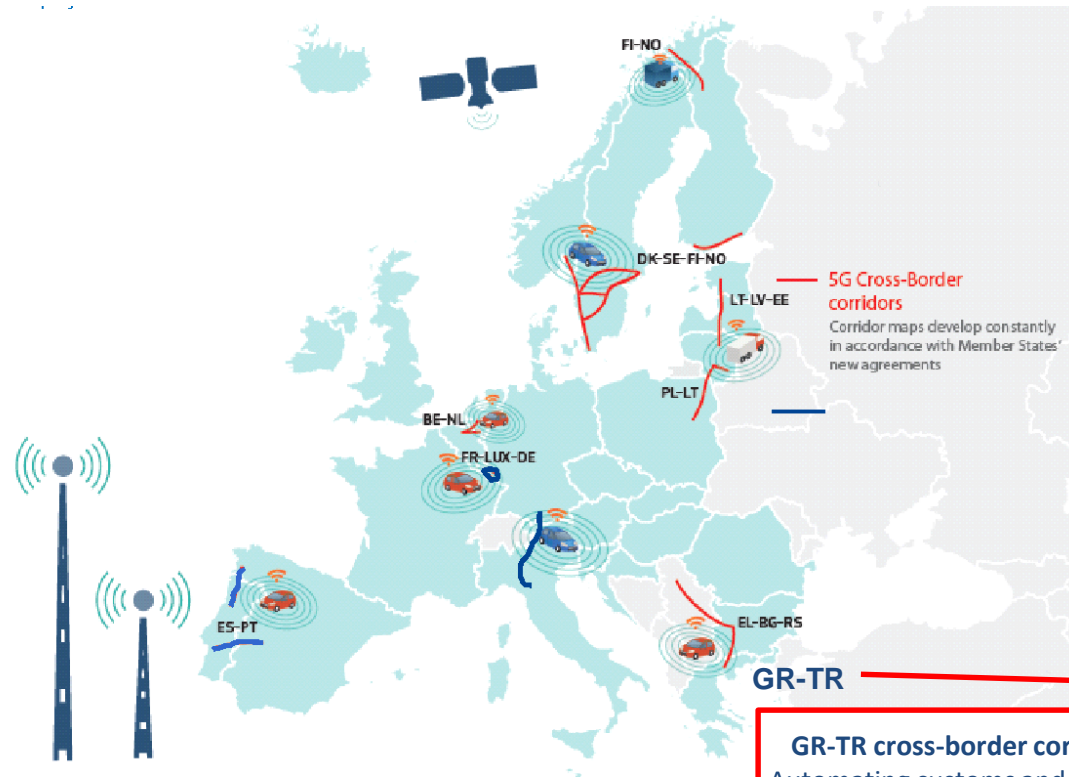
Vessel with on-board hotspot

<https://5g-ppp.eu/5g-trials-roadmap/> and <https://ec.europa.eu/digital-single-market/en/news/europe-advancing-5g-new-wave-projects-launched-accelerate-5g-take-vertical-industries>

# 5G Pan-EU Trials Roadmap

## PPP Phase 3 Projects - Corridors (Highlights)

- PPP Phase 3 Projects 5G Corridors (Highlights)



<https://5g-ppp.eu/tag/automotive/>

<https://5g-ppp.eu/phase-3-part2-pre-structuring-model/>

### EU Corridors

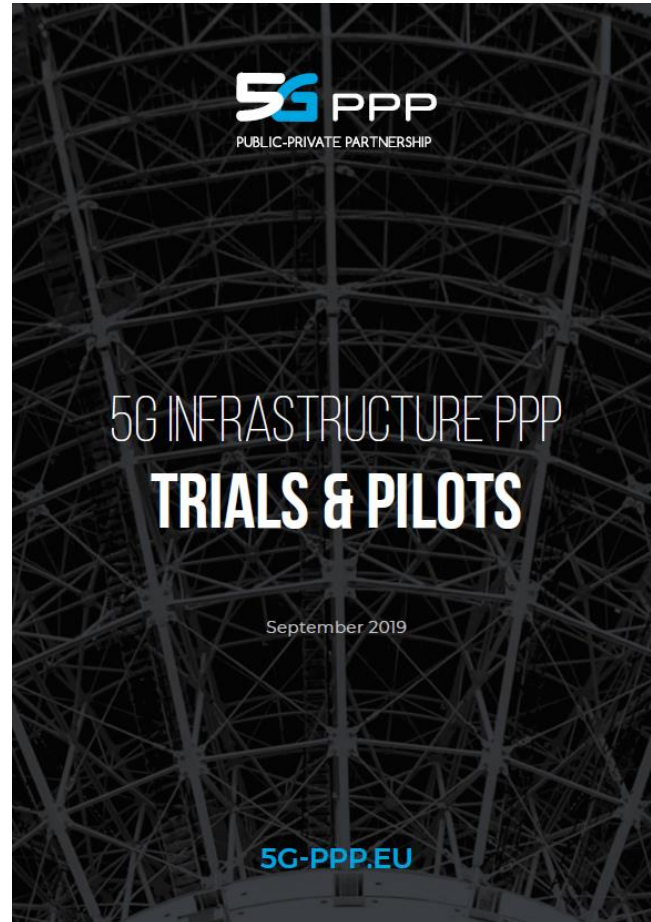
- Metz-Merzig-Luxembourg (FR-DE-LU)
- Rotterdam-Antwerpen-Eindhoven (NL-BE-NL)
- Porto-Vigo and Evora-Merida (PT-ES)
- Tromso-Kolari - E8 "Aurora Borealis": (NO-FI)
- Helsinki-Turku-Stockholm-Gothenburg-Oslo-Copenhagen Nordic Way2 (FI-SE-NO-DK)
- Munich-Bologna - Brenner Corridor (DE-AT-IT)
- Thessaloniki-Sofia-Belgrade (EL-BG-RS)
- Tallinn-Riga-Kaunas - Via Baltica (E67)-Lithuanian/Polish border (EE-LV-LT)
- Kaunas-Warsaw - Via Baltica (LT-PL)

<https://5g-ppp.eu/5g-trials-roadmap/>

# 5G Pan-EU Trials Roadmap

## PPP Trials & Pilots (T&Ps) Brochures

- First PPP Trials & Pilots Brochure – September 2019 – Phase 2 Projects (Highlights)



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[https://5g-ppp.eu/wp-content/uploads/2019/09/5GInfraPPP\\_10TPs\\_Brochure\\_FINAL\\_low\\_singlepages.pdf](https://5g-ppp.eu/wp-content/uploads/2019/09/5GInfraPPP_10TPs_Brochure_FINAL_low_singlepages.pdf)

# 5G Pan-EU Trials Roadmap

## Horizon Europe – Smart Networks & Services (SN&S)

- Smart Networks & Services (SN&S) Partnership – Public Position Paper



Brussels, 13<sup>th</sup> February 2019

5G IA's Position Paper on a European partnership on Smart Networks and Services under Horizon Europe

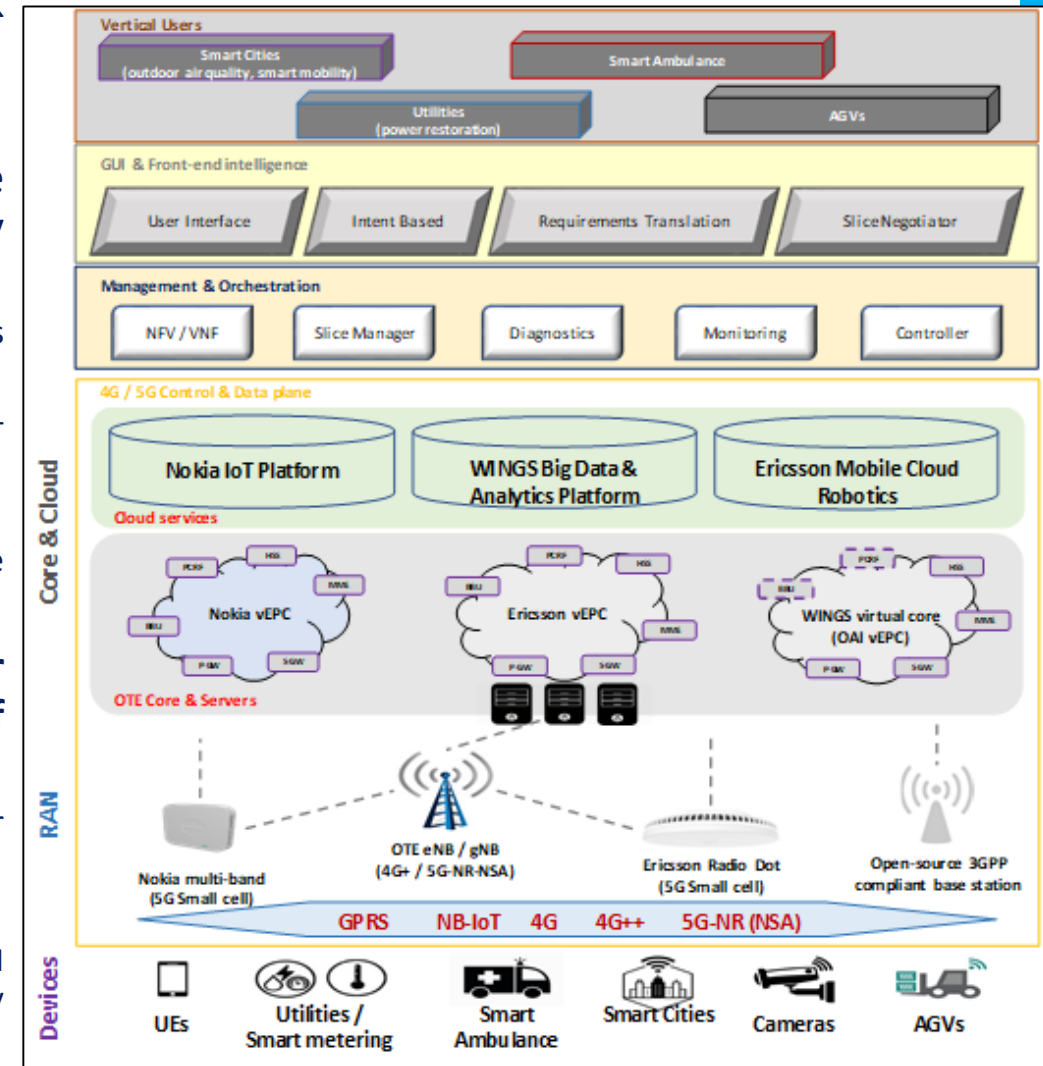
### *Smart Networks and Services for Next Generation Internet*

Smart networks and services are essential for the digital transformation of all sectors of our economy and society, for addressing societal challenges, and for protecting and empowering European citizens to participate in the digital society.

[https://5g-ppp.eu/wp-content/uploads/2019/02/5G-IA-Position-Paper-Smart-Networks-and-Services\\_Horizon-Europe.pdf](https://5g-ppp.eu/wp-content/uploads/2019/02/5G-IA-Position-Paper-Smart-Networks-and-Services_Horizon-Europe.pdf)

# 5G Pan-EU Trials Roadmap: Sample Work: 5G European Validation platform for Extensive trials (5G-EVE)

- The Greek 5G EVE site facility covers a region of Northern Athens, around the R&D site of the Greek National Telecommunication Organization (**OTE**)
  - 5G end-to-end functionality for eMBB, URLLC and mMTC
- OTE, Ericsson GR, Nokia GR and WINGS** are responsible to prepare and upgrade the site facility to enable use cases. First are:
  - Industry 4.0 functionality with Automated Guided Vehicles (AGVs) (ERICSSON-GR)
  - Utilities applications on Smart Energy grid monitoring & ultra-reliable / fast fault detection (WINGS)
  - Smart cities application focused on smart mobility (WINGS)
  - Smart cities applications focused on Connected Ambulance (NOKIA-GR)
- The facility will be offered to vertical industries for execution and validation of pilots with full sets of 5G capabilities**
  - Testing ground for services, equipment, and new features prior to their commercial release
  - IBN and diagnostics (for all sites)
  - Mix of Ericsson and Nokia technologies (complemented by OAI technologies managed by WINGS), which will be progressively extended





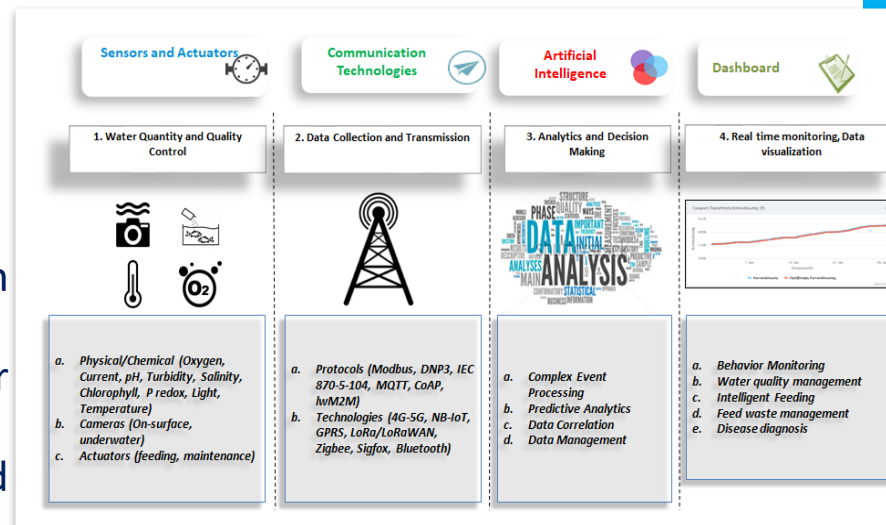
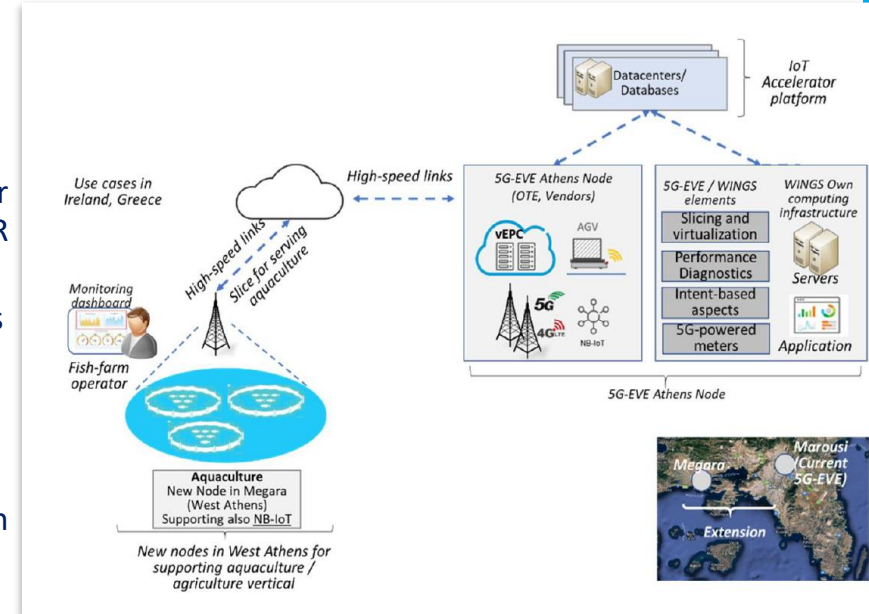
## 5G Pan-EU Trials Roadmap: Sample Work: 5G European Validation platform for Extensive trials (5G-EVE)

- 1st release of AGV, Smart City and Utilities platforms available
- Vertical end devices available, Smart city sensors and actuators, AGVs, Smart energy distributed producers /consumers, sensors, etc.
- GUI development with Intent-based functionality to support vertical users
- Nokia and Ericsson vEPCs (1st release) installed at OTE facilities
- Ericsson Radio-Dot installed at OTE facilities
- Implementation of “Umbrella” Greek site Orchestrator under way
- Greek site facility was part of 5G EVE demo booth at EuCNC 2019 (runner-up award for best demonstration booth)
- Greek team participated in EuCNC 2019 with the publication “Vertical Industries Requirements Analysis & Targeted KPIs for Advanced 5G Trials”



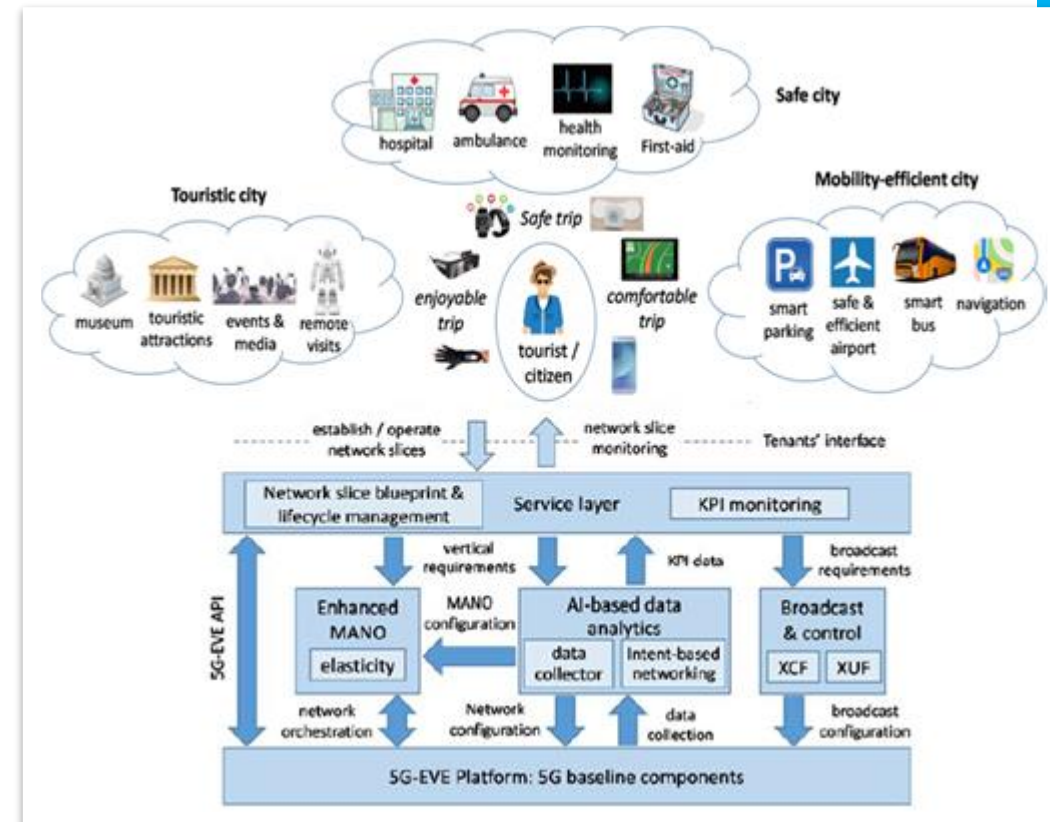
# 5G Pan-EU Trials Roadmap: Sample Work: 5G HEalth AquacultuRe and Transport validation trials (5G-HEART)

- 5G-HEART (validation trials) will focus on these vital vertical use-cases of healthcare, transport and aquaculture. Specific use cases include:
  - Healthcare:** pillcams for automatic detection in screening of colon cancer and vital-sign patches with advanced geo-localization as well as 5G AR/VR paramedic services
  - Transport:** autonomous/assisted/remote driving and vehicle data services
  - Aquaculture:** remote monitoring of fish and water quality
- Aquaculture site
  - 50000 m3 in the area of "Kato Aloni", Megara Bay, Western Attica
  - Three sites: an area of 20000 m3 with 15 cages, an area of 10000 m3 with 12 cages, and an area of 20000 m3 with 10 cages
- Test cases to be integrated in the Greek node
  - Multi-parameter monitoring/data collection (mMTC)
  - Security camera footage (eMBB)
  - Fish monitoring (eMBB)
  - Infrastructure monitoring (eMBB)
  - Autonomous functionality (URLLC)
- Underwater cameras, drones and sensors will be attached in the net or near the surface
- A 5G gateway attached to a raft or a buoy needs to be near the pens, to transmit sensor and camera data
- Data will be received and analyzed by the Integrated Management System applications over the 5G network



# 5G Pan-EU Trials Roadmap: Sample Work: SmarT mObility, media and e-health for toURists and citizenS (5G TOURS)

- 5G-TOURS (validation trials) will focus on the vital vertical use-cases of smart mobility, media and e-health for tourists and citizens aiming not only to improve the quality of life for citizens and tourists, but also represent an important business opportunity as they address industry segments accounting for more than 50% of the estimated revenues generated by verticals.
- Specific use cases include:**
  - Turin, the touristic city:** focused on media and broadcast use cases
  - Rennes, the safe city:** where e-health use cases will be demonstrated
  - Athens, the mobility-efficient city:** that brings 5G to users in motion as well as to transport-related service providers
- The Athens node is based on 5G-EVE Athens site facility which will be extended towards the Athens International Airport, with OTE, Nokia GR, KEMEA, where the following scenarios will be trialed:**
  - Smart airport parking management
  - Video-enhanced ground-based moving vehicles
  - Emergency airport evacuation
  - Excursion in an AR/VR- enhanced bus



# 5G Pan-EU Trials Roadmap: Conclusions

- Intense activity both in quantity and quality
- Validation ongoing
  - Technical and Business Standpoints
- Challenging years with prospects
  - Translating research and development to products and business cases
  - Quest for new frontiers through the SN&S activities

