

Pan-European 5G Trials Roadmap, and International Trials



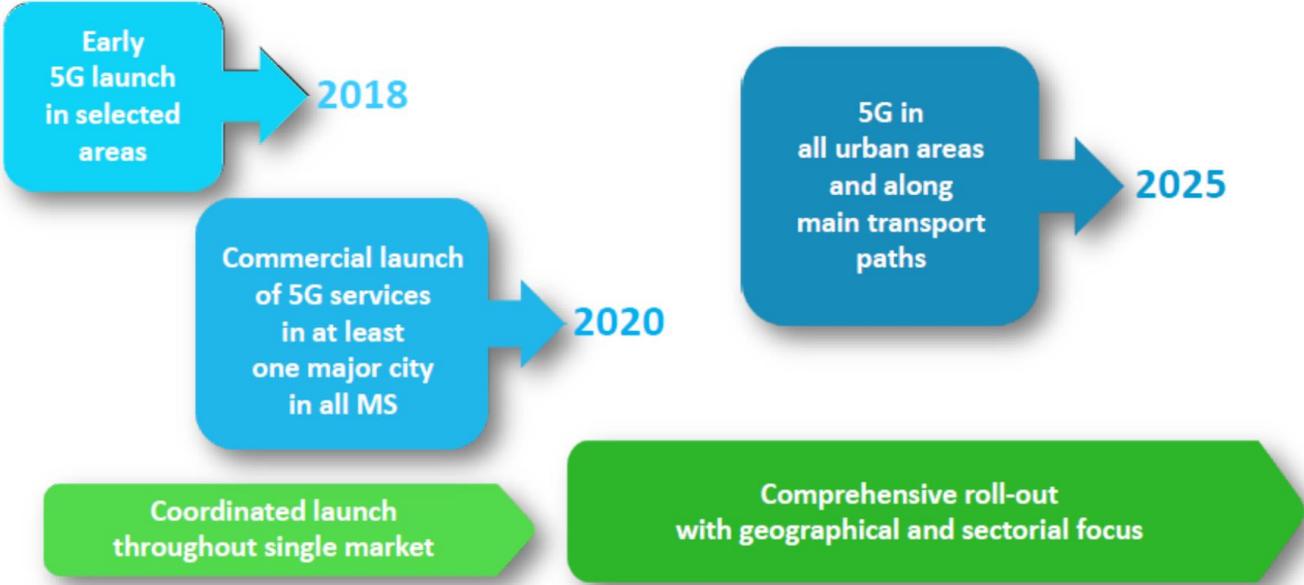
**The voice of the European industry for the
development, deployment and evolution of 5G**

Jean-Pierre Bienaimé, Secretary General, 5G-IA
5G Vertical Users Workshop 12-13 February 2019, Brussels

European Industry
5G Manifesto → 5G Action Plan



5G Action Plan: European strategy for 5G introduction

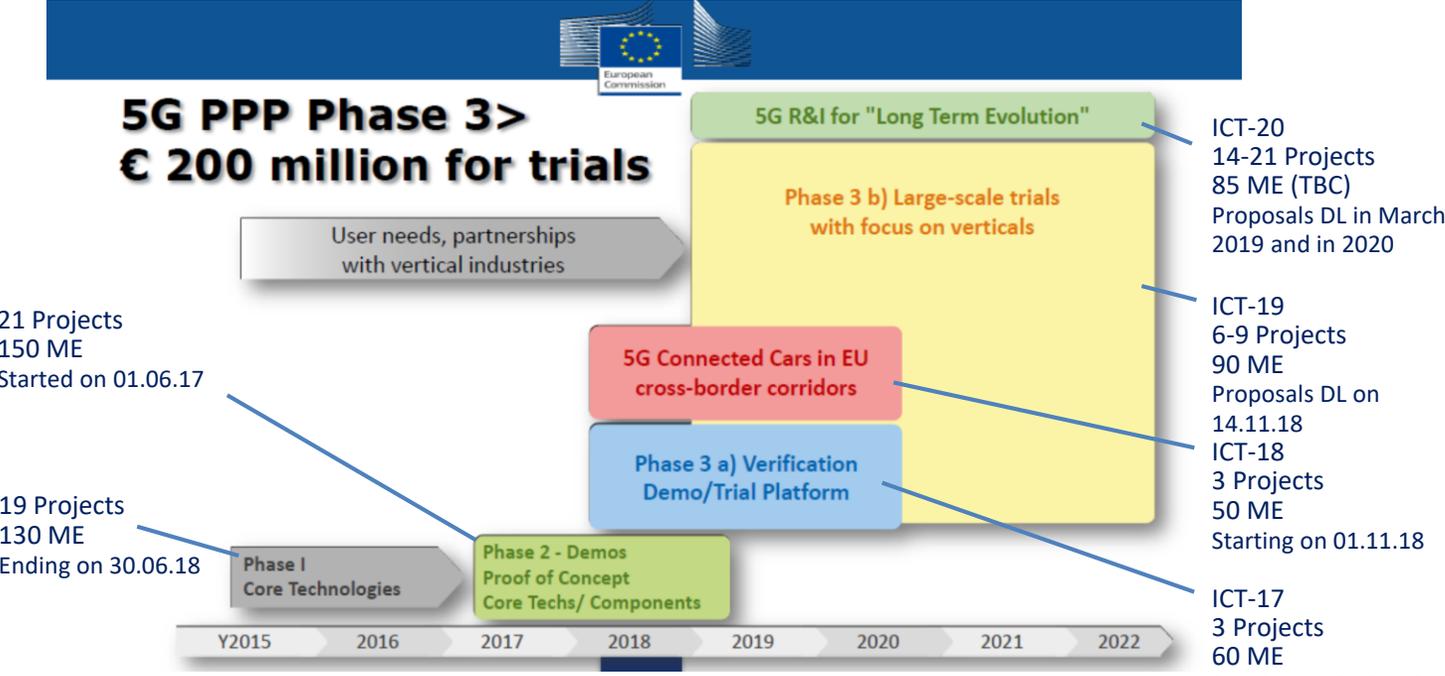


Source: EC DG CNECT

5G Infrastructure PPP
The European path towards global next generation communication networks

**5G PPP
Projects Phase 1 / Phase 2 / Phase 3**

+ additional Strategic Objectives in EC WP2020

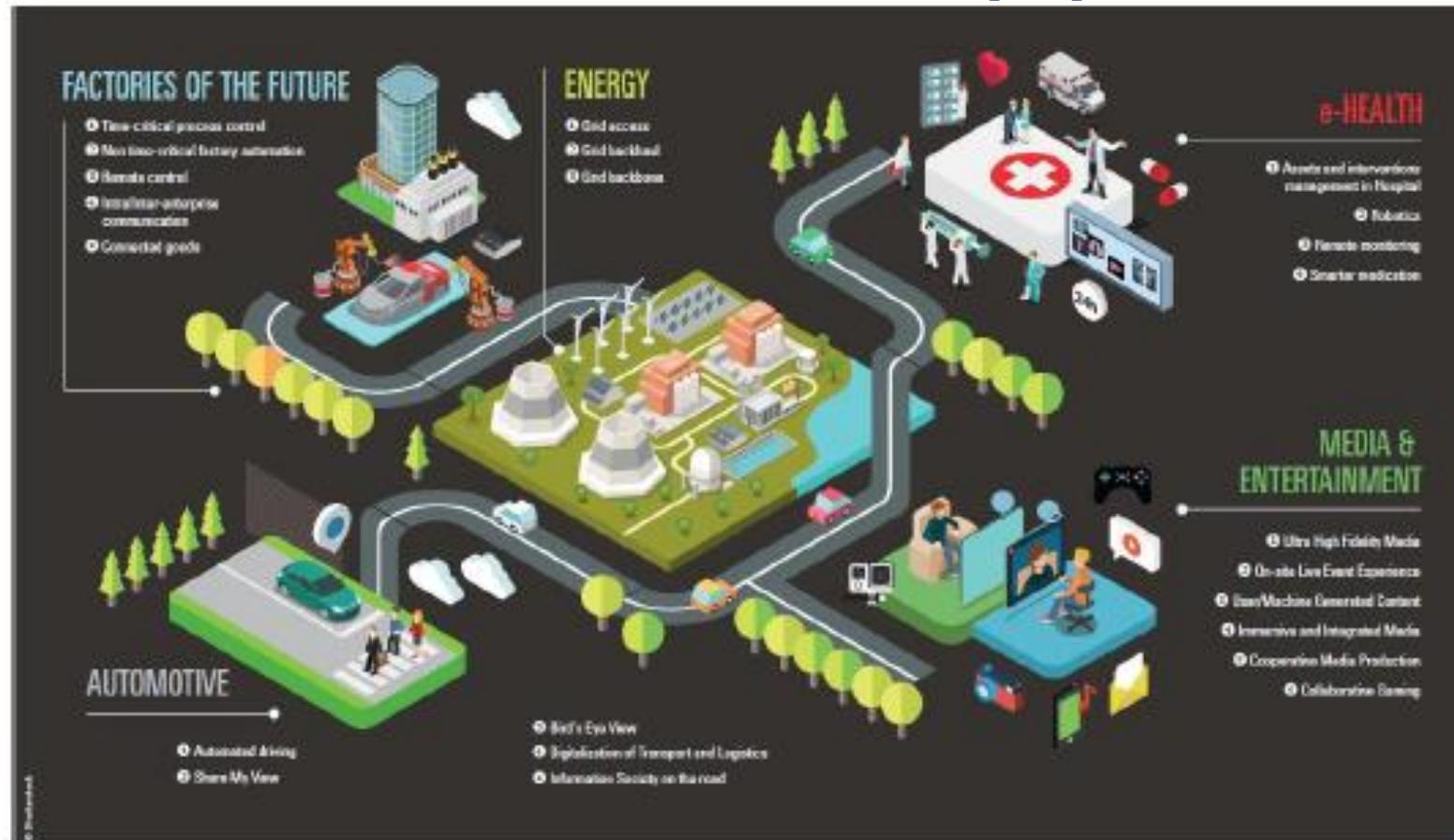


Source: EC DG CNECT

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

5G for Verticals - Whitepaper

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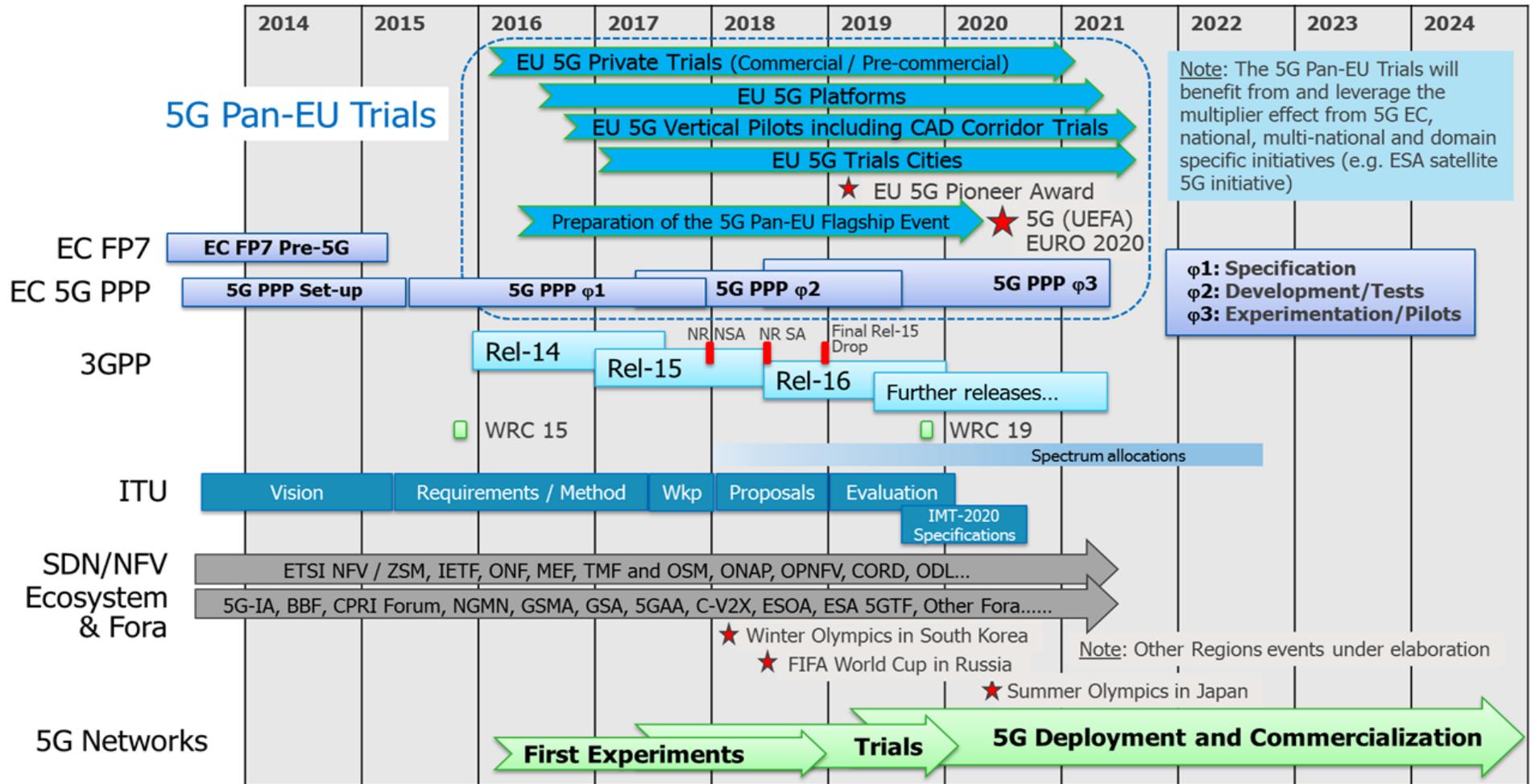
Whitepaper: <https://5g-ppp.eu/white-papers//>

- Whitepapers for each sector have been produced in collaboration of vertical industries champions

5G PAN-EUROPEAN TRIALS ROADMAP TIME PLAN



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https://5g-ppp.eu/wp-content/uploads/2017/05/5GInfraPPP_TrialsWG_Roadmap_Version2.0.pdf



5G roadmap in Europe

Source: Idate



Rel. 15

Rel. 16

Chipsets & devices

Fixed

Mobile

Massive availability and lower costs

Frequency bands

700 MHz

3.5 GHz

mmWave bands

Trials

Commercial deployment

Limited deployments

Massive deployments

2018

2019

2020

2021

2022

2023

2024

2025

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5G Pan-EU Trials Roadmap Version 4.0

EU Trials & Pilots (Highlights)

- **EU 5G Action Plan 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
- **5G strongly boosted in EU in 2018** (pre-commercial, commercial, trials & pilots, R&I, spectrum...), and many EU cities already strongly engaged in 5G development, trials and pilots. First commercial deployment to already start in specific EU cities in 2019
- **5G-IA Trials Roadmap Version 4.0 highlighting the key EU cities** targeted for 5G early deployments, already engaged in 5G pre-commercial/commercial trials and pilots, engaged in 5G R&I trials and pilots and also making available 5G R&I platforms. Description of the major EU cities engaged in the 5G UEFA EURO 2020 Flagship event also included
- European 5G strategy further **targeting large scale adoption of 5G by vertical sectors**, and EU actions boosted with the EC EU 5G Observatory (E5GO)
- **EU 5G trials and pilots supported (R&I) by 5G PPP** incl. running Phase 2 and Phase 3 Platforms and Corridors projects and starting soon Phase 3 Vertical Pilots projects
- **5G-IA at forefront EU level**, incl. on 5G PPP / Projects, Trials WG, Verticals involvement...

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

5G Private Trials in Europe



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Vertical Pilots

- Targeted at validating 5G technologies in multi-vendor and multi-user environments
- 11 different industry segments focused by 5G-IA trials WG → up to 70 use cases
- Different verticals with different levels of 5G readiness/expectations
- Automotive factor & connected cars, industry 4.0,...

5G trials cities

- 5G trials cities / 5G pioneering city where 5G will be deployed in 2020
- Turin (IT), Barcelona (SP), Trikala (GR), Innsbrück (AT), Oulu (FI), Bristol (UK), Paris...

5G for UEFA Euro 2020

- Flagship event to showcase 5G
- Launching event for 5G in Europe with services tested (AR/VR, automated transportation and PPDR)

5G Pan-EU Trials Roadmap Version 4.0

European 5G Observatory (E5GO)

- 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/>)
- First E5GO quarterly report available (http://5gobservatory.eu/PDF/80082-5G-Observatory-Quarterly-report_1.pdf).
2nd Quarterly Report of the 5G Observatory released on 22.01.19 (<http://5gobservatory.eu/wp-content/uploads/2019/01/80082-5G-Observatory-Quarterly-report-2-1.pdf>)

European 5G Observatory

ABOUT OVERVIEW MARKET DEVELOPMENTS DEPLOYMENTS 5G TRIALS PUBLIC INITIATIVES 5G SPECTRUM LINKS

As 5G is gearing up for market deployment, the European 5G Observatory provides updates on all of the latest market developments, including actions being undertaken by the private and public sectors, in the field of 5G. The 5G observatory also delivers an analysis of the strategic implications of the 5G Action Plan and other public policy objectives.

The Observatory focuses on 5G developments in Europe, along with major international developments (USA, Japan, China, South Korea) that could impact the European market.

LATEST NEWS IN EUROPE

- ESA actions in the 5G field**
How to get ESA funding for trials combining 5G with space applications in the context of 5Groningen?
- Deutsche Telekom has taken another step towards commercial 5G launch**
Deutsche Telekom announced a network partnership with Telefonica in October 2018 and an eight-point plan on 5G for Germany.
- Italian 5G spectrum auction**
The auction on 21 September raised 4.42 billion EUR, of which 2.2 billion EUR for mid-range frequencies
- 3.4-3.8 GHz auctions in Finland**
The 130 MHz licenses were awarded to the three different players

<http://5gobservatory.eu/>

TRIALS – Vertical Trials CityScape

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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	(SL)
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)



Source: **Vertical Cartography** (<http://global5g.org/cartography>) *

- 63 trials in 38 cities across 13 Member States covering 8 vertical sectors

*Developed in the context of the TB Vertical Cartography ad-hoc Team and Trials WG Roadmap Version 4.0

EC 5G PPP Phase 2 – Vertical trials & pilots



Connected and Automated Mobility

Smart Cities

Industry 4.0

Projects	Vertical Stakeholders	ITU Service Types	Locations	Projects	Vertical Stakeholders	ITU Service Types	Locations
		eMBB, URLLC	Montlhéry (FR)			mMTC	Hamburg (DE) Turin (IT)
	City councils of Barcelona, Bristol and Lucca	eMBB, URLLC (mMTC)	Barcelona (ES) Bristol (UK) Lucca (IT)			mMTC, URLLC, (eMBB)	Terni (IT)
		eMBB	Watford (UK) Paris (FR) Madrid (ES)			mMTC (URLLC)	Detmold (DE)
		eMBB	Surrey (UK) Munich (DE) Turku (FI)			URLLC	Brande (DK)
		eMBB	Egaleo (EL)			mMTC, URLLC, eMBB	Barcelona (ES) Bristol (UK)
		eMBB	Athens (EL) Thessaloniki (EL) Madrid (ES) Rome (IT)			mMTC, URLLC	Paris, Grenoble (FR)
		eMBB, URLLC	Aveiro (PT) Athens (EL)			URLLC, eMBB	Coventry (UK)
		URLLC	Turin (IT), Pisa (IT) Madrid (ES) Nice (FR)			URLLC (eMBB)	Genoa (IT) Ljubljana (SL)

Consumer and Professional Services

Transport

Public Safety & Digital Divide

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Phase 2 Projects Use Cases

- **Automotive**
 - Connected car – V2X
 - Autonomous driving
- **Industry**
 - Factory & process automation
 - In-factory tracking of goods and resources
 - Agriculture & farming technologies
 - Logistic
- **Media & Entertainment**
 - Broadcast services (B2C, B2B2C)
 - Education
- **Health**
 - Smart health
 - Smart pharmaceuticals
 - Medical emergency management
 - Hospital administration
 - Telemedicine
- **Public Safety**
 - Emergency communication
 - Rapid disaster response
 - Public event management
 - Critical asset protection
 - Remote area coverage
- **Energy**
 - (Residential/industry) energy management and provisioning
- **Smart Cities**
 - Public administration
 - Tourism
 - Assisted living
 - People mobility
 - Smart Building
 - Education
- **Transport & Logistics**
 - Rail, maritime and aviation
 - Efficient mobility of people and goods
 - Mobility as a Service

Ongoing Activities

- Synchronization with Global5G.org web site:
<http://www.global5g.eu/cartography>

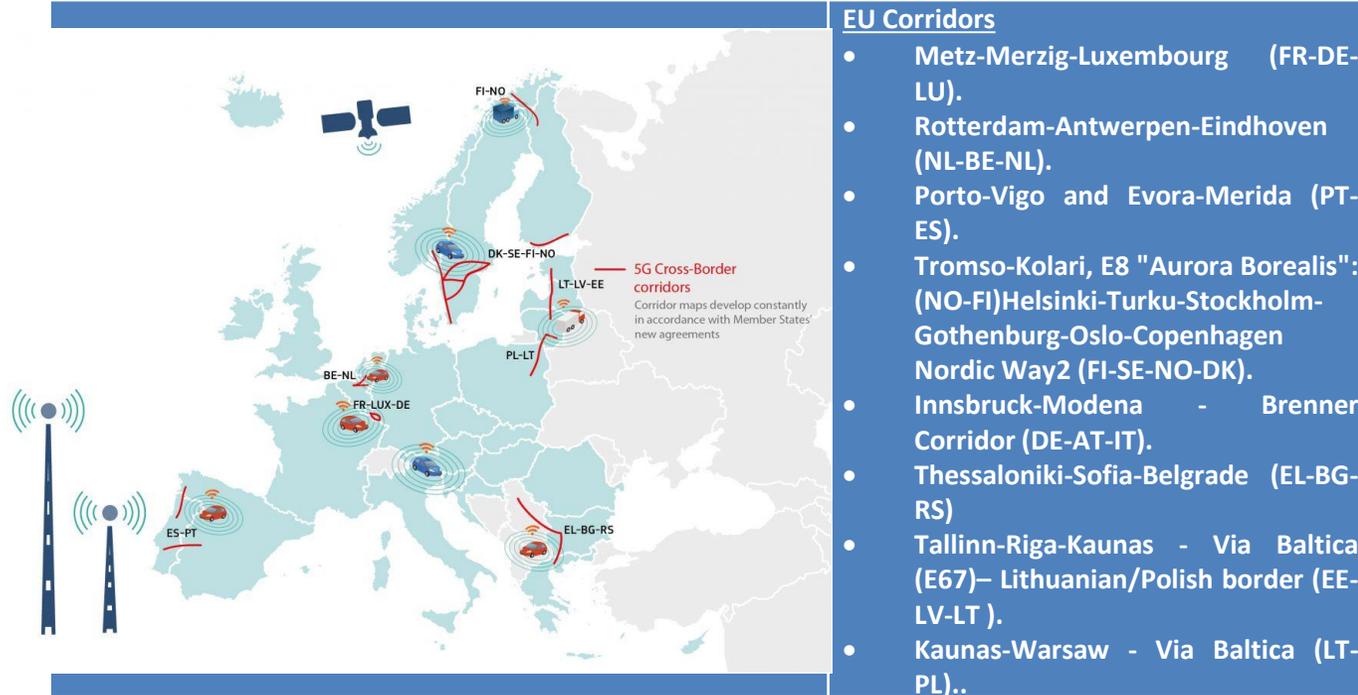
Phase 2 Projects Clustering

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Vertical Category	Project	Verticals Stakeholders	Project Trial / Pilot Focus	ITU Service Type	Location
Connected and Automated Mobility	5GCAR	Volvo, PSA, and Bosch	End-to-end V2X network connectivity for highly reliable and low-latency V2X services.	eMBB, URLLC	Monthéry (FR)
	5GCity	City councils of Barcelona, Bristol and Lucca	Distributed cloud and radio platform for municipalities and infrastructure owners acting as 5G neutral hosts.	eMBB, URLLC (mMTC)	Barcelona (ES), Bristol (UK), Lucca (IT)
Consumer and Professional Services	IoRL	BRE, Issy Media and Ferrovial	Indoor delivery of very high bandwidth, low latency and location based services.	eMBB	Watford (UK), Paris (FR), Madrid (ES)
	5G-Xcast	BBC, EBU and LiveU	5G network architecture for large-scale immersive media delivery.	eMBB	Surrey (UK), Munich (DE), Turku (FI)
	5G ESSENCE	Smart Mobile Labs GmbH	5G Edge network acceleration for a stadium.	eMBB	Egaleo (GR)
	5G-MEDIA	CERTH/ITI, IRT and RTVE	Tele-immersive applications, mobile contribution, remote and smart production in broadcasting.	eMBB	Athens (GR), Thessaloniki (GR), Madrid (ES), Rome (IT)
Transport	5GTANGO	Nurogames	Immersive media application showing added value of 5G service network programmability, automatic testing and NFV orchestration.	eMBB, URLLC	Aveiro (PT), Athens (GR)
	5G-Transformer	CRF and SAMUR	Transforming today's mobile transport network into an SDN/NFV-based Mobile Transport and Computing Platform (MTP) which brings the "Network Slicing" paradigm into mobile transport networks.	URLLC	Turin (IT), Pisa (IT), Madrid (ES), Nice (FR)
Industry	5G-MoNArch	Hamburg Port Authority and Turin Palazzo Madama	A flexible, adaptable, and programmable architecture for 5G brought into practice in two testbeds: Hamburg for	mMTC, URLLC (eMBB)	Hamburg (DE), Turin (IT)

Vertical Category	Project	Verticals Stakeholders	Project Trial / Pilot Focus	ITU Service Type	Location
			network resilience and Turin for resource elasticity.		
	NRG-5	Ineo Energy & Systems, Romgaz, Emotion and ASM Terni	Smart Energy-as-a-Service: Making the operation and management of communications and energy infrastructures easier, safer, more secure and resilient.	mMTC, URLLC (eMBB)	Terni (IT)
	5GTANGO	Weidmüller	Smart manufacturing showing added value of 5G service network programmability, automatic testing and NFV orchestration.	mMTC (URLLC)	Detmold (DE)
	VirtuWind (PPP Phase 1)	Siemens Wind Power	SDN/NFV to lower CAPEX/OPEX in control network infrastructure in an operational wind energy park.	URLLC	Brande (DK)
	5G-Picture	FGC Ferrocarrils de la Generalitat de Catalunya and Comsa Industrial	Adoption of the 5G disaggregated RAN (DA-RAN) architecture for demonstration of 5G rail services in a real railway testbed.	mMTC, URLLC, eMBB	Barcelona (ES), Bristol (UK)
	NGPaaS	Vertical M2M and Virtual Open Systems	"Build-to-order" IoT Platform as a Service: Isolation of two devices (Health vs Temperature) using a single virtual IoT gateway component.	mMTC, URLLC	Paris, Grenoble (FR)
Public Safety & Digital Divide Resorption	5G-ESSENCE	Thales Communications & Security SAS	Demonstrate and evaluate the cloud-integrated multi-tenant small cell network customisable on a per vertical basis.	URLLC, eMBB	Coventry (UK)
	MATILDA	ININ Internet Institute	5G-enabled emergency response for real time intervention monitoring and critical infrastructure protection, showing Services Orchestration with SLA Enforcement.	URLLC (eMBB)	Genova (IT), Ljubljana (SL)

TRIALS – 5G Corridors

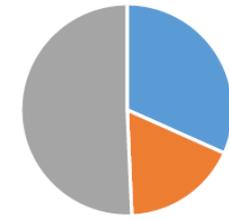
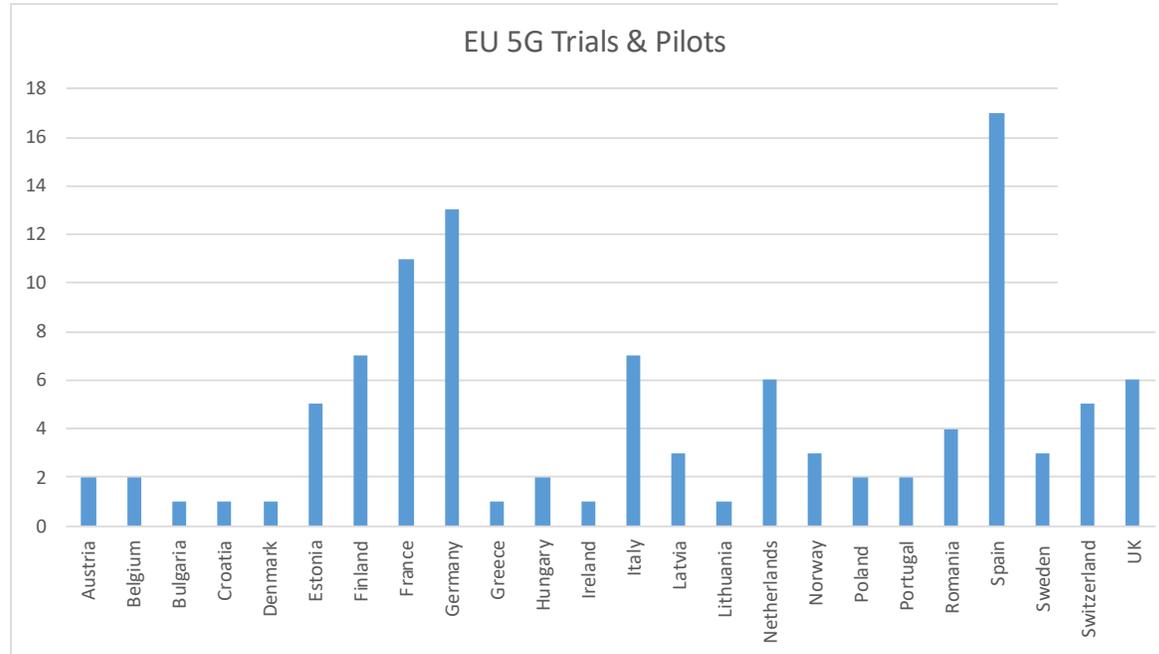


Source: 5G Trial Roadmap

- Corridors to test CAD/CAM vs 5G have been realized with CEF and 5G PPP Phase 3 funding
- Automotive sector with a leading role in 5G testing but ITS G5 is also supported

TRIALS – GeoDistribution

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- (1) "Announced / Planned"
- (2) "In Progress"
- (3) "Completed"

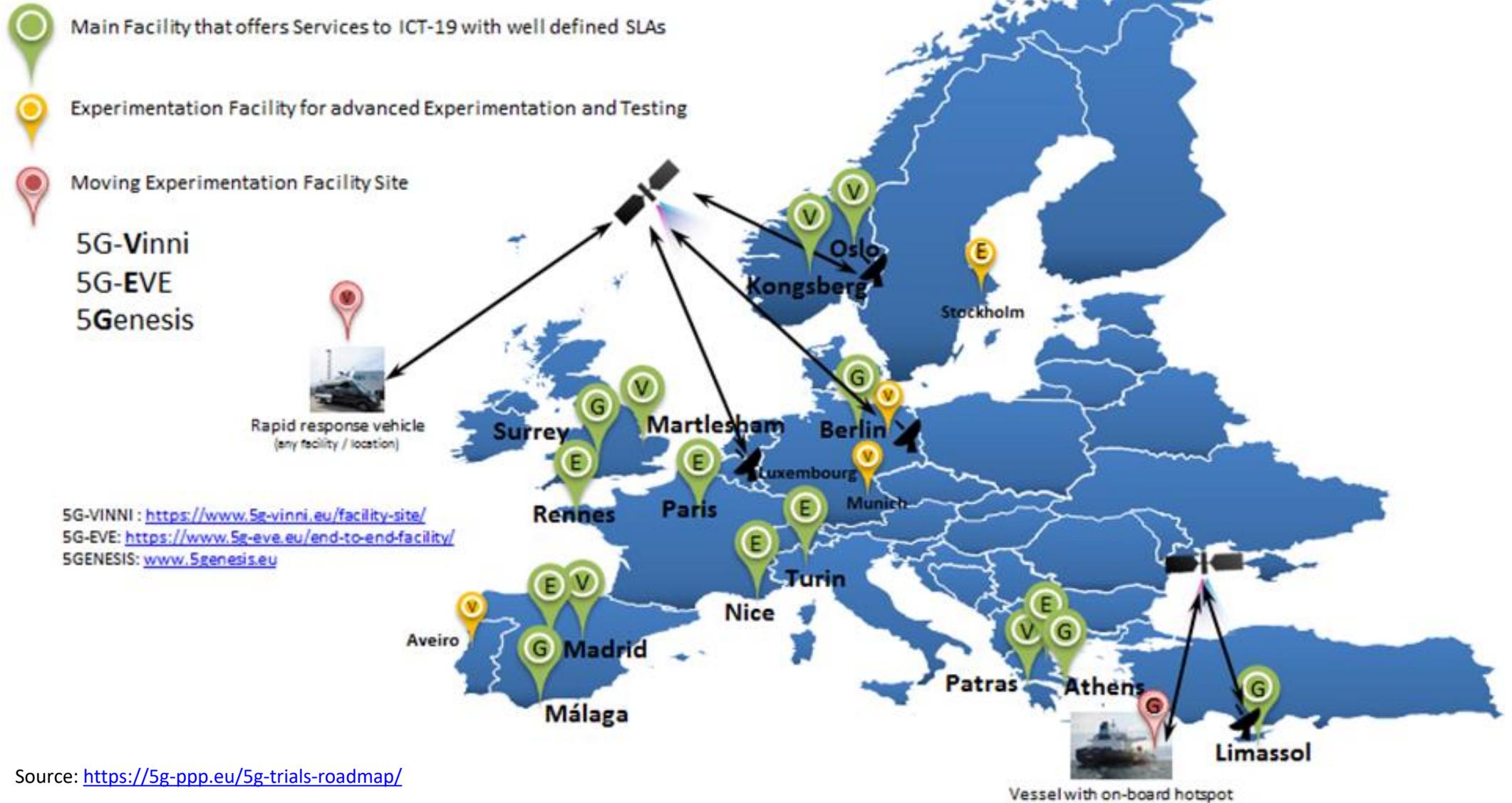
Source: **5G Observatory**: (<https://5gobservatory.eu/5g-trial/>)

- 106 trials (with different level of maturity) in EU cities and MSs, filtering the data from the current draft XML file of the EC EU 5G Observatory, in the context of the development of the 5G Pan-EU Trials Roadmap Version 4.0



EC 5G PPP Phase 3 – 5G Platforms

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

International Trials

Pan-European 5G-IA trials roadmap - international trials:

- International cooperation on trials is needed to contribute to ensure:
 - Global 5G vision, and consensus on 5G standards and spectrum requirements
 - **Avoid premature “5G” launch announcements and the subsequent potential fragmentation among the different countries**
- To achieve these goals, the 5G-IA/5G PPP is notably promoting **joint cooperation via participation in trials:**
 - **Private trials** (the already signed multi-lateral MoU can pave the way to have bilateral agreements / MoUs on trials). Additional MoUs are being sought after.
 - **5G PPP calls of H2020** (the EC funding to partially support the development of EU-X joint trials between regions/countries is of paramount importance)

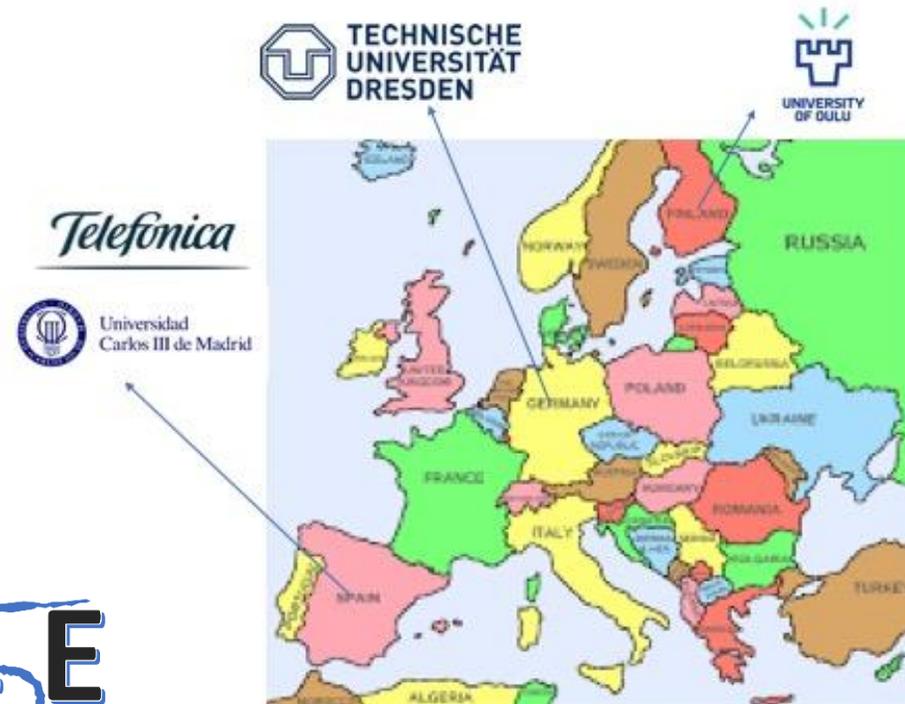
Inter-regional Activities – 5G PPP Calls in H2020



	R&D , 2018-20 Work-programme	Policy
JAPAN	<ul style="list-style-type: none"> - Applications and trials with 5G networks - Beyond 5G, applicability of spectrum >275 GHz 	<ul style="list-style-type: none"> - Spectrum, interoperability at different bands
REPUBLIC OF KOREA	<ul style="list-style-type: none"> - Application trials at mmwave bands - Interoperability and integration of 5G vertical testbeds in heterogeneous environments 	<ul style="list-style-type: none"> - Standards, validation of specs
CHINA	<ul style="list-style-type: none"> - eMBB trials at 3,5 Ghz and trials in the V2X context 	<ul style="list-style-type: none"> - Spectrum co-operation - Standards, preparing 5G phase 2 through trial results
TAIWAN	<ul style="list-style-type: none"> - 5G trials addressing End to End Testbeds for specific applications 	
BRAZIL	<ul style="list-style-type: none"> - Trials 	<ul style="list-style-type: none"> - Spectrum co-operation - Standards - Trials

International collaboration

- Brazil and Europe joint call on 5G.
- 5G-RANGE project: design and implement a 5G network for remote areas



RANGE

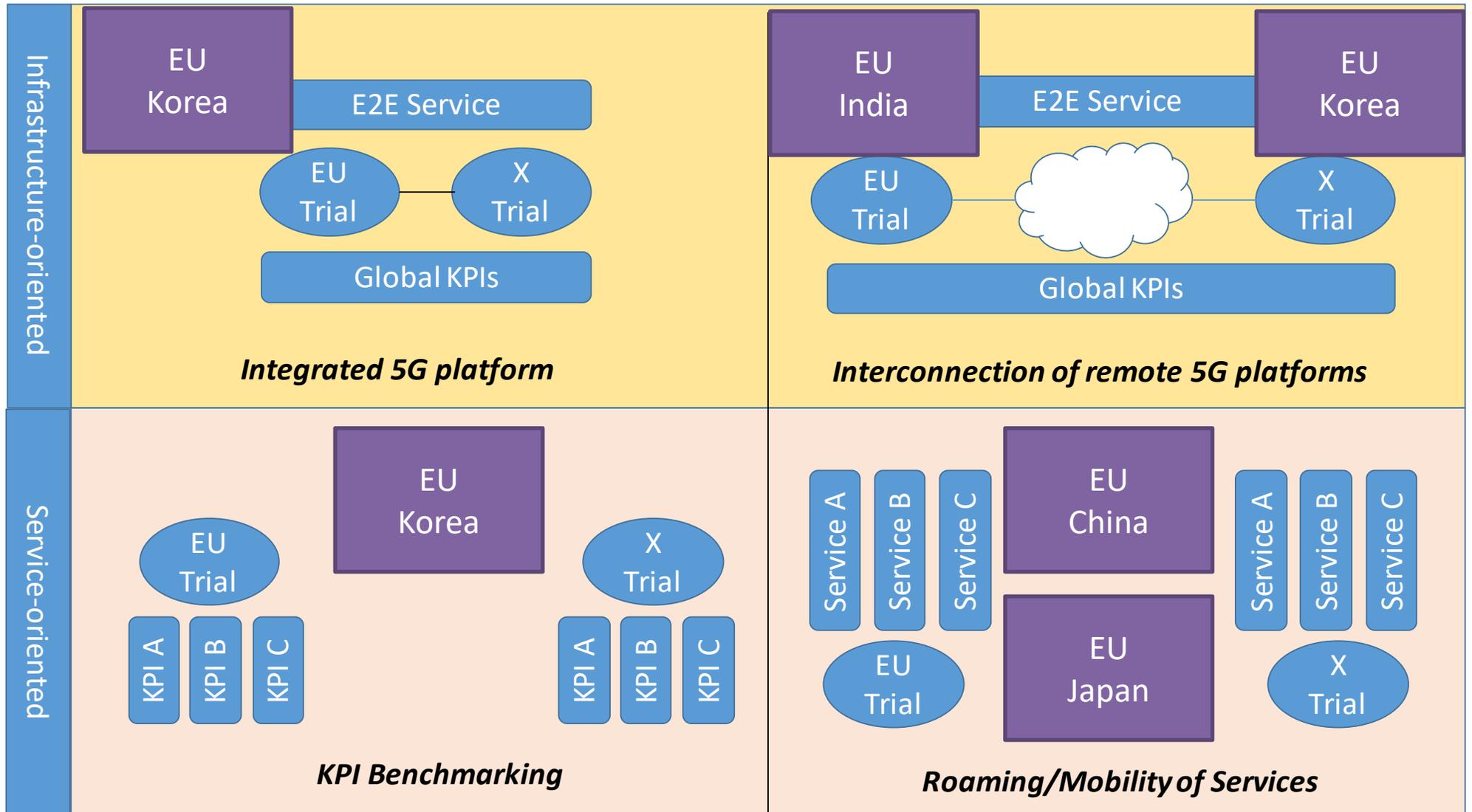
EU-China Trials Project



**→ EU-China Phase 3 Project 5G-DRIVE
5G Harmonised Research & Trials for
Service Evolution between EU and China:
joint trials and deployment scenarios on
eMBB and V2X**

Inter-regional Trials

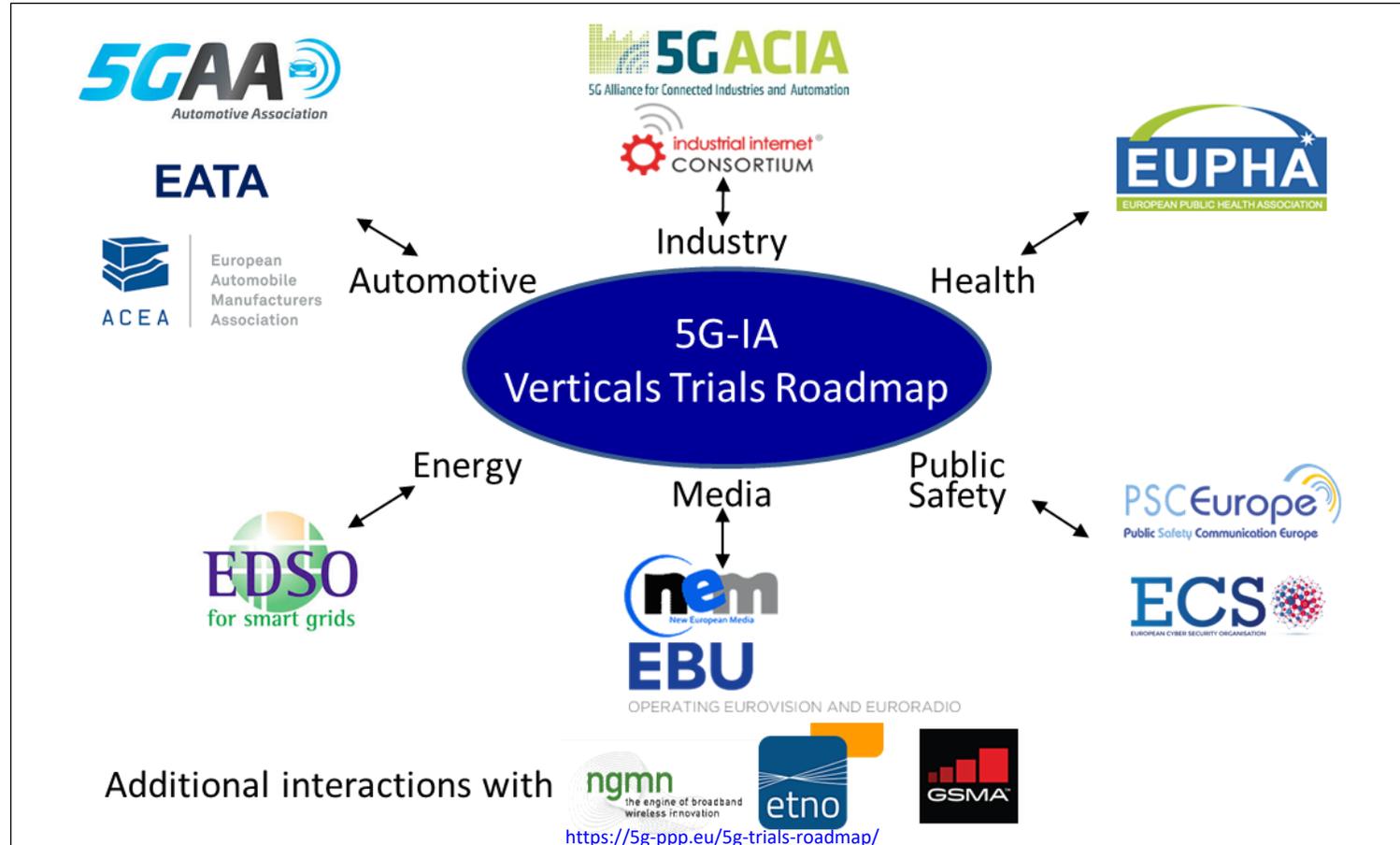
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5G IA – 5G PPP Vertical Perspectives & Cooperation



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5G Challenges ...



- Automated, secure-by-design, 5G service engineering, delivery & operation
- Spectrum harmonization
- Standardization

→ Consolidation of the verticals needs (automotive,...) and of trials/pilots between telecoms actors (vendors, operators) and vertical actors, in order to build the 5G ecosystem

Thank you for your attention!

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5G IA
INFRASTRUCTURE ASSOCIATION

**The voice of the European industry for the
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<http://5g-ia.eu>