Status update on the 5G PPP Collaboration & Moving ahead

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http://5g-ppp.eu/
5G Research & Development (5G PPP)

PHASE 1: 5G Core Research
main achievements:
• 5G System design & Evaluation aspects
• 5G Air interface innovations
• Network management & Security innovations
• Virtualization & Service deployment innovations
• 100s of contributions to standardization

PHASE 2: 5G Vertical Trials

PHASE 3: 5G Innovation Platforms

5G PPP Phase 3

Platforms, Corridors, Verticals Pilots, 5G LTE...

International Cooperation

https://5g-ppp.eu/phase-3-pre-structuring-model/
## Inter-regional Activities

<table>
<thead>
<tr>
<th>Country</th>
<th>R&amp;D, 2018-20 Work-programme</th>
<th>Policy</th>
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</thead>
<tbody>
<tr>
<td>JAPAN</td>
<td>- Applications and trials with 5G networks</td>
<td>- Spectrum, interoperability at different bands</td>
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<tr>
<td></td>
<td>- Beyond 5G, applicability of spectrum &gt;275 GHz</td>
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<tr>
<td>REPUBLIC OF</td>
<td>- Application trials at mmwave bands</td>
<td>- Standards, validation of specs</td>
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<tr>
<td>KOREA</td>
<td>- Interoperability and integration of 5G vertical testbeds in heterogeneous environments</td>
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<tr>
<td>CHINA</td>
<td>- eMBB trials at 3,5 Ghz and trials in the V2X context</td>
<td>- Spectrum co-operation</td>
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<td>- Standards, preparing 5G phase 2 through trial results</td>
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<tr>
<td>TAIWAN</td>
<td>- 5G trials addressing End to End Testbeds for specific applications</td>
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<tr>
<td>BRAZIL</td>
<td>- Trials</td>
<td>- Spectrum co-operation</td>
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<td>- Standards</td>
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<td>- Trials</td>
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# 5G PPP Governance – Work Groups

<table>
<thead>
<tr>
<th>5G IA WGs &amp; Activities</th>
<th>5G-PPP Projects WGs</th>
<th>NetWorld 2020 WGs</th>
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<tbody>
<tr>
<td>Pre-standardization WG</td>
<td>Trials WG</td>
<td>SME WG</td>
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<tr>
<td></td>
<td>Software Networks (SDN and NFV) WG</td>
<td>Show the expertise and innovation of SMEs in 5G and beyond, to increase their participation in global projects and collaborations</td>
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<td></td>
<td>Security WG</td>
<td>SatCom WG</td>
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<td></td>
<td>Security (Content and Community wise) the way it should be for 5G to generate the necessary trust and confidence to release its full potential</td>
<td>Define Vision for &amp; Prioritize SatCom related research topics. Foster: fixed/mobile Satellite network CV with 5G network and the link between SatCom Research and standards. Inputs to EC research plans</td>
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<tr>
<td>Spectrum WG</td>
<td>5G Architecture WG</td>
<td>Media WG</td>
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<td></td>
<td>Network Mgmt &amp; QoS WG</td>
<td>(NEM Initiative and NetWorld2020)</td>
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<td></td>
<td>Community building and Public Relations Activity</td>
<td>Identify the Media &amp; content domain requirements and the corresponding impacts on 5G.</td>
</tr>
<tr>
<td>Vision and Societal Challenges WG</td>
<td>ITU-R IMT2020 Evaluation WG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposed description is too long</td>
<td></td>
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<tr>
<td>5G International cooperation Activity</td>
<td>Automotive WG</td>
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<td></td>
<td>Focuses on connected and automated mobility. Range of topics, such as use cases and KPIs, business aspects, spectrum usage, infrastructure capabilities, security and safety</td>
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<tr>
<td>5G-PPP Contractual Arrangement, KPIs Activity</td>
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</table>

- **Trials WG membership is open (approval is required). Verticals are welcome to join the WG.**
- **NetWorld2020 membership is free.**
Mission of IMT-2020 Evaluation Group

- ITU-R initiated - as for former systems - an independent evaluation process of submitted radio interface technologies (RITs).
- Objectives of the 5G IA Evaluation Group are:
  - To perform an independent evaluation of IMT-2020 proposals to support ITU-R WP5D for the finalisation of the IMT-2020 specification in 2020.
  - To prepare a complete evaluation report from the European perspective in the global context of other evaluation groups from other regions and to demonstrate the importance and global presence of communication technology industry in Europe.
  - To focus evaluation activities on the 3GPP Releases 15 and 16 to check, whether this proposal meets the minimum 5G requirements of ITU-R and whether this proposal can be regarded as an IMT-2020 system.

Source: 5G Infrastructure Association.
Registered IMT-2020 Evaluation Groups
Status: December 2017

- **5G Infrastructure Association** - 5G PPP web site
- **ATIS WTSC IMT-2020 Evaluation Group** - WTSC web site
- **ChEG Chinese Evaluation Group** - ChEG web site
- **Canadian Evaluation Group** - CEG web site
- **Wireless World Research Forum** - WWRF web site
- **Telecom Centres of Excellence, India** - TCOE web site
- **The Fifth Generation Mobile Communications Promotion Forum, Japan** - 5GMF web site
- **TTA 5G Technology Evaluation Special Project Group** - TTA SPG33 web site
- **Trans-Pacific Evaluation Group** - TPCEG web site
- **ETSI Evaluation Group** - ETSI web site
5G system aims at providing a flexible network architecture, enabling new business cases and models supporting vertical industries. Network slicing emerges as a promising future-proof framework and needs to be designed from an end-to-end perspective. Furthermore, security architecture shall be natively integrated into the overall architecture. The support of verticals is enabled also by a flexible function deployment and relocation based on the requirements in terms of capacity, latency and reliability.

https://5g-ppp.eu/white-papers/
https://5g-ppp.eu/5g-architecture-paper
5G Automotive WG: A Study on 5G V2X Deployment

- **Main stakeholders:**
  - 5G industry
  - Automotive industry
  - Standardization (e.g. 3GPP)
  - Road infrastructure operators and mobile service providers (MSP)
  - Policy makers
  - Users (vehicles and humans)
Conclusions and Further Study

**Conclusions:**

- Stakeholders’ role needs to be clarified
- **Business models must be re-thought:** involving users actively and potentially “rewarding” collaboration between them.
- Initial investment in 5G on highways shall provide ITS and other services simultaneously (shared costs).
- Return on investment can be expected after a few years, key parameters are **service fees** and **number of active users**.

**Further Study:**

- What will be the “money flow” on a “5G digitized highway”?  
- A subset of services (see-through, platooning) could be provided over V2V sidelink in order to offload the network infrastructure.
- Business scenario looks very promising, but **key parameters and value estimations need careful study** before deployment starts.
- Business models and overall plans need to be agreed between all stakeholders.
- Early engagement of OEMs and automotive industry needed!
5G PAN-EUROPEAN TRIALS ROADMAP STRATEGY

5G Private Trials (Commercial and pre-commercial)

5G Trials Cities

5G Platforms

Platforms Projects

5G Vertical Pilots

Vert. Pilots Projects

EC 5G Infrastructure PPP / Phase 3

Platforms

Vertical Pilots

Domains Specific Programs

Platforms

Vertical Pilots

MSs Programs

Private funding

Public co-funding

5G PAN-EUROPEAN TRIALS ROADMAP
TIME PLAN

The true differentiator for 5G is the vertical markets.
If we fail with the verticals, we fail with 5G.
Real world Verticals are committed to 5G

LEONARDO: “5G will provide the basis for relevant evolutions in vertical applications for Security (Public Protection, Disaster Relief, Critical Infrastructures). Full integration of operational Narrowband Mission Critical Systems in the 5G ecosystem, and compliance with Security specific KPI, will need ad-hoc trials and tests with final users”

VOLKSWAGEN: “Automated Driving 2.0 will need Dynamic Network Slicing and predicted QoS, THE enabler for automotive 5G use cases…”

PEUGEOT: “Integration of 5G in automotive responds to global needs in connectivity, as well as requests for autonomous car with connections to networks and cloud, and V2X connectivity. Autonomous car will request hybrid architecture, sensors and femtocells networks for a perfect virtual knowledge of the road…”

BOSCH: « 5G may be disruptive for the manufacturing industry: high reliability and low latency are major requirements for new applications, such as mobile robots, factory automation, augmented reality and logistics »
## 5G Pan-EU Trials Roadmap

### Vertical Pilots in 5G PPP Projects

<table>
<thead>
<tr>
<th>Projects</th>
<th>Vertical Stakeholders</th>
<th>ITU Service Types</th>
<th>Locations</th>
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<tbody>
<tr>
<td>5G Pan-EU Trials Roadmap</td>
<td>eMBB, URLLC</td>
<td>Monthlery (FR)</td>
<td></td>
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<tr>
<td>5G City</td>
<td>eMBB, URLLC (mMTC)</td>
<td>Barcelona (ES) Madrid (ES)</td>
<td></td>
</tr>
<tr>
<td>5G City</td>
<td>eMBB</td>
<td>Watford (UK) Turku (FI)</td>
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<tr>
<td>5G ESSENCE</td>
<td>eMBB</td>
<td>Egaleo (EL)</td>
<td></td>
</tr>
<tr>
<td>5G MEDIA</td>
<td>eMBB</td>
<td>Athens (EL) Thessaloniki (EL) Rome (IT)</td>
<td></td>
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<tr>
<td>5G tangoA</td>
<td>eMBB, URLLC</td>
<td>Aveiro (PT) Athens (EL)</td>
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</tr>
<tr>
<td>IRT</td>
<td>URLLC</td>
<td>Turin (IT), Pisa (IT) Madrid (ES) Nice (FR)</td>
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<tr>
<td>NUROGAMES</td>
<td>URLLC</td>
<td>Genoa (IT) Ljubljana (SL)</td>
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[https://5g-ppp.eu/5g-trials-roadmap/](https://5g-ppp.eu/5g-trials-roadmap/)
Dedicated Board Task Force to make engagement more effective

- **Strategy document** created:
  - Priority Vertical Sectors
  - Industry fora to be addressed
  - Relevant B2B industry events

- Bottom up activities on verticals recorded in a Tracker document to trigger future top down actions – “one stop shop” document on all vertical related activities in 5G PPP

5G Vertical Strategy
Vertical Sectors and Associations

5G-IA
Verticals Trials Roadmap

Additional interactions with

https://5g-ppp.eu/5g-trials-roadmap/
**Verticals Task Force Outputs**

- **Vertical Cartography** – mapping of vertical Use-Cases vs 5G functions in 5GPPP funded project

<table>
<thead>
<tr>
<th>Use (Industry Vertical)</th>
<th>Description</th>
<th>Experiment Location</th>
<th>Type of Experiment</th>
<th>Targeted Experiment</th>
<th>Relevant 5G ITU Functionality (eMBB / URLLC / mMTC)</th>
<th>Relevant Addressed Standardization Body/Group</th>
<th>Vertical Consortium Partners Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>5GCAR - Lane Merge</td>
<td>The lane merge use case deals with the automated creation of gaps for cars entering a lane, using cellular communication and a centralized lane merge coordination. In the planned setup, a fixed camera installation near the intersection is used to detect vehicles that are not connected and thus cannot receive instructions or communicate their location and intentions.</td>
<td>Lure (F)</td>
<td>Demonstration</td>
<td>Q2-2019</td>
<td>eMBB, URLLC</td>
<td>5G NSA, 5G NR, 5G C-RAN</td>
<td>Volvo, PSA, Ericsson, Orange, KCL, Marben, Viscoda, CTAG</td>
</tr>
<tr>
<td>5GCAR - Cooperative Perception for Manoeuvres of Connected Vehicles</td>
<td>Cooperative perception is enabled by a combination of V2V and V2I communication, using both 5G and 4G simultaneously. 5G provides low latency V2V communication based on camera streaming overlaid with sensor information.</td>
<td>Lure (F)</td>
<td>Demonstration</td>
<td>Q2-2019</td>
<td>eMBB, URLLC</td>
<td>5G NR, 5G NSA, 5G C-RAN</td>
<td>Bosch, Huawei, Orange, Bosch</td>
</tr>
<tr>
<td>5GCAR - Vulnerable Road User Protection</td>
<td>A car and a VRU (vehicle as vulnerable road user) with both using all the vertical requirements, are each equipped with hardware prototypes continuously transmitting 5G positioning signals to the network infrastructure. A 4G network is used to exchange real-time location information and warning messages, to enable solutions. If driverless, the vehicle detects relevant clients such as cyclists or pedestrians, showing a visual alert in near real-time to the driver, or a visual alert for pedestrians. This could also be used to display the position of the vehicle to others.</td>
<td>Lure (F)</td>
<td>Demonstration</td>
<td>Q2-2019</td>
<td>eMBB, URLLC</td>
<td>5G NR, 5G NSA, 5G C-RAN</td>
<td>Volvo, PSA, Nokia, Orange, CTAG</td>
</tr>
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- **Vertical Use-Cases** – mapping of 5G use cases against 5G technology functions (for 5G trials)

- **Vertical 5G Trials** – EU roadmap and full map of 5G trials/pilots in Europe [https://5g-ppp.eu/5g-trials-2/](https://5g-ppp.eu/5g-trials-2/)

- **Vertical Events** – updated list of B2B events in vertical industries (with 5G IA speakers) [https://5g-ppp.eu/verticals/](https://5g-ppp.eu/verticals/)
In June 2019, Global 5G Cooperation will meet EUCNC...
Beyond H2020: 5G-IA Recommendations

- Communication Infrastructures are critical to creating the future digital society, creating jobs and creating growth.
- Europe needs to continue the good work started by 5G PPP
- Europe should establish a new key area in FP9 on Smart Networks (communication infrastructure, digital security and connectivity) with a significant budget allocation
- This activity should be implemented in a (PPP-type) partnership instrument in close cooperation with other areas in FP9, which can contribute to Smart Networks.
Thank you for your attention!

http://5g-ppp.eu