



The 5G Infrastructure Public-Private Partnership

5G and vertical sectors whitepapers (WWRF 5G Huddle)

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David Soldani

(Board Member of the 5G Infrastructure Association)

Context of this presentation



- **A workshop**, aiming at fostering the interactions between the more traditional ICT sector and vertical industries, was co-organized by the European Commission and 5G Infrastructure Association in **Brussels the 18th of June**.
- The workshop gathered around **50 participants** from automotive, energy, factories of the future / manufacturing, health, media / entertainment and ICT sectors.
- Following this workshop, **4 whitepapers on 5G and vertical sectors** have been initiated and cover:
 - Socio-economic **drivers** of vertical sectors at the horizon 2020
 - How can **5G be a catalyzer** for vertical sectors?
 - **Use cases** and technical **requirements**
 - **Limitations** of existing communication technologies
 - Business and **regulatory** aspects
 - Research and Innovation issues: **new technical problems to address**

White Paper 5G and Automotive



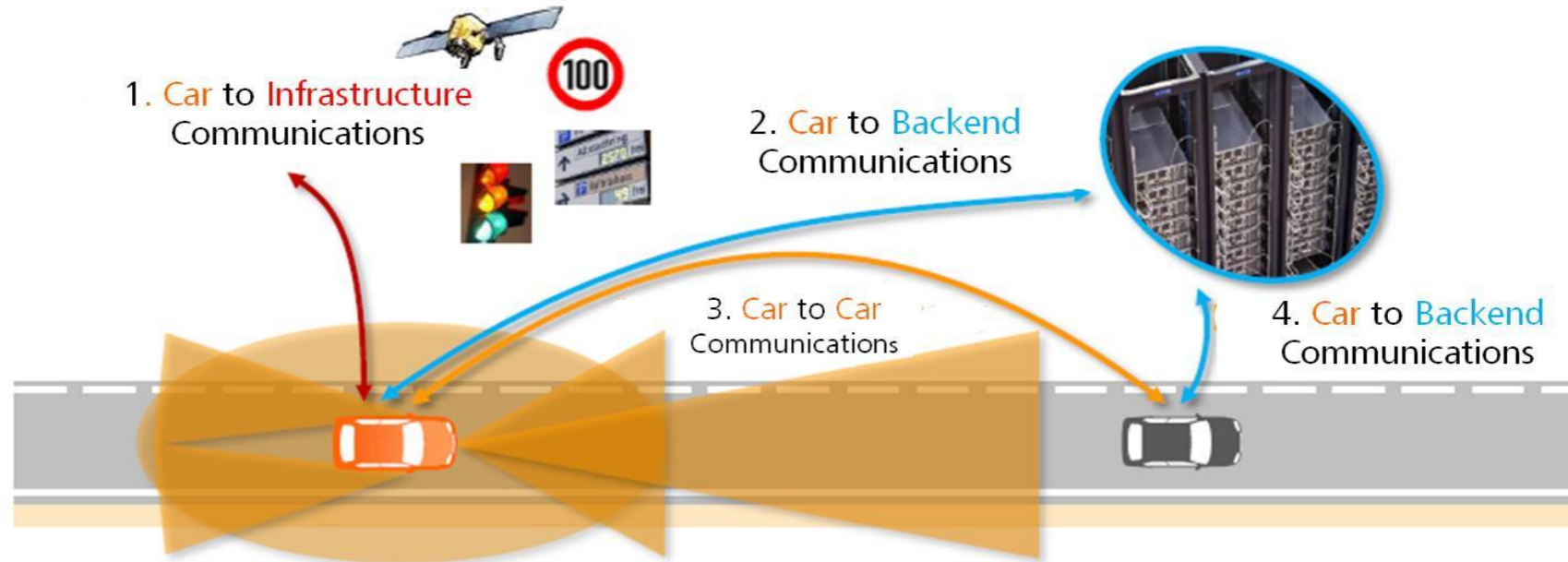
- Automotive use cases
 - Automated driving
 - Overtaking, cooperative collision avoidance, high density platooning
 - Road safety and traffic efficiency services
 - See-through, Vulnerable Road User (VRU) Discovery, Bird's Eye View
 - Digitalization of transport and logistics
 - Remote sensing and control, Remote processing for vehicles
 - Information society on the road
 - Nomadic nodes (vehicles as small cells)
- R&I on **reliable communication** in conjunction with **low latency and security**, but also on the **business models**, such as **Pay as You Drive**, **Mobility as a Service (MaaS)** and **Predictive Maintenance**.
- Contributing affiliates: **VW, Volvo, PSA, Bosch, Orange, Vodafone, DoCoMo, Samsung, Qualcomm, Nokia, Ericsson, Alcatel-Lucent, Huawei, CTTC, Kings College London, Univ. of Athens, Tu Dresden, ERTICO, InterDigital**

Technical requirements and KPIs

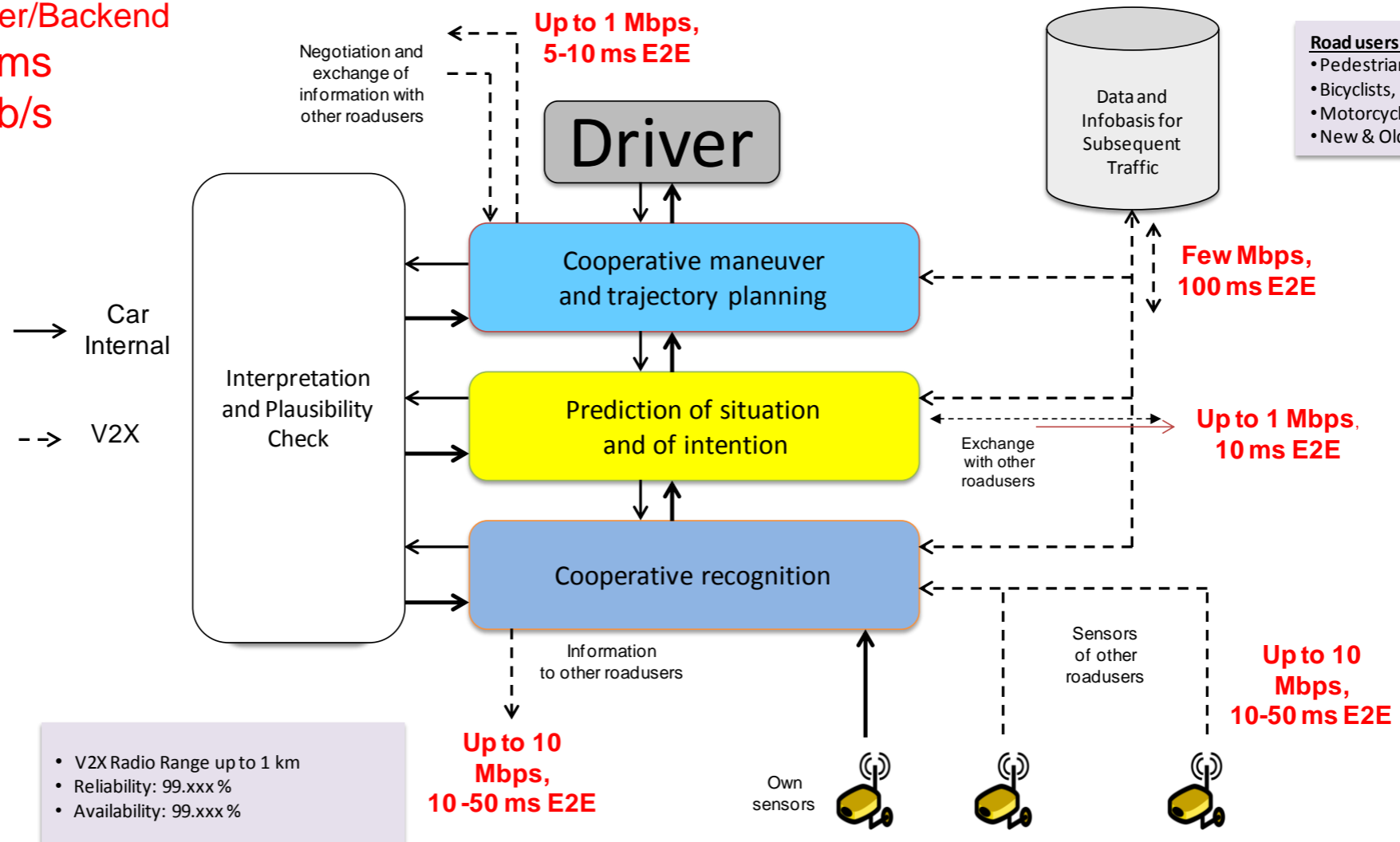


- **End-to-end latency (ms)**
 - Time packet source-destination
- **Reliability (10-x)**
 - Packet loss rate at the application layer
- **Data rate (Mbit/s)**
 - Minimum required application bit rate
- **Communication range (m)**
 - Distance source-destination(s)
- **Node mobility (km/h)**
 - Maximum relative speed
- **Network density (vehicles/km²)**
 - Vehicles / unit area
- **Positioning accuracy (cm)**
 - Error tolerated by the application
- **Security (application, user)**
 - Authentication, authenticity of data, integrity of data, confidentiality, user privacy

Connectivity demands



V-Roaduser/Backend
 • 5-100 ms
 • 1-10Mb/s



- Road users:**
- Pedestrians,
 - Bicyclists,
 - Motorcyclists
 - New & Old Cars

- V2X Radio Range up to 1 km
- Reliability: 99.xxx %
- Availability: 99.xxx %

e.g. Longitudinal & Lateral Accelerations, car distances, video (HD or preprocessed), Sensors for local road conditions, etc.

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



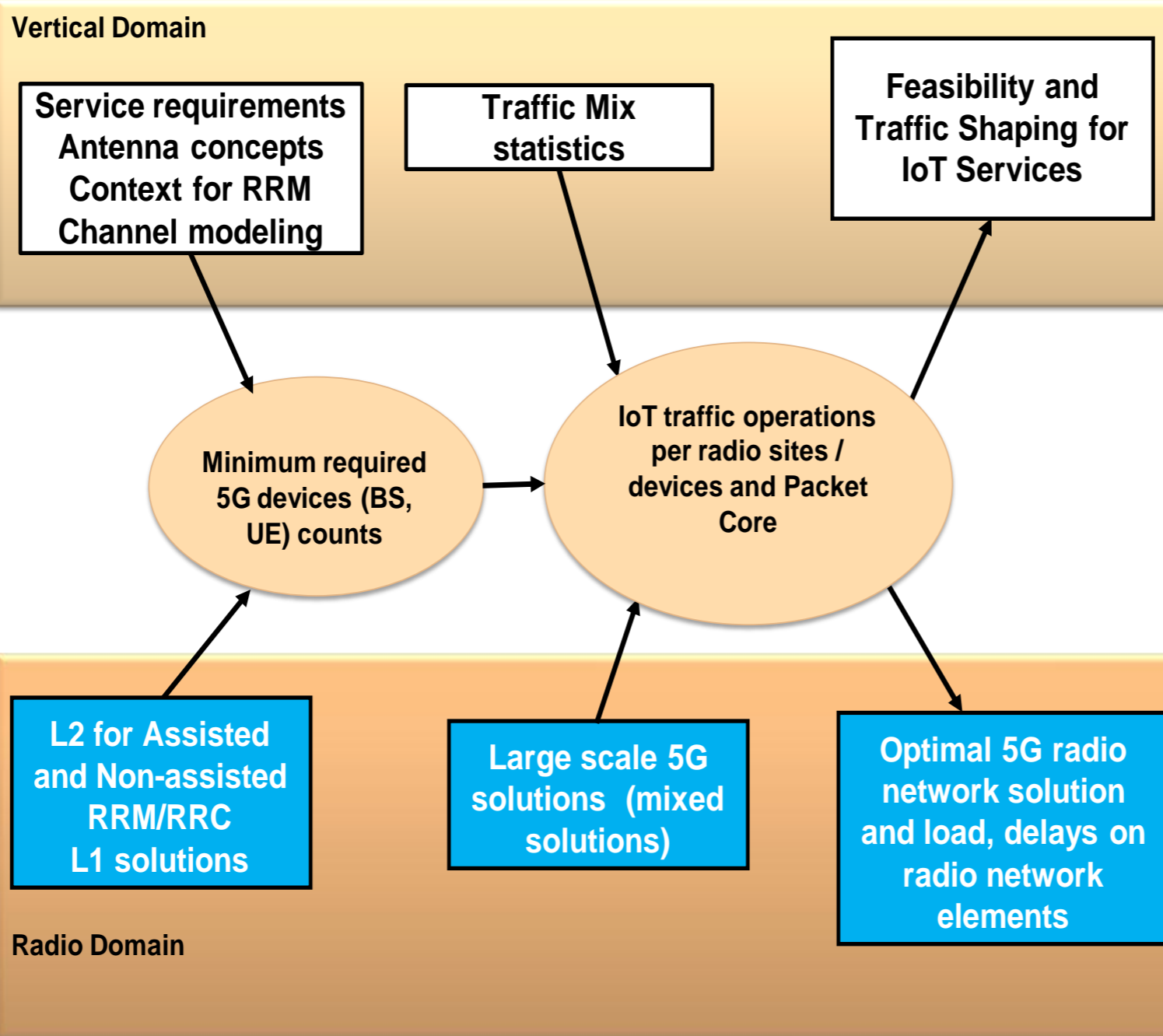
Use Cases vs. Solutions



Use Cases	Cellular Assisted V2X	Fully Cellular V2X	Ad-Hoc V2X (Non-assisted)
1.	Works well in high-loaded network, Inter car distance ≤ 1 km	For lower-loaded networks, Inter car distance > 1 km	Very low load, <u>no-coverage</u> (tunnels, country side)
2./ 4.	N/A	Needed for car offloading (MEC), regional traffic management, etc. by cloud	N / A
3.	High-loaded network, High velocity and complex Autonomous Driving, 1-3 ms	Moderate velocity and complex Autonomous Driving, $> 1-3$ ms	<u>No-coverage</u> , Low velocity / complex Autonomous Driving, $\gg 1-3$ ms



Necessary collaborations



- **Traffic modeling** required
- **New 5G air interface** based on e2e delay and robust protocols
- Support of **assisted and non-assisted M2M (V2V)**
- New **distributed antenna** concepts for machines, cars, robots
- **New channels models** for M2M, jointly agreed with industry
- **Machine context** based RRM

Standardization



- Ensure **IPR protection** and adequate returns on investment
- Align **3GPP/ETSI timelines** when it comes to 5G developments
- **ETSI TC ITS – R2**: Integrate new **5G connectivity framework** (architecture, stack) and incorporate future automated driving systems and services
- **3GPP – SP-150051**: “Study on LTE Support for V2X Services” → ProSe **Direct Communication for V2V** communications and **5G coexistence** and augmentation with other access technologies (e.g., ITS-G5)
- **IEEE** – Extensions of LTE and LTE-A is considered fundamental as **interworking** networks in a **multi-link / multi-RAT approach**

Regulation



- **ITS security and privacy** in the context of automotive connectivity for mission-critical applications and future automated driving systems and services
- **Policies** that promote innovation and reward investment in communication networks and innovative standards are needed, together with **preserving a technology-neutral approach on use of spectrum**
- **Regulatory framework** to reduce **sector-specific** ex ante ("before the event") **regulation** and ensures a **level playing field across market players** in the digital value chain
- **Security, integrity, data protection, and privacy in the data economy in a holistic manner** from a user's point of view, in particular by setting rules that apply to all providers offering equivalent services

Conclusion and next steps



- Requirements from vertical sectors cover, especially, high **reliability / security**, very low **latency** and seamless **experience**
- We should go beyond listing requirements towards a **joined design between vertical and ICT players**
- Next steps
 - Presentation at 5G PPP session in ICT 2015 (21/10)
 - **Cross vertical workshop in Brussels (09/11)**
 - Identify commonalities between verticals
 - Discuss how to integrate verticals in next Work Programme (esp. 5G PPP Phase II)
 - **Communication at next Mobile World Congress**



Thank you!

