5G and the Automotive Transformation
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The automotive and transportation sector is going through a deep technology-driven transformation, with some predominant, intertwined trends. In addition to the vehicle passengers, a large part of the benefits of such transformation is geared towards society as such, in terms of improved safety, efficiency, comfort and reduced carbon footprint. This new socio-economical framework is driving innovations in technology, in the automotive ecosystem and even in private-public partnerships.

One such technology trend is the recent growth of vehicle connectivity, which quickly evolved into being a common vehicle feature that enables a number of new services. Another trend is the increasing vehicle automation, with the automotive sector standing among the largest investors in AI R&D, aiming at enabling new ways of driverless transportation and logistics efficiency. The traditional role of some OEM carmakers is also being redefined, with increasing business appetite in partnering with service providers to deliver new on-demand vehicle services to current and new customers and partners. One example is carmakers companies redefining themselves as shared mobility providers. However, as vehicles become similar to large computers on wheels, carmakers are also forced into a much higher speed of research, development and commercial adaptation. A further trend is electrification, which not only addresses sustainability goals, but it even triggers opportunities in terms of electric engines and battery efficiency and drivetrain technology evolution. New data analytics and AI play a role in electrification development efficiency.

Sharing and analyzing real-time data is a key element and enabler for all the above trends. In some cases, large amounts of data need to be exchanged in an affordable way, in other cases data becomes latency-critical and has to be reliably delivered within extremely tight latency budgets. 5G is the primary wireless technology for mobile, open area communications, and it will have a fundamental role in accelerating the above trends.

On open roads, we expect short-latency 5G-based communication to complement increasingly capable on-board sensors, providing information that cannot be obtained by sensors (e.g., seeing around corners) and transforming roads into truly cooperative ecosystems. Vehicles, pedestrians and road infrastructure will act in a coordinated, intelligent way and at different abstraction levels: some decisions will be taken locally in the vehicles for safety and liability reasons, other decisions will be taken in a distributed way (e.g., by the agents involved in one intersection) and other decisions will benefit from a more centralized perspective. Such local-centralized dichotomy is efficiently enabled by 5G by exploiting different radio and network architectures and topologies and different cloud distribution levels.

Despite the high momentum of connectivity for automotive, some important open questions and research challenges are still present. For example, the ethical dilemmas that arise in safety-critical automated systems are debated in regulatory, technical and philosophical environments. Another challenge is the definition of a new liability and security framework

that encompasses complex multi-vendor systems rather than its individual components. Such a mindset may potentially lead to innovations in the way that networks and data systems are built, managed and deployed.