6   Publishable Summary

We are living in an era in which Asian countries are setting up extremely large vertical supply chains Europe cannot afford; European manufacturing in all high tech sectors is gradually and continuously decreasing. In such a context where competition is intended as a commercial state supported war, sharing knowledge amongst research teams across Europe is likely the most effective route to follow for Europe to keep state of the art technology developments. **3Ccar sets the collaborative environment amongst over 50 research teams sharing visions and objectives in a well-defined exponentially growing area: electro-mobility**. Because the underlying technology is widely acknowledged to cross cut all sectors of mobility, the research community of this project, although clearly focused on road transport, is also considering direct exploitations of the developed solutions in other application contexts.

About 20 million vehicles are recalled in a year with a record of over 30 million in 2004[9], many because of software issues related to electronic systems such as cruise control, antilock braking, traction control, and stability control. **3Ccar proposes new and scalable methods to evaluate such controls in a realistic and open setting**. The increasing complexity of software in automotive systems has resulted in the rise of firmware-related vehicle recalls due to undetected bugs and software faults[10]. AUTOSAR (Automotive Open System Architecture)[11] represents a significant effort to incorporate automotive software testing and verification at the design stage, however, current automotive systems lack a systematic approach and infrastructure to support post-market runtime diagnostics for control software. Once a vehicle leaves the dealership lot, its performance and operation safety are a "black box" to the manufacturers and the original equipment providers. Amongst the standard diagnostic trouble codes (DTCs) for software none targets the ECU software even though systems such as stability, cruise, and traction control are critical for safety.

The wait-and-see approach to recalls has a significant cost in both time and money and may have a negative impact on the vehicle manufacturer's reputation. Consequently, there is an urgent need for systematic post-market in-vehicle diagnostics for control system software so that issues can be detected early. **3Ccar proposes in-vehicle systems that could monitor sensor values, perform runtime evaluation of the states of the system controls and could allow remote reprogramming. 3Ccar is the first European project in our knowledge addressing the development of common-standard HW-SW platforms that could allow the remote monitoring of the critical parameters and the update of the software.** This would have a considerable impact on the design of new architectures and on security. In view of more automated functionalities, from car parking to full autonomous driving, **the remote update of powertrain and steering software related functions would become an ever-increasing problem-opportunity addressed for the first time by 3Ccar.**

System partitioning is more and more crucial to assure higher robustness, simplicity, higher fail-safe redundancy, cost reduction and simplified maintenance independency from suppliers. Rather than stressing system integration, EVs demand smart partitioning of the macro functionalities. **For example, the conventional approach adopted by most OEMs relying on a multifunctional centralized body computer will be challenged by 3Ccar approaching the overall system design with a high level of partitioning allowing OEMs to become more independent from suppliers, reducing complexity and related costs, simplifying maintenance, monitoring and update the functionalities.**

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[9]   http://mashable.com/2014/04/09/car-recalls-2014/
[10]   IEEE Spectrum. 2011, Available online at http://spectrum.ieee.org.
[11]   www.autosar.org.

In the last two decades European policy and research have lead to impressive achievements in both road safety and reduction of air pollution. European roads are the safest in the world with less than half fatalities per 100,000 inhabitants than America. European cars and cities are the cleanest of the world; the average CO_2 and noxious emissions of EU cars are 30-40% lower than American cars. Emissions control and safety features have allowed European automotive manufacturers to continue sharing a good position in the market (19% of total Motor Vehicle production, 23% of passenger car production).

These positions and achievements of Europe are mostly attributed to the evolution of smartness in vehicle developments, that is, electronics.

The collaboration proposed in 3Ccar is the natural continuation of the same virtuous process started with the project ENIAC E3CAR later on complemented by projects launched in Artemis and within the EU Green Car Initiative. The results achieved are impressive. In only four years of developments Europe has succeeded to radically reduce the existing gap on high power electronics and more in general on electromobility with Japan who kept a focus on hybrids technologies for over seventeen years.

The overall sector of transport and specifically the success of the EU motor industry generating a turnover of 840B€ in 2011 depends more and more on the level of collaborations that will establish with the semiconductor and smart system community. The largest the specialized community is the better.