Modeling and Simulation of Connected Cars Applications

Poster Track

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1 INTRODUCTION

Vehicle-to-everything (V2X), including vehicle-to-vehicle (V2V), vehicle-to-pedestrian (V2P), vehicle-to-infrastructure (V2I), and vehicle-to-network (V2N) communications, improves road safety, traffic efficiency, and the availability of infotainment services. Standardization of Cellular V2X has been actively conducted by 3GPP to provide solutions for V2X communications, and has benefited from the global deployment and fast commercialization of LTE systems. As standardization efforts continue to evolve, enhanced V2X (eV2X) services are introduced and V2X has become one of the killer applications of 5G.

In this poster, using Intel CoFluent Technology, we show how to model and simulate autonomous and connected cars. We also simulate the full E2E 5G-connected car involving realistic model and data generated by cars, the modem side, infrastructure (RSU, eNB, GW) and the cloud side as well.

We simulate and analyze three different technologies for the connected vehicles in an E2E environment; we start by analyzing DSRC and LTE-based implantations and compare them to the 5G-based connected vehicles. The KPIs for our study are hybrid and include:

- Wireless communication: throughputs, latencies, capacity (number of connected vehicles per infrastructure)
- Infrastructure: required memory for caching and required processing power (CPU loading)
- Core network: Infrastructure to Cloud characterization in terms of latencies and throughputs
- Cloud computing and storage.

2 E2E VEHICULAR NETWORK MODELING AND STUDY

The E2E architecture is given by Figure (1) and represented the network from "sensors" (in our case cars) to the cloud. The network component is defined as DSRC, LTE or the 5G networks modeled in CoFluent.

The car model is defined by two components: the behavioral model defining the algorithms and SW flow of data acquisition and data processing in the car, and an architectural model defining

the HW platform of the connected vehicle. Some of the KPIs analyzed are presented in Figure (2).

This type of analysis allows us to quantify E2E the performance of DSRC vs LTE vs 5G communications applied to connected cars

We can see the jump on performance that LTE and 5G offer compared to DSRC and the scaling laws of the various KPIs function of connected cars per infrastructure.

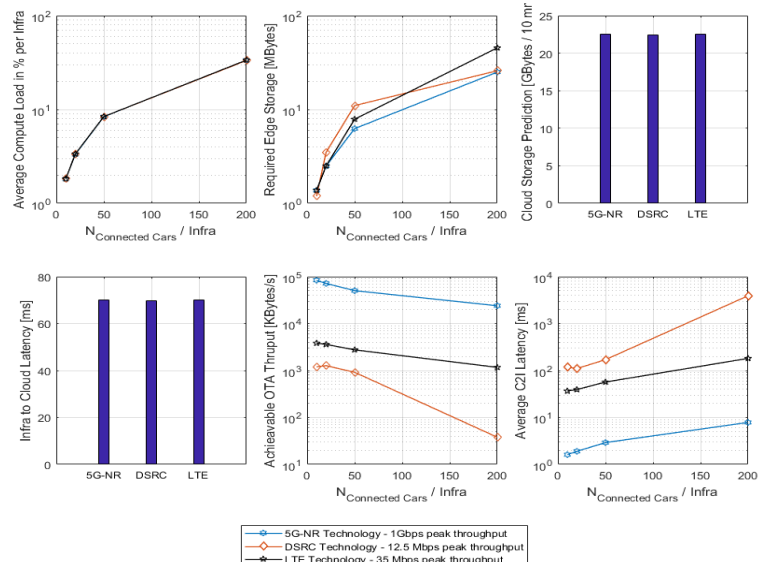**Figure 1- E2E Vehicular Network Model**

Figure 2- KPI analysis for wireless networks used to V2I applications: DSRC Vs LTE Vs 5G