During a century of existence, vehicles transformed from mechanical masterpieces into consumer products with more and more computing power and sensing capabilities. Current vehicles include tens or even hundreds of Electronic Control Units (ECUs) that gather important amounts of information from the embedded sensors, and use this information to control different parts of the vehicles or to provide relevant messages to the driver. Until recently, all this data was only partially and temporarily stored inside the vehicles. However, with the advent of traffic information system or fleet management applications, the trend is to recover this *floating car data* (FCD), through a cellular network, at a central server where the FCD is treated and the results are potentially disseminated back to the vehicles. While the current penetration ratio of vehicles equipped with a cellular interface remains low, the number of FCD-enabled vehicles is expected to grow rapidly, triggered especially by a smartphone-vehicle integration.

This inflation of applications and equipped vehicles risks to result in a non-negligible load on the cellular uplink access. Considering that the mobile demand has already reached the capacity limits of 3G networks, and that even the upcoming LTE infrastructure is deemed unable to cover such a gap, offloading FCD through direct vehicle-to-vehicle (V2V) communication could only benefit the cellular network operation. In this scenario, only a subset of the vehicles would use the cellular uplink, while also being in charge of data aggregation and, potentially, fusion (e.g. if the application requiring the data only needs an average value for a certain parameter).

The FCD offloading problem therefore maps to identifying, in an efficient, distributed way, the vehicles in charge of performing the data fusion and upload after gathering the FCD from their neighbors. Clearly, we wish such a set to be as small as possible, since the fewer the vehicles performing the local fusion and upload, the lower the uplink traffic load on the cellular network. At the same time, however, we do not want the offload process to reduce the quality of the overall FCD information. In other words, the objective becomes that of collecting FCD from the whole network using the least amount of vehicles, so as to minimize the number of uploads and maximize the local FCD fusion. The FCD offloading problem can thus be formulated as a classical graph-theory *Minimum Dominating Set* (MDS) problem, whose solution yields the minimal set of vehicles that cover all the other cars through V2V communication.

On both general and unit disk graphs, the problem of finding a MDS is NP-hard, therefore we use four different heuristics with a known MDS approximation factor to study the optimal achievable gain for the offloading problem. Our study leverages the largest vehicular mobility data-set available up to date, covering 4500 km of roads in the greater urban area of Koln, in Germany, and spanning over 24 hours of a typical working day. Our results showed that FCD offloading through V2V communication is an interesting approach to reduce the volume of traffic that will be uploaded to the cellular infrastructure by sensing vehicles in urban areas. It is noteworthy that the gain achieved by such an offloading approach depends on both daytime and geographical regions. However, FCD offloading performs best, with less than 5% of vehicles using the cellular uplink, precisely at the hours and in the regions where the cellular network needs to be relieved the most.

Nevertheless, this optimal gain can only be achieved by using centralized MDS algorithms, which is not possible in a dynamic vehicular network. Moreover, while a distributed algorithm requiring multiple rounds can be interesting in a static scenario like the initialization of a wireless sensor network, such a solution does not seem suited for networks involving high mobility, where the network topology would change before the algorithm reaches a solution. As opposed to these general MDS algorithms, we propose and analyze three heuristics that allow the distributed construction of a set of relays used to offload FCD in a time frame that takes into account the properties of direct V2V communications. Using the mobility trace mentioned above, we show that these mechanisms, despite their simplicity, manage to achieve near-optimal performance with no actual calibration required.