A Cooperative Vehicular Network Framework

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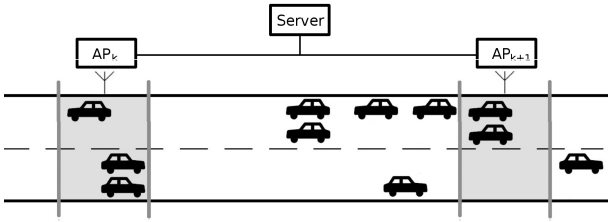
Introduction:

This paper address **car-to-road communication** in which vehicles traveling on highways use sparse Access Points in a Delay Tolerant Network architecture.
Due to the high speeds, vehicles have **few seconds** to access road infrastructure.
Furthermore, the environment presents a **high level of packet losses** (vehicles in a highway passing in front of an AP report losses on the order of 50-60%).



Previous Work:

We showed **experimentally** how a simple Delayed Cooperative-ARQ (DC-ARQ) scheme was able to minimize efficiently packet losses.
Experiments in an urban scenario using three vehicles and one AP showed a **recovery on the order of 50%** of the lost packets.

Main Idea:

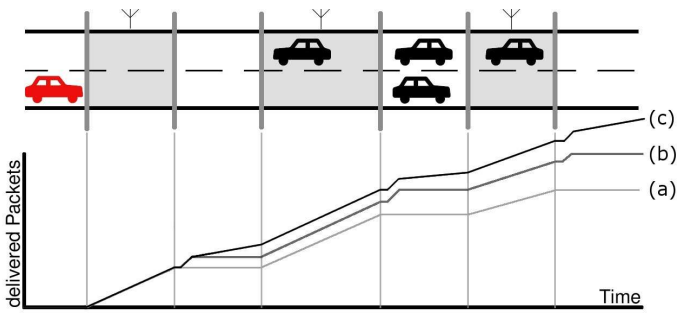
Definition of a VANET framework following a DTN architecture, and **evaluation on larger scenarios** using ns-2 simulations. The framework integrates:

a) End-to-end ARQ to allow vehicles to download a file opportunistically when crossing different AP.

b) DC-ARQ mechanism to reduce packet losses of transmissions from AP to vehicles and from vehicles to vehicles. Cooperations are done outside AP coverage.

c) Carry-and-forward mechanism based on the predictability of vehicle road routes that cross opportunistically other vehicles to improve transfer delivery of information. An AP schedules C&F cooperations when there are no nodes downloading on coverage.

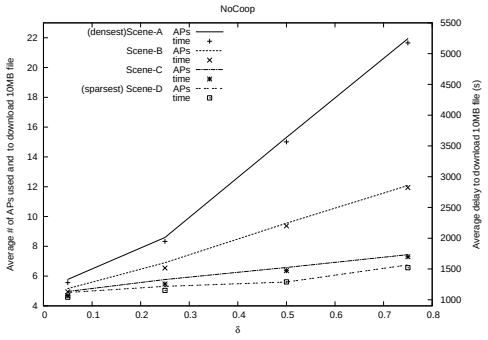
All the cooperations are done for free.

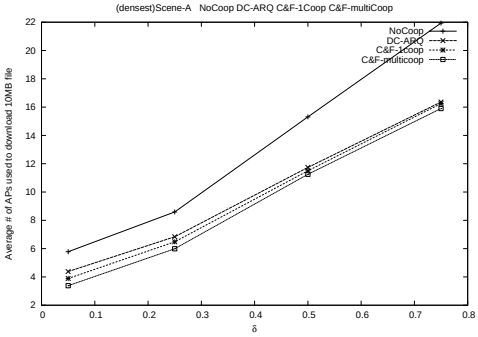


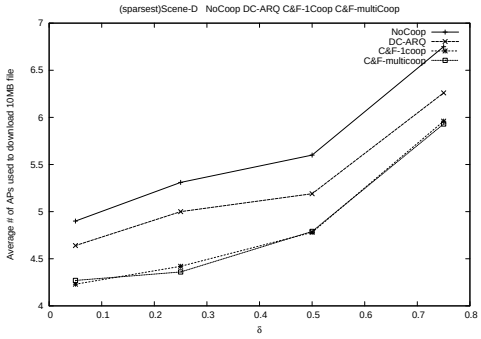
Results:

We evaluate: (i)Total delay experienced, (ii) number of APs needed, (iii) packets received using the DC-ARQ and (iv) packets received using C&F cooperations obtained by a car to download a 10MB file, depending on:
· Density of cars in the road.
· Density of cars downloading information, δ.

Dense vehicle scenarios make better use of DC-ARQ while sparse vehicle scenarios make better use of C&F mechanisms.







Conclusion:

The framework works as a Delay Tolerant Network and benefits from two cooperative mechanisms:

DC-ARQ: recovers packet losses due to the harsh physical conditions.

C&F mechanism improve throughput and total transfer delay.

The combination improve performance parameters for dense and sparse scenarios.