A Data Collection and Aggregation Platform for Vehicular Networks

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***Abstract*—This paper presents a demonstration of a platform for data Collection and Aggregation for vehicular NETworks (CANET) developed by France Telecom R&D. The aim of this platform is to collect a set of information issued from different data sources (sensors, GPS,...) and aggregate them in a reliable manner. Collected data is then stored in an MySQL database and presented though a user-friendly web interface. It presents useful information (such as traffic information or weather) that could be disseminated to vehicles through a dissemination protocol like ROD [1].**

***Index Terms*—Vehicular networks, data collection, data aggregation**

I. Introduction

A vehicular network is a specific type of mobile network in which vehicles are able to communicate with their environment through a radio interface. Depending on the type of the vehicular network, the vehicles communicate with fixed infrastructures or with other vehicles. Hybrid networks with Vehicle-to-Vehicle and Vehicle-to-Infrastructure communications also exist. The main projects working on vehicular networks are CVIS [2], CALM [3], Pre-Drive C2X [4], Car-to-Car Communication Consortium (C2C-CC) [5], and ETSI-ITS [6].

Vehicular networks aim not only to improve the driver and passengers safety, but also to provide more comfort and efficiency services to driver and passengers. A lot of vehicular networks services uses the vehicles as a source of information: (i) The vehicles send information issued from their on-board sensors to a main server (ii) The main server collects the data and treats them (iii) The main server disseminates useful information to the interested vehicles based on calculations made on the retrieved vehicular data.

We focus in this paper on the two first items. Data dissemination can be performed using ROD dissemination protocol [1]. Hence, we developed a platform named CANET (data Collection and Aggregation platform for vehicular NETworks).

The vehicles send periodically data about the traffic and environment such as speed, parking places, temperature and humidity to the main server via an UMTS interface.

Our objective is to estimate the amount of data traffic generated by all potential vehicular services (traffic information, weather ...) and evaluate their impact on the UMTS network. This will prove that networks complementarity is necessary to handle all of these new potential services in a vehicular context.

The rest of the paper is organised as follows. A first section will describe the CANET platform by presenting the vehicle side and the server side of the platform, and then the proceedings of the demo. The second section will give practical information about the proceedings of the demo.

II. Demo description

CANET platform is constituted of a vehicular platform and a main server connected to the Internet (see Figure 1). The orange rounded rectangles represents CANET applications written in Python. The vehicular platform holds: (i) an on-board computer connected to the Internet via an UMTS PCMCIA card (ii) a Crossbow sensor which sends temperature, humidity and acceleration data using ZigBee protocol, (iii) a Holux GPS receiver which sends GPS data using Bluetooth protocol. During the on-road tests, a passenger had to manually click on a button to notify the amount of road-side parking places to the server. This could be automatized by a embedded camera which detects free places.

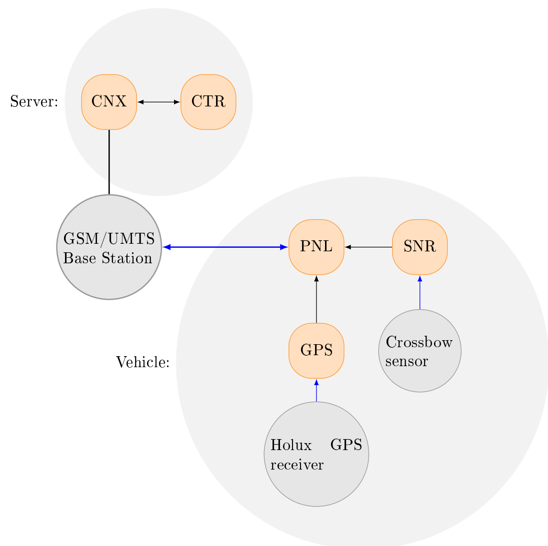
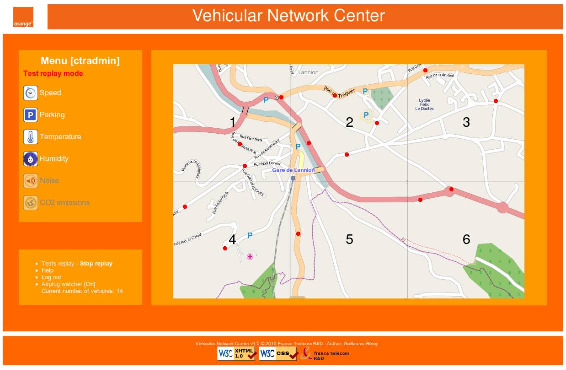
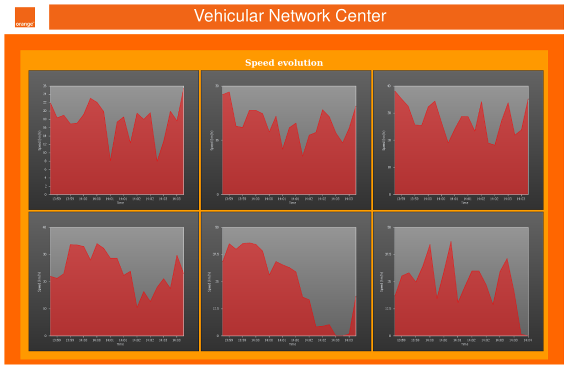


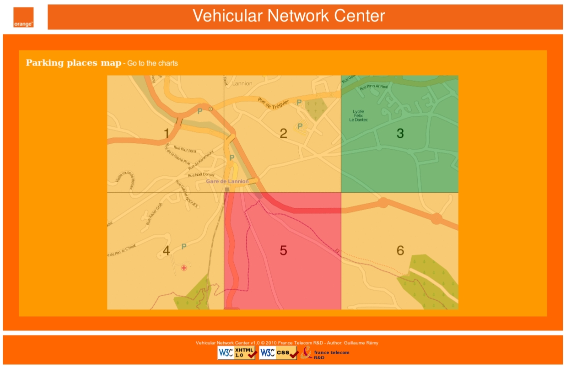
Figure 1. CANET platform structure



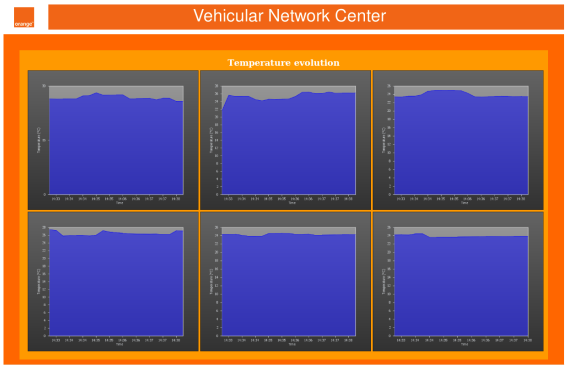
(a) Server map



(b) Speed charts



(c) Parking places



(d) Temperature charts

Figure 2. Website screenshots (presentation of aggregated data)

A. CANET vehicle side

The on-board computer of the vehicular platform holds a SQLite database (see Figure 3). This database stores all the data collected by the vehicle: the `speed` table contains speed data (retrieved by the GPS application), and the `sensors` table contains temperature, humidity and acceleration data (retrieved by the SNR application). This database can be used as a black box for investigations (e.g. after an accident).

The server Geo-casts the aggregated information in the service areas. Each area receives its own statistics (speed, temperature, humidity and parking places evolution). The vehicles need to perform unicast requests to get information about other areas than the one they are crossing.

The on-board computer provides a graphical interface (the PNL application), which allows to show these statistics to driver and passengers. It also permits to show the current position of the vehicle on a map, the weather in its region, and other traffic information. Additional services are planned to be implemented on this platform in the future.

B. CANET server side

The server hosts three significant servers: (i) The main CANET server, which consists in Python scripts (the CNX application), retrieves vehicular data using a home-made protocol (ii) The MySQL server (populated by the CTR application) holds all vehicular data (see Figure 4). (iii) The apache server provides a website which uses the MySQL database to retrieve vehicular data.

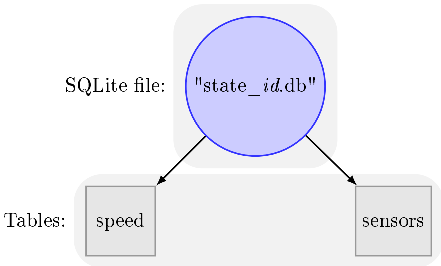


Figure 3. Vehicular database structure (SQLite)

The vehicular data stored by the `mysql` database on the MySQL server are divided into two types of tables: the `periodic_*` tables contain position, speed, temperature and humidity vehicles data, and the `pkg_*` tables contain data about the amount of available road-side parking places.

The web interface allows the user to monitor the movement of all the vehicles in the server controlled area in real time. It is possible to get charts of speed, temperature, humidity and parking places evolution (see Figure 2).

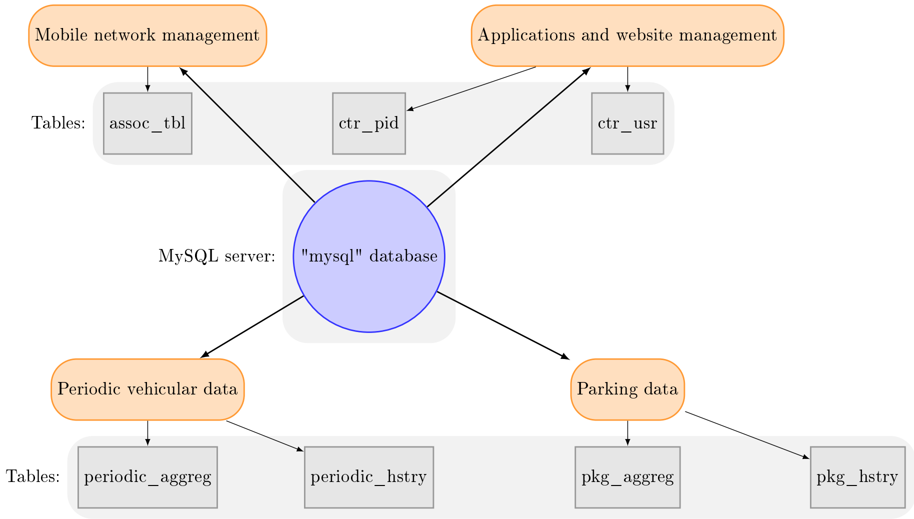


Figure 4. Server database structure (MySQL)

C. Proceedings of the demo

The demo presents the system through the replay of on-road tests [7]. Each of these tests was made in Lannion (France), with a dozen of equipped vehicles circulating in the city center for five minutes.

The web interface allows the replay of the selected test in a real time way. The user can follow the movement of the vehicles, and see the creation of the statistic charts as if the test is currently in progress.

The demo consists in a global presentation of the website features, and a real time replay of a test.

III. Practical information

A. Equipment to be used for the demo

The demo needs a laptop computer with a web browser and an internet connection.

Then, the space needed is only a small table.

B. Setup time required

The setup time required for the demo is about ten minutes.

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