INTERNET FOR VANET NETWORK COMMUNICATIONS -FLEETNET-

Bahidja Boukenadil and Mohammed Feham

Department Of Telecommunication, Tlemcen University, Tlemcen,Algeria

ABSTRACT

Now in the world, the exchange of information between vehicles in the roads without any fixed infrastructure is enabled thanks to the novel technology of the Vehicular ad hoc networks called (VANETs).

The accidents and congestions warning, Internet access e.g. via gateways along the road are the main applications of these networks related to the safety and comfort applications. A high requirement on the routing protocols is introduced in these complexed VANETs networks
In order to implement a reference intelligent transportation system and contribute to the standardization of vehicle to vehicle communication or vehicle to infrastructure, in Europe, several projects are held and different partners are joined from the industry, governmental agencies and academia.

This paper explains the main progress and purposes of the standardization process and research initiatives of FleetNet project. These solutions will present in the future a common worldwide VANET platform integrating several services of inter-vehicles communications.

KEYWORDS

FleetNet, VANET, ITS, tesbed, Internet

1. INTRODUCTION

The communications between vehicles without any access points or base stations is a great field of research. The main aim of VANET offers a safety and comfort for passengers. For this purpose, a particular electronic device will be placed inside each vehicle which will provide Ad-Hoc Network Connectivity.

This network tends to function without any infrastructure. Each vehicle equipped with a device VANET will be a node in the Ad-Hoc network and can receive and transmit messages of others through the wireless networking.

One of the forthcoming technologies of vehicular ad hoc network is FleetNet, this novel platform uses a new standard dedicates to the communications inter - vehicles, named DSRC (Dedicated Short Range Communication) [1].

The applications related to the road safety represent a big part of the applications of the vehicular networks. These applications understand the diffusion of the messages giving an account of the state of the traffic, the weather, the state of the roadway, the accidents works or messages pointing out the speed limits or the security distances.

The examples of services are not limited only to the applications of safety but to other types of applications in particular the diffusion of practical informations by providers of services to the motorists (spot of information, offer of service useful for the drivers: service station or

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presentation of parking bays available), all this, is thanks to connection to Internet available in the vehicles via ad hoc network using both communications between vehicles and between the vehicles and the fixed equipments installed along the roadside , usually called equipments of the road.

In worldwide, major research, development and standardization on the inter-vehicle communications are underway. Moreover, many projects, in Europe were initiated to form the basis of an Intelligent Transportation System (ITS).

We focused in this work on the main project called FleetNet.
In what follows we will describe the goals, applications and routing characteristics of major project FleetNet, which treats Vehicular communications by exploiting different aspects and different notions, finally we conclude this paper.

2. THE FLEETNET PROJECT

For the purpose of communicating vehicle to vehicle within a group, the project FleetNet (Internet on the road) [2] was launched by six German car manufacturers and three universities, it was opened to the suppliers, to the research organizations and to other partners.

The main purpose of this major project is the development of a communications platform for vehicular networks, to implement an intelligent system, and to standardize the proposed solutions in aim to improve drivers' and passengers' safety and comfort.

The FleetNet routing architecture is based on a location and navigation system .For providing the Internet access service, FleetNet considers vehicles to infrastructure communications.

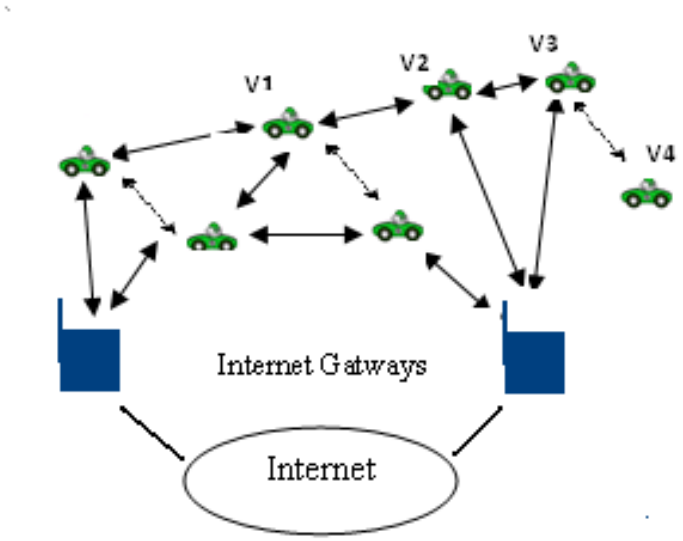

Figure 1. Access to Internet in transport

3.THE FLEETNET OBJECTIVES

So as to offer a safety and the comfort of the passengers FleetNet aims to:

- improve the road safety, by managing effectively the traffic through the use of the IVC for Inter-Vehicle Communication and RVC for Roadside-to-Vehicle Communication.
- Developing buoyant and promising strategies in terms of network infrastructure deployment and provision of related services.
- Implementation of V2V and V2I prototype for Intelligent Transportation system (ITS).
- Present a series of standards and protocols dedicated to the vehicular communications.

APPLICATIONS

The vehicles communicating in the road deliver a constant set of local informations witch are needed for the drivers. Consequently, the range of awareness will be extended along the road.

- In the following, three areas of FleetNet applications will be exposed

 Cooperative driver assistance :

 Notification of Emergency

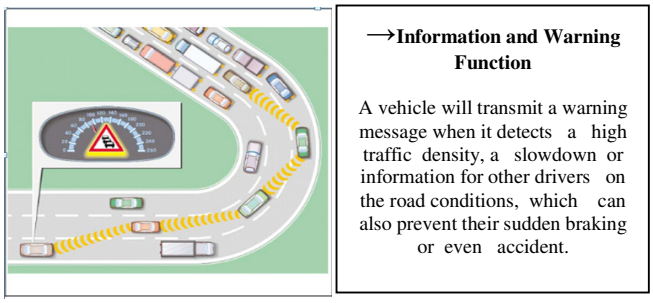

Figure 2. Alert function between vehicles [3]

- Overtaking assistance

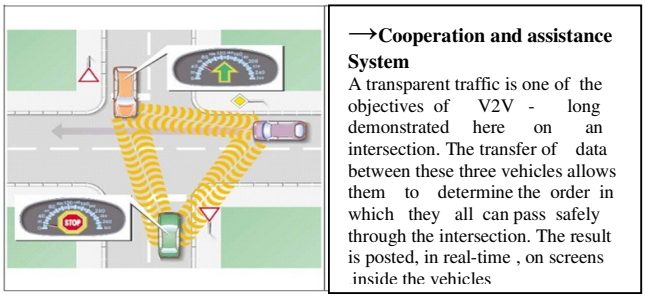

Figure 3. Cooperation between vehicles [3]

Obstacle warning

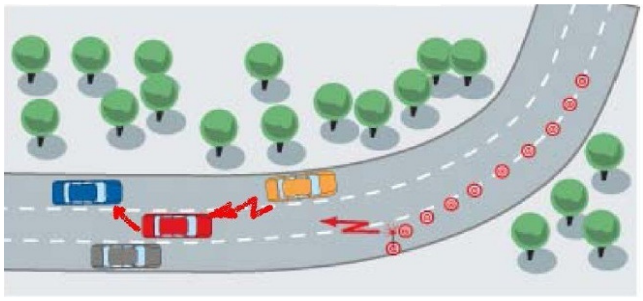

Figure 4. Works on the roads

Internet in transport :

- Mobile internet
- Continuous diffusion program « distributed television»
- Collaborative charts (wiki) and the distributed announcements.
- navigation on Internet via server relay (known as « proxy-cache ») in zones without connection to Internet
- Distribution system of publicities and practical informations (concerts, restaurants…) can be installated at the entry of the cities.
- Predictions of the itinerary weather
- purchase of music and video in the vehicle
- Marketing, publicity; commerce, business online
- applications of network games
- Management of free spaces in the parkings

5. FLEETNET CHARACTERISTICS

The specific characteristics of this technology are

IVC for Inter Vehicle Communication (IVC) and Roadside-to-Vehicle Communication (RVC).

- Internet integration and dynamic navigation along the roads.

Very low data transmission delay

- Is suitable for cooperative driver assistance and safety related applications.

Position and geographic based mechanisms

- Enables Location-based services.

Unlicensed radio frequency bands are considered

- Low cost of data transmission.

Multi hop ad-Hoc Network Connectivity

- Awareness of drivers in the road

Standardization of conceived solutions

- Develop standards and specifications for ITS (Intelligent Transportation System).

6. INTERNET INTEGRATION

The FleetNet architecture enables the access to Internet from vehicles or clients situated at vehicles as well as access to vehicles from the Internet.

This is achieved by:

- fixed gateways installed along the roadside
- Vehicles gateways integrating different FleetNet services,
- specific Internet routing protocols for specific Fleetnet technology,
- roaming supporting between different gateways.
- optimization of routing mechanisms for V2V and V2I communications,

.

7. POSITION-BASED ROUTING

FleetNet routing considers geographical position of the vehicles in the network.

Since the inter-vehicle networks are classified with the large and highly dynamic networks, several position-based routing approaches can be used and major improved scaling behavior and adaptability with respect to VANET networks can be achieved compared to non-position-based mechanisms.

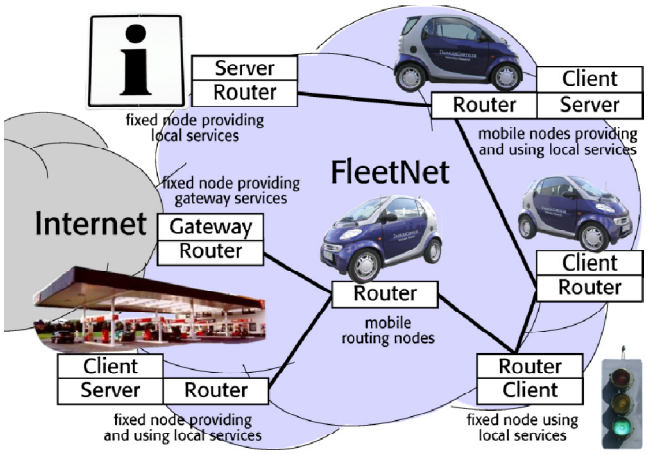

Figure 5. Routing paradigm in FleetNet platform

Thus FleetNet routing

- implements a system of location and navigation,
- uses forwarding mechanisms based on local knowledge,
- incorporates a distributed location service,
- handle positional errors by implementing recovery mechanisms

For studying radio coverage and routing strategies, the simulations use traffic models. For these goals, a compiled set of 'real-world' samples of vehicle movements has been generated including scenarios from German autobahns, country roads, and inner city streets at various FleetNet penetration rates.

8. FLEETNET RADIO COMMUNICATIONS

The FleetNet radio communication system requires:

- robustness in case of high relative velocities;
- support of high bit rates;
- operation in unlicensed frequency bands.
- high multi hop connectivity ;

For testing and verification an created standard solutions for V2V communications in the FleetNet, the wireless LAN components are used.

9.FLEETNET TESTBED

The FleetNet platform is composed of Ten Smart cars and a number of roadside stations act as a 'real world' testbed.

A 'real world' testbed of FleetNet is conceived with Ten Smart cars and a number of roadside stations to test an intelligent transportation platform.

The vehicles of this testbed are equipped with intelligent components such as touch screens, cabin mounted cameras, and internal computers providing access to the vehicle's navigation system and to its body electronics via a CAN car interface.