

# FleetNet – Internet on the Road

## Ad Hoc Radio Network for Inter-Vehicle Communications



You are driving at 180 km per hour on a motor way and you are notified about an accident behind the next bend.

You are approaching a traffic jam and you ask for the traffic flow conditions ahead to find out whether you should better use an alternative route.

Your children make friends with children in cars close to yours by chatting or playing interactive games.

You get detailed information about fuel prices and the services offered by the next service station.

... and it is all for free!

### ■ The FleetNet Project

The objectives of FleetNet are

- to develop a communication platform for inter-vehicle communications
- to implement demonstrator applications
- to develop promising introduction strategies and
- to standardize the solutions found

in order to improve drivers' and passengers' safety and comfort.

### ■ Schedule

From September 1, 2000 to December 31, 2003.

### ■ Partners

- DaimlerChrysler AG
- Fraunhofer FOKUS
- NEC Europe Ltd.
- Robert Bosch GmbH
- Siemens AG
- TEMIC Telefunken microelectronic GmbH
- Universities of Mannheim, Hamburg-Harburg, Karlsruhe, and Hannover.

The Project is partly funded by the German Ministry of Education and Research (BMB+F).

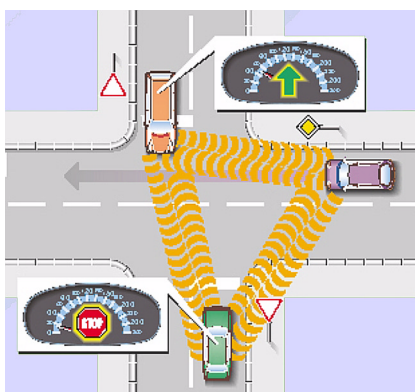
### ■ Applications

While driving there is a constant need for local information.

Inter-vehicle communications will deliver this information and will extend the 'range of awareness'.

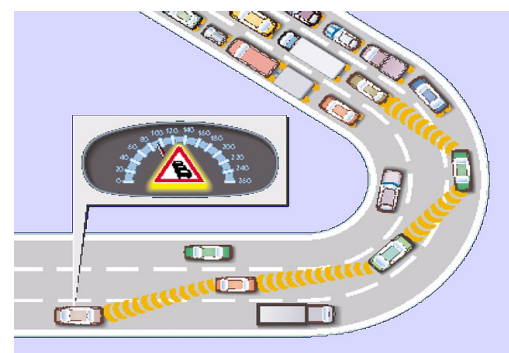
FleetNet applications will mainly evolve from three areas:

- Cooperative driver assistance, e.g.
  - Emergency notification
  - Overtaking assistance
  - Obstacle warning
- Decentralized floating car data, e.g.
  - Traffic jam monitor
  - Dynamic navigation
  - Route weather forecast
- User communications and information services, e.g.
  - Hot-spot Internet access
  - Mobile advertising
  - Inter-vehicle chat
  - Distributed games

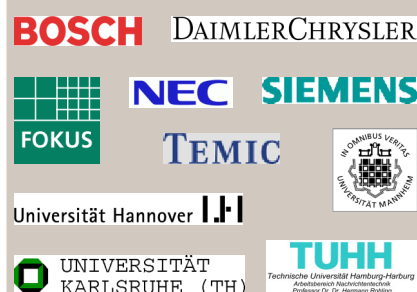


### ■ Fleetnet Key Features

- Wireless multi hop ad hoc networking
  - extends the 'range of awareness'.
- Considering unlicensed radio frequency bands
  - allows for low cost data transmission.
- Very low data transmission delay
  - is suitable for cooperative driver assistance and safety related applications.



- Vehicles are addressed according to their position
  - inherently enabling position-based routing and location-based services.
- Vehicle to vehicle and vehicle to fixed roadside station communication
  - enables Internet access and Internet integration.
- Open solutions
  - to be standardized and open to other vehicle manufacturers.



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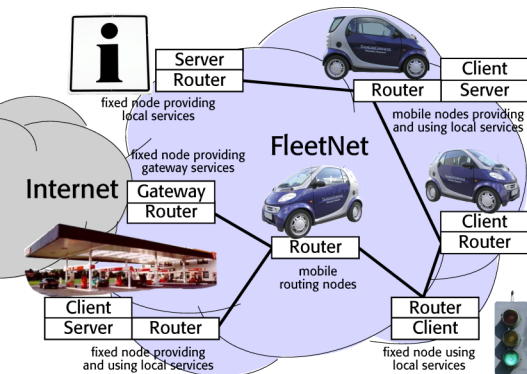
### ■ Internet Integration

The FleetNet architecture includes capabilities to provide access to the Internet from vehicles – or clients situated at vehicles – as well as access to vehicles from the Internet. This is achieved by:

- stationary FleetNet nodes providing gateway services,
- implementing network services to locate gateways,
- supporting Internet protocols on top of the FleetNet radio communication system,
- protocol optimization for vehicle to gateway communications,
- support of roaming between several gateways.

### ■ Position-based Routing

FleetNet routing assumes that vehicles are aware of their geographical position.



By making use of position-based routing strategies, an improved scaling behavior and adaptability with respect to large and highly dynamic networks can be achieved compared to non-position-based approaches.

Thus FleetNet routing

- makes use of navigation systems,
- incorporates a distributed location service,
- implements forwarding strategies based on local knowledge,
- implements recovery strategies for handling positional errors.

Ongoing simulations study radio coverage and routing strategies based on traffic models. For this purpose, 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.

### ■ Radio Communications

The requirements on the FleetNet radio communication system are manifold:

- support of high bit rates;
- robustness in case of high relative velocities;
- provisioning of multi hop connectivity even in low traffic density scenarios; and
- operation in unlicensed frequency bands.

The FleetNet project plans to use a UTRA TDD radio hardware. Radio protocols of the centrally organized UMTS Terrestrial Radio Access system will be enhanced or replaced by FleetNet protocols enabling operation in an unmanaged ad hoc mode.

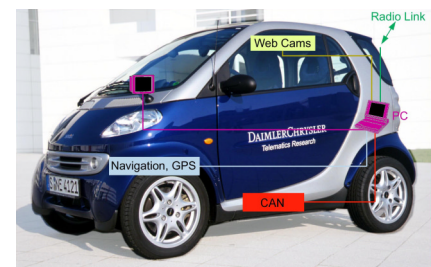
Additionally, radar-based communication currently under feasibility study will focus on safety-related applications.

During the FleetNet development process commercially available IEEE 802.11 wireless LAN components will be used intermediately for testing and verification purposes.

### ■ Testbed

Ten Smart cars and a number of roadside stations act as a 'real-world' testbed.

The vehicles are equipped with cabin mounted cameras, LCD touch screens, and internal computers providing access to the car's navigation system and to its body electronics via a CAN bus interface.



Fixed FleetNet nodes will act as roadside stations providing gateway services and similar functions e.g. required to set up FleetNet-internal servers.

### ■ Standardization

Many of the potential applications of FleetNet will only yield best benefits when market penetration is high. Thus, FleetNet results will be open to other vehicle or equipment manufacturers to allow inter-vehicle communication systems to be installed in vehicles regardless of their makes and brands.

Furthermore, the FleetNet project will aim for standardization of technical solutions found.

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