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Vehicular Networks in the mobility of the Cities of the Future

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GATV
Main research lines

• The main research lines developed by the Group members are:
  – Signal processing applications in smart transport, smart house and smart industry
  – Signal and Communications Applications in Intelligent Transportation Systems
  – Remote Sensing for Environmental Applications
  – Future Internet environment sensing
  – Visual communications
  – Telecommunications Systems
  – Computer vision
  – Audio and video technologies
Intelligent Transport Systems

- Intelligent Transport Systems include technological efforts towards integrating ICTs into the transport environment.
- These efforts encompass aspects related to the data collection, processing, communications and user services, amongst others.
- ITS Services can be:
  - Safety Critical applications
  - Traffic efficiency applications
  - Infotainment applications
  - Road charging applications

The environment

The Cooperative ITS environment is determined by the complexity of the services.

- Many involved entities: ITS-related and non-ITS related.
- Different technical and operational requirements (security, privacy, ...)
- Administrative and procedural regional differences in regulations.

It is necessary to view this environment at least in two levels:

- Technical level
- Business level
FOTsis (European FOT on Safe, Intelligent and Sustainable Road Operation)

- FOTsis (2011-2015) was a large-scale field testing of the road infrastructure management systems needed for the operation of seven close-to-market cooperative I2V, V2I & I2I technologies (the FOTsis Services), in order to assess in detail both 1) their effectiveness and 2) their potential for a full-scale deployment in European roads.

- From the communications point of view, the objective was to specify an open, scalable and flexible system architecture, based on the ISO Cooperative ITS reference architecture and the most recent IEEE, ETSI and ISO working groups’ developments.
Cooperative ITS
The FOTsis project

FOTsis C-ITS architecture deployment

- Interoperability 802.11p RSU <-> VRL
- Network connectivity checks.
- Services end-to-end flow support.
- Long-range (3G) and short-range (2 802.11p hotspots) links.
- Full IPv6 Mobility and transport information checks.
- OBU-MR validation.
- End-to-end performance checks: latency, connectivity, bitrate.

Cooperative ITS environment – IP Convergence

- Non-IP communications are suited to time-critical V2V safety applications.
- IP communications can be used for all other applications.
  - Traffic efficiency, comfort mobility, non time-critical safety applications, Internet connectivity
  - Reporting of information to a fleet management center, map updating, data transmission from RSUs to HCCs, remote diagnosis, etc...
- IP-based communications are essential for:
  - Maintaining information flow over any available media (11p, 11n, cellular, satellite, DVB, ...)
  - Interoperability with various ITS & Non-ITS Sectors.

- IP-based communications facilitate the interconnection and large scale deployment of C-ITS, and the integration of different entities (ITS and non-ITS), therefore being a key for business models development.
- IP communications are closely related with future concepts of Internet of Things or Smartcities.
Cooperative ITS
Immediate future

• The key players in deployment of ITS have established the lines of work for the immediate future of Cooperative ITS.
• Some of these lines are a direct follow-up of the work in FOTsis, and are being incorporated in the Day 2 deployment strategies of the AG.

Platform C-ITS EC DG MOVE
Recently created platform to accelerate the deployment of C-ITS in Europe.

The platform includes the key stakeholders for ITS deployment.
The issues are approached from both a political/business and a technical point of view.
Two major scenarios identified for ITS deployment:

- **Urban mobility**
  ITS developments in traffic and public transport have usually been isolated. As mobility is becoming more and more an integrated concept, it is necessary to view these areas jointly.

- **Autonomous vehicle**
  The autonomous vehicle also poses challenges. Until now, these have been approached in different, isolated ways. As part of the whole mobility picture, the issues in the development and deployment of the autonomous vehicle must be addressed in an integrated way.

As deployment of complex road services is becoming a closer reality, projects like FOTsis increased awareness of aspects that could make those service more accurate, efficient and useful. In particular, the increase in the use of more and more localized information:

- Vehicle as a floating sensor, Data from nomadic devices, sensor networks, etc. -> Internet of Things, Future Internet
- Extensive use of existing road operators (public/private) infrastructure. Involvement of different stakeholders.
- Integration of public transport and traffic data (OPTICITIES Project).

The assumed increase in available data will in turn make it necessary to implement BigData and distributed processing mechanisms for the management systems.
Mobility in SmartCities
Some non-technical views

- Technological development of ITS in SmartCities is quite advanced. We are getting to a point in which it is not so much about what can be done, but rather how to facilitate.
  - Are all the entities relevant for deployment aware of the issues and the solutions being proposed?
  - Is the regulatory framework adequate for large-scale deployment?
  - Is the framework of mechanisms of standardisation, conformance testing and certification ready to guarantee interoperability for manufacturers and users?
  - Is the framework of business model development and commercialization ready for the companies and manufacturers to undertake large-scale production and deployment?

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