Roads to the future

Oscar Lázaro discusses the importance of the European iTETRIS project – a research program designed to encourage greater adoption of cooperative ITS technologies and strategies

The importance of cooperative ITS for improved, sustainable mobility cannot be denied and various solutions in this arena have already been investigated and implemented by several major companies. One of the most important questions being raised by road authorities today, though, is how can the worth of this actual investment as well as effectiveness of traffic engineering applications on city traffic be estimated. To answer such questions requires new decision-support tools, which can guarantee accuracy and realism, thereby paving the way for the next-generation of ITS.

Traffic congestion costs the European Community around €50 billion a year. The majority of European citizens live in urban areas where there is a significant increase in demand for mobility of both people and goods. Given that urban environments do not generally allow for building additional roads to tackle this situation, wireless vehicular cooperative systems are an attractive solution to improve road traffic management. V2V and V2I communication technologies can improve traffic management through the real-time exchange of traffic information (RTTI) among vehicles and road infrastructure. However, before cooperative ITS projects can be successfully deployed worldwide and evaluated in Field Operational Tests (FOTs), road authorities are demanding clear evidence (at city level) of the benefits and impact of these solutions within their own particular scenarios.

Real-world versus virtual world

The development of new urban mobility policies and traffic management solutions that rely on cooperative technology demand that engineers and policy-makers are provided with decision-making tools that are flexible, accurate and technologically sound. The positive evaluation of FOTs and future deployments of cooperative ITS solutions will be affected by our ability to anticipate, understand and engineer best-of-breed solutions for effective management of cooperative ITS. This is unavoidably linked to our capacity to model and reproduce in simulated and controlled environments the real-life conditions that will be encountered by such systems. The effectiveness and worth of investment of next-generation cooperative ITS will therefore be driven by the correct dimensioning of the real chances of traffic information reaching the right car, at the right time, at the right place. Such probability is fundamentally affected by the fidelity of the communication models employed in the analysis

The EC estimates that traffic congestion currently costs €50 billion per year, or 0.5% of the EC's total Gross Domestic Product

Main objectives

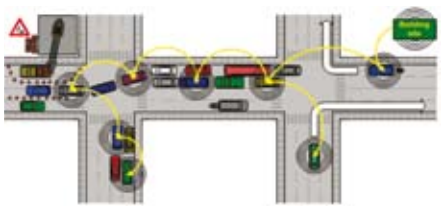
The overall aim of iTETRIS is to focus on the various technical objectives that still need to be solved to prove the ability of the wireless vehicular communication technologies that could improve road traffic management. A number of subsidiary objectives were also identifed, including the need to address large-scale vehicular communication scenarios, which have never been analyzed with this level of accuracy before. A pan-European standardized and open platform for advanced evaluation of cooperative ICT solutions for road traffic management also needed to be facilitated, which is currently non-existent worldwide.

New hybrid traffic control strategies were key and needed to be developed more autonomously and adaptively, with a new level of granularity that relies on cooperative technology and can be analyzed with the performance metrics defined. Current traffic mobility and vehicular communication platforms would also need to be augmented with highly accurate energy, noise, pollution and wireless link models respectively, and integrated in a unique simulation platform.

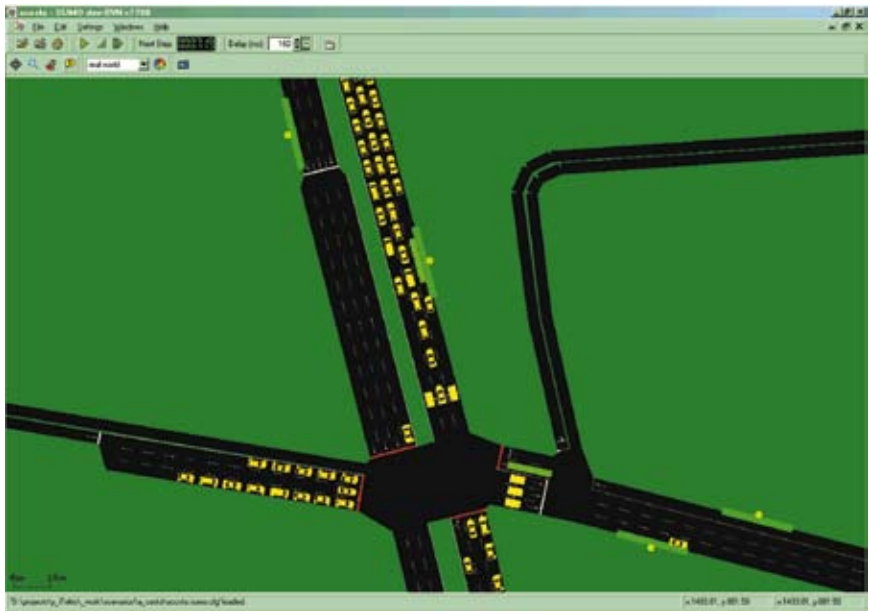
Other objectives include the definition of new traffic metrics to quantify the overall traffic network performance, new protocol ideas for data dissemination and routing,and the proposal of advanced V2V-V2I cooperative ICT strategies to handle low density V2V systems scenarios. Meanwhile, optimal and suitable communication strategies to handle transient periods when V2V technology is at a low penetration level would need to be proposed and anlyzed. Development of adequate communication protocols for vehicular communications to guarantee QoS was also key.

Assessment parameters

The iTETRIS simulation framework is equipped with a number of advanced features to assess sophisticated traffic management strategies, such as fine-grained, sub-second traffic simulation support for evaluation of traffic management strategies under realistic context information disposability, and emission and noise modeling support for sustainable traffic management strategies evaluation. It also includes intelligent re-routing simulation support for dynamic online route adaptation, Traffic Light System (TLS) algorithm support, as well as ADAS modeling support.



> Quantifiable results of large-scale deployments and investment on cooperative ITS applications can now be presented to road authorities



Integrating wireless communications and traffic simulation is a key part of iTETRIS

and the scale over which the impact assessment of the traffic management policy takes place. Small-scale evaluations of cooperative ITS systems could exhibit a high level of effectiveness at a local level but hide the problems caused by reallocating traffic on a wider scale. Hence traffic engineering companies and road authorities are demanding more powerful platforms for the evaluation of new types of strategies at city level.

The iTETRIS project[1] has developed an open, ETSI standard-compliant, flexible simulation framework to satisfy this need. iTETRIS integrates high-fidelity wireless communications and road traffic simulation platforms in an environment that is easily tailored to specific situations, allowing performance analysis of cooperative ITS at city level. The accuracy and scale of the simulations leveraged by iTETRIS clearly reveals the impact of cooperative, ITS-assisted traffic engineering on city road traffic efficiency, operational strategy, and communications interoperability.

iTETRIS is a 30-month EU FP7-funded research project (from July 2008 to December 2010) that involves nine partners from five different countries

The importance of communication

The project has devoted a great deal of effort to the development of accurate wireless ITS communication models that could bring together high fidelity in terms of information distribution accuracy and communication availability. For this purpose, iTETRIS considers the main technologies involved in V2V and V2I communications for cooperative ITS as four radio-based technologies – ITS 5.9GHz, UMTS, WiMAX, and DVB-H – which can be configured in multi-bearer and multi-channel modes. Moreover, iTETRIS implementation follows the ETSI ITS Facilities specification for supporting Local Dynamic Map (LDM) concepts, messages, mobile stations, relevance checks and location referencing facilities.

Networking protocols

The Networking and Transport layer contains the different protocols required for fully functional communication in ITS scenarios. Each networking protocol may be connected to a specific, dedicated ITS transport protocol or to pre-existing transport layer protocols, such as UDP or TCP. This means that iTETRIS supports both C2C-CC and IP communication stacks. iTETRIS has been developed for unicast, multicast and broadcast ITS applications and implements a number of networking protocols including standard compliant geo-networking addressing schemes.

The simulations leveraged by iTETRIS have so far revealed the impact of cooperative ITS on city road traffic efficiency. Quantifiable results of large-scale deployments and investment on cooperative ITS applications can finally be presented to road authorities in meaningful formats for informed decision making.

[1] *www.ict-itetris.eu*