When COMeSafety started in 2006, many European projects and activities were planned or already on their way dealing with different aspects of Car2X communication and cooperative systems. A European wide process was missing to consolidate the results and to support the projects to introduce these results into the European and world-wide standardisation.

Rudy Mietzner (Cirquent), Timo Kosch (BMW Research and Technology), and Dieter Seeberger (Daimler) proposed a new consolidation process as one of the main guiding principles of COMeSafety (see Figure 1). The basic idea was to collect the requirements of the projects under consideration. These requirements needed to be consolidated. The results of the consolidation would provide a basis for the European and world-wide standardisation and the frequency allocation process.

Now, 2 years later, the process is alive. COMeSafety is chairing an architecture task force that is both collecting and consolidating the requirements and defining an architectural framework. The three currently running big integrated projects dealing with cooperative systems, CVIS, COOPERS and SAFESPOT are all actively participating in this work. Furthermore, members of these projects are also active in the C2C Communication Consortium, which provides industry-wide platforms to harmonise the technical details and forward them to European standardisation in ETSI.

Figure 2 shows the connection between projects and standardisation. The process is a sequence of collaboration, consolidation and harmonisation into standardisation, which is fostered by the support of COMeSafety (see figure 3).

A key problem is finding the way of getting the best progress. For solving that problem a so called group of experts is established to coordinate all activities in a qualified way. Triggered by COMeSafety activities the main tasks of the group of experts are amongst others:

- the dialogue to the C2C Communication Consortium,
**COMeSafety’s contribution to standardisation**

(by Dr. Ilse Kulp, BMW Research and Technology)

- the contact to the European and world-wide standardisation bodies
- the compensation of specifications and requirements between the involved European projects.
- The group of experts can be seen as an information exchange and control centre between the involved European projects and standardisation bodies on one side and the COMeSafety and C2C Communication Consortium on the other side.

**Figure 4**: Role of the Group of Experts ©2008-COMeSafety

A consortium under the lead of Daimler AG, that consists to the bigger part of CAR 2 CAR CC members had proposed the PRE-DRIVE C2X (PREparation for DRiving im-plementation and evaluation of C2X communication techn-ology) project in the 2nd call for proposals by DG INFSO of the European Commission for the 7th Framework Pro-gramme. The proposal was accepted and within the next two years the consortium will develop a detailed system specification and a functionally verified prototype of the common European architecture for an Inter-Vehicle and Vehicle 2 Infrastructure communication system defined by COMeSafety. Furthermore, PRE-DRIVE C2X will develop an integrated simulation model for cooperative systems, which, for the first time, enables a holistic approach for estimation of the expected benefits in terms of safety, ef-ficiency and environment. This work will be topped by the development of tools and methods necessary for function-al verification and testing of cooperative systems in labo-ratory environment, on test tracks and on real roads in the framework of a field operational test. Last but not least extensive dissemination activities are planned to commu-nicate the benefits of cooperative systems technology to the public and to address all relevant European stakehold-ers.

PRE-DRIVE C2X will start on July 01, 2008 and has an overall budget of about 10 MEuro of which 50% will be contributed by the European Commission.

**Summary: eIMPACT**

(by Kerry Malone, TNO)

IVSS are seen as having tremendous potential for reduc-ing road fatalities, which were over 40,000 in 2005 in the EU. The eIMPACT project, “Socio-economic Impact As-sessment of Stand-alone and Co-operative Intelligent Ve-hicle Safety Systems (IVSS) in Europe”, assessed the socio-economic effects of Intelligent Vehicle Safety Systems (IVSS) and their impact on traffic, safety and efficiency. eIMPACT is part of the EU’s Sixth Framework Programme for Information Society Technologies and Media.

The project carried out impact assessments of twelve stand-alone and cooperative systems at the EU level, for 2010 and 2020. For each of these two future years, a sce-nario with a low penetration rate, reflecting no incentives for information exchange and control centre between the involved European projects and standardisation bodies on one side and the COMeSafety and C2C Communication Consortium on the other side.

Figure 4 illustrates the role of the group of experts.

The COMeSafety Architecture Task Force is creating a common archi-tecture document. The goal of this document is to enable and facilitate conceptualization and specification of flexible, interoperable coop-erative traffic and safety solutions based on agreed standards. The document will have three major parts: Overall Architectural Frame-work, Specifications and Stan-ards, Proof of Concept. The append-dix provides a common terminology for communication technology for European cooperative systems and many additional information and documents to the particular chap-te rs.

In order to achieve a common un-derstanding of a basic Car2X archi-tecture the document is intended to be read, discussed, updated and maintained by all members of the task force, the related projects as well as the COMeSafety Project Of-ficer of the European Commission and subsequent projects.

The document may be a basis for the developer work of stakehol-ders in the safety solutions area (e.g. OEMs, authorities, telecommunica-tion industries) as well as for IT-ar-chitects and developers of related research projects and the standard-isation bodies.

The common architecture doc-ument shall be released and availa-ble in the second half of 2008.

**Figure 5**: Liaison Managers of COMeSafety

PRE-DRIVE C2X (by Matthias Schulze, Daimler)
Highly dependable IP-based networks and services

HIDENETS (www.hidenets.aau.dk) is a Specific Targeted Research Project (STREP) in the European 6th Framework Program, which runs for 3 years until the end of 2008. Its objective is to develop and analyse end-to-end resilience solutions for distributed applications and mobility-aware services in Car 2 Car Communication scenarios with infrastructure service support. Thereby, the HIDENETS solutions go beyond the classical notion of fault tolerance to be able to cope with system evolution and unanticipated conditions. Development and analysis of such resilient solutions requires a holistic approach combining aspects of communications, middleware, service deployment and access. Hence HIDENETS combines forces from automotive domain, engineering community, and from leading research teams on resilient distributed systems.

HIDENETS develops appropriate fault-prevention and fault-tolerance mechanisms at the middleware and communication layers, as well as methodologies to support the design, development, evaluation, and testing of dependable solutions using such mechanisms.

The main HIDENETS outcomes are:

- Middleware dependability services: These functions enable fault-prevention and fault-tolerance for application programs. Functionality includes data replication and efficient access to distributed fault-tolerant storage, error detection and fault diagnosis, as well as recovery actions for different fault scenarios. Standardised interfaces from the SA-forum (see www.saforum.org) are utilised and extended to meet the additional requirements of the ad-hoc communication domain.

- Enhanced communication protocols: Resilient communication in HIDENETS is achieved via extensions of the Link and Network Layer functionality, including multiple radio/channel management, robust routing mechanisms, new reliable flooding schemes, and traffic differentiation.

- Architectural hybridisation: As critical functionalities should remain unaffected by the most frequent fault cases, HIDENETS employs architectural hybridisation, which separates these functionalities. Furthermore, stronger timeliness and security properties can be assured via this architectural split.

- Holistic evaluation workflow: HIDENETS develops a new holistic evaluation workflow/framework to quantitatively analyse the developed solutions, utilising analytic models, simulations and experimental approaches. This holistic evaluation is essential for the dependability analysis of comprehensive end-to-end systems.

- Testbeds and prototypes: HIDENETS solutions are implemented in testbeds. Assurance of time- and security properties and timely reactions has been demonstrated by prototypes in the context of a safety-critical platooning use case.

- Application development support and testing methodologies: From HIDENETS perspective, providing development support for its applications is a necessity, as dependability arises mainly from stage of development.

HIDENETS solutions are capable to contribute to a user perception of trustworthiness of future wireless services, as this perception is strongly impacted by dependability aspects. Therefore, the HIDENETS solutions are essential for the deployment of future business-critical applications. Under further investigations, in accord with C2C-CC, these solutions will run into C2C-CC standardisation.

See www.hidenets.aau.dk for more details.
SAFESPOT is an integrated project aimed at improving road safety adopting cooperative systems based on V2V and V2I communications. The project was promoted by EUCAR, started in Feb 2006, will end on January 2010 and has an overall budget of about 38 Million of Euros (20.5 of which funded by the European Commission).

The main technical objectives of SAFESPOT are the following:

- To develop or improve and assess the key enabling technologies:
  - Communication through ad-hoc dynamic networks whose nodes are vehicles and road side units.
  - An accurate relative positioning
  - Local dynamic maps.
  - Wireless sensor networks to be used at infrastructure level.
- To develop the Safety Margin Assistant, that is an integrated application framework using the safety-related information provided by the network properly fused with the on board sensor and able to advise or warn the driver.
- To define in commonality with other EC projects an open, flexible and modular architecture for cooperative systems.

Moreover a dedicated Subproject (BLADE) is dealing with legal, business and deployment organizational aspects.

The basic concept of SAFESPOT is the extension of the driver awareness through communication. Typical scenarios are reported in fig. 1. Some vehicles are equipped with the SAFESPOT devices and some have enhanced sensing capabilities (e.g. a radar). The equipped vehicles are communicating among themselves and with the Infrastructure nodes (Road Side Units –RSU).

The RSUs may operates as a repeater or, having on board intelligence, may manage infrastructure sensors and run complex applications (e.g. intersection management).

In the figure the role of RSU is to extend and store the information. The figure reports different situations (sliding road, tilted motorbike, Red light runner) and the corresponding data flow. Fig. 2 shows the internal architecture of a SAFESPOT node with the main blocks.

In V2I application, developed by the COSSIB subproject, the warning is defined by the infrastructure nodes and then sent to the vehicles which are running a common client able to interpret and display the message on the vehicle HMI.

It should be underlined that the logical architecture is the same for vehicle and RSU. The platform domain is the core of the SAFESPOT system. It contains the Local dynamic map (LDM), a multilayered data base containing all the relevant information (Static and dynamic) in the surrounding of the node. The other two key blocks are the Application Manager and the Message Manager which manage respectively the applications which define the warnings and the application content to be sent on the Vehicle ad hoc network (VANET). VANET is based on 802.11p and support multi-hop geo-broadcasting. The final protocol is a main topic of discussion of C2C-CC, an ETSI working group and the COMESAFETY architecture Task Force. SAFESPOT is contributing to all these working groups.

SAFESPOT applications are classified as V2V or V2I depending on where the warning strategy is implemented. In V2V applications, developed by the SCOVA subproject, messages are generated on the vehicle based on raw data provided by internal sensors or by the other VANET nodes.

Figure 2: The SAFESPOT architecture

In the BLADE subproject a number of deliverable were produced including a preliminary organizational architecture and business model, risk analysis and mitigation strategies, analysis of legal aspects. In the remaining period the analysis will be assessed and a complete cost/benefit analysis will be made. More information about SAFESPOT may be found on the project web site www.safespot-eu.org where it is possible to download the public deliverables.

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