COOPERATIVE SYSTEMS DEPLOYMENT AND ORGANISATIONAL ISSUES

Booklet of the E-FRAME Project, June 2011

CONTENT

E-Frame is funded by the EC, FP7 IST Programme

From RTD to Implementation

The use of information technologies and communications (telematics) in road transport, or Intelligent Transport Systems (ITS), has progressed exponentially during the last 40-50 years. All major regions and cities now use a range of ITS to make transport more efficient, safer and to provide information to travellers. These however, tend to be deployed in a piecemeal manner, whereas it has been demonstrated that major improvements, and better quality services, can be created with the greater integration of inter-operable equipment, i.e. ITS RTD (Reasearch and Technology Development) is much easier than ITS deployment! The wish to deploy Cooperative Systems has exacerbated the problem.

Technical and Organisational Harmonisation

Technical harmonisation requires the use of standardised interfaces and protocols for the exchange of data between systems components and external interfaces. It also requires the ITS deployment and operation to be planned in such a way that all stakeholders get what they expect from the services, and that they are available wherever and whenever required.

The deployment of ITS frequently involves both public and private organisations, including local authorities, public transport operators, equipment manufacturers, service providers. Before a service can be successfully deployed, their relative roles and responsibilities (financial and organisational) must be clearly established. Often new forms of collaboration in both pubic and private sector organisations are required.

In order for a set of ITS services to be successful throughout the EU they must therefore:

- be **effective** – make a tangible contribution towards solving a key challenge
- be **cost-effective** – for all the organisations involved
- provide **geographical continuity** – to ensure seamless services across the EU
- be **inter-operable** – to exchange data, information and knowledge
- have a **degree of maturity** – to ensure they work as required

There must therefore be a planned approach so that compatible equipment will work everywhere, when required and in the same way.

INTRODUCTION TO COOPERATIVE SYSTEMS

Cooperative Systems is the term that has been given to those road transport services that become available once vehicles can communicate with each other, and with road-side or central units. A distinctive feature of many Cooperative Systems applications and services is that they provide a more personal service than other forms of ITS. Through the use of wireless communications, they also enable information to be provided to drivers without the need to pass by fixed roadside structures such as Variable Message Signs. The possible applications and services are varied and can be classified under the following headings:

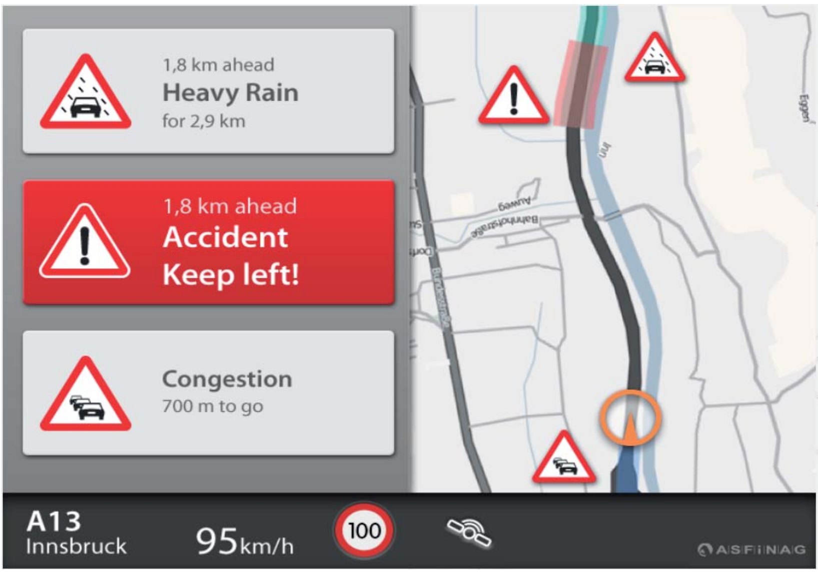
Traffic Safety

A key feature is that one vehicle discovers a problem, and then passes this information to those vehicles that will arrive at that location in the near future.

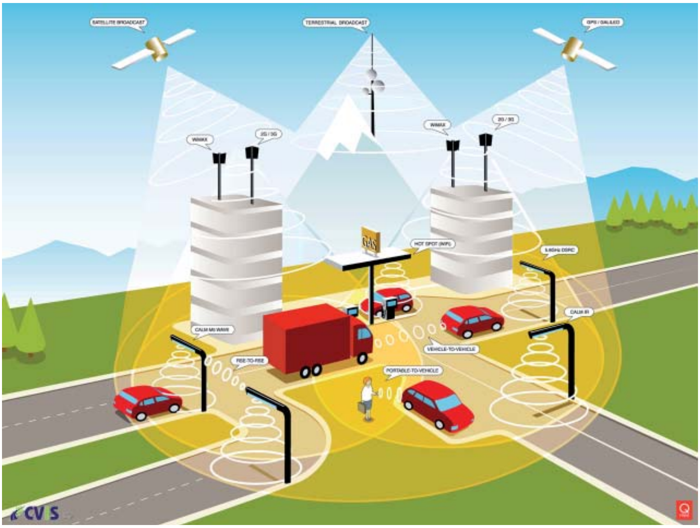
Topics include:

- Road Hazard Warning
- Ghost Driver Management
- Lane Utilisation
- Speed Management
- Collision Warning
- Vulnerable Road User Warning

Example of Cooperative Services: COOPERS



V2X Communication to enable Cooperative Services, Source: CVIS



Traffic Efficiency

Each driver is given advice that reduces the numbers of vehicle stops and starts. Topics include:

- Traffic Flow Optimisation
- Advanced Adaptive Traffic Signals
- In-vehicle Signage
- Flexible Lane Allocation

Freight and Fleet Management

The key feature is that each driver is provided with information that is specific to his/her circumstances (e.g. rest period), or the vehicle's load. Topics include:

- Loading Zone Management
- Rest Area Parking

Value Added and Other Services

There will be a wide variety of these, some of which will be available as Applications or „Apps" in the vehicle whilst others will also need facilities in other locations. Topics include:

- eCall
- Enhanced Route Guidance and Navigation
- Insurance Services

Current Situation

These, and other, Cooperative System applications have been demonstrated by a number of research projects with many prototypes validated technically. Whilst some applications are close to market, many others require further work to be done before they will be ready for deployment.

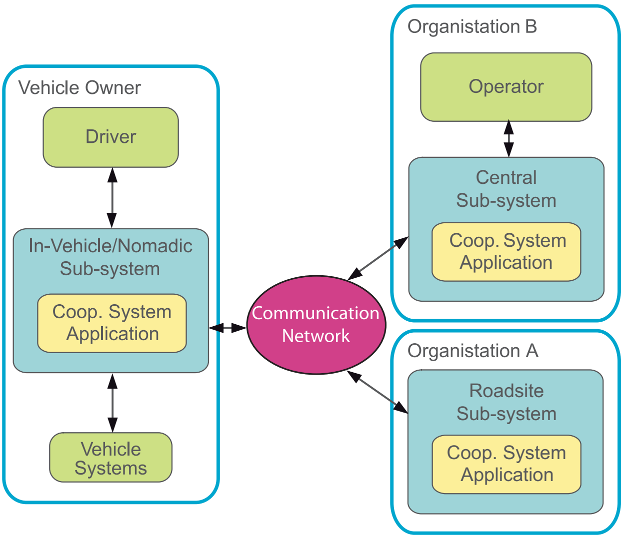
Deployment Issues

An ITS Architecture is not an end in itself, it is a means to an end and provides a tool whereby ITS Services can be understood at the “application” level, and the principal components and communications needed to provide them can be identified. Although the developers of a Cooperative System application may wish to exercise great flexibility, those who are providing the supporting infrastructure need to plan for a deployment that will last for many years, and the application will have to fit into this structure.

As well as being able to create a deployment plan, much of the technical content of a Call for Tender (Request for Quotation – RFQ) can also be provided from the contents of an ITS Architecture. The interfaces between the sub-systems (also called ITS Stations) are also clearly visible and the use, or the need for the creation, of standards can be identified.

Organisational Issues

Each sub-system will be owned and/or managed by an organisation or a person. Those ITS Services with many sub-systems may need a number of organisations to be involved, both public and private. This can get quite complex, especially if (part of) the service requires payment for non-safety-related information. The ITS Architecture enables issues such as the ownership of data to be analysed and discussed, and upon which a full business model can be created.



Example of a Cooperative System Architecture including the responsible organisations

One of the more complex issues associated with the provision of fully integrated and inter-operable ITS Services are the mechanisms by which everyone who is needed to provide that service will wish to be involved, i.e. how will they get paid, and by whom? Most current ITS Services are provided by a single supplier, but the provision of Cooperative Systems may require a number of stakeholders to work together in order to supply the user (driver or traveller) with the desired information. An ITS Architecture provides the basis for building a model of how each stakeholder can contribute to the service.

In a typical scenario there are a number of stages:

- Data Acquisition – raw data is collected, usually from or about individual vehicles.
- Data Fusion – the non-homogeneous data is combined and processed in order to obtain a single, homogeneous pattern representing the current traffic situation, as well as a prediction of the future.
- Service Generation – the information that is to be given to the user is generated; in some cases it will be customised for a specific (class of) user.
- Service Distribution – the information is distributed to the user via a designated distribution channel.

Value chain for Cooperative Systems

Consideration of these issues leads to the following questions:

- Which are the most likely deployment scenarios?
- What role should be played by the road and highway operators?
- How will investment and expenditure from public sources be justified?
- Which practicalities have to be solved before the deployment can go ahead?

Further research is required before their answers are fully known.

The following deployment scenarios have been proposed:

Industry Driven Scenario

A group of industry partners agree to support the introduction of Cooperative Systems to the market place. It agrees on the functionality for a set of commercially exploitable services that can be deployed through cooperation between them, and invites other companies and public bodies to participate. The basic system design and ITS Architecture is agreed within the core group and proposed as the technical basis for work in standardisation committees. Once key customers have become interested, the functionality can be extended into the efficiency and convenience areas.

The main challenges are achieving agreements on the functionalities of the common services and the timing of their introduction so as to reach an acceptable level of market penetration rapidly. The relationship with public authorities needs particular attention; otherwise the necessary road-side (infrastructure-based) elements will not be deployed.

Regulation Driven Scenario

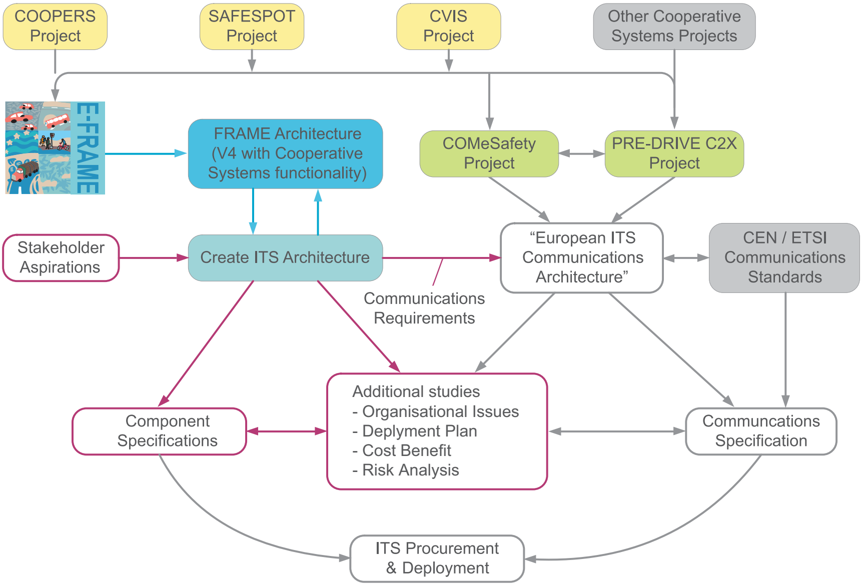
Public authorities take the initiative to introduce Cooperative Systems via European regulation in a Directive, which is then followed up at the Member State level. Basic road safety-related functionality is defined and standardised. Their introduction is made mandatory for new equipment purchased from a certain point in time, and made an obligatory part of public procurement tenders. Since the equipment in vehicles and at the road side is certified and mandatory, liability for industry and service providers would be limited and controlled.

The main challenges are achieving agreements between the Member States, and the processes leading to the introduction of the systems into the market. There would need to be a clear time line for industry and authorities to maintain in order to achieve a successful introduction. Users will also have to be educated.

Common European Mobility Scenario

Public authorities and industry agree on the introduction of Cooperative Systems within Europe and agree their respective roles and responsibilities. Basic road safety, efficiency and comfort services are defined to be attractive for all stakeholders. Development will be done with a special focus on inter-operability between the various regions and scalability of the selected solutions. The impact on the market will be high.

The main challenges are reaching an agreement on the roles and responsibilities between organisations and groups that do not normally work together. They will then have to maintain a step-by-step agreed approach that is defined in detail.



Relationships between Cooperative Systems ITS Architecture activities

The questions in relation to the role of the operators and the justification of public and private investments have not yet been answered. Starting from the stakeholder aspirations, which are statements of what the stakeholders want the ITS to provide, an ITS Architecture can be created from the FRAME Architecture, which has been extended to include Cooperative Systems. This will result in a Functional Viewpoint sub-set of the FRAME Architecture. A Physical Viewpoint is then produced for a given deployment, which shows the locations of the functions and data stores in the Functional Viewpoint. The next stage in the process is to examine the communications requirements between the physical components with a view to identifying the mechanisms or standards that can be used in the design. For those communications paths that relate to Cooperative Systems it will be necessary to consult the European ITS Communications Architecture created by the COMeSafety and PRE-DRIVE C2X projects and/or the standards being created by CEN and ETSI.

The resultant component and communications specifications will be used to enable the procurement of systems, components and communications from various suppliers.

Multiple Ownership

Cooperative Systems may be provided by components owned by more than one organisation, and some hazards may be the result of interactions between those components. It will therefore be necessary to identify who is responsible for dealing with the consequences, both legal and technical. An ITS Architecture provides a model of the components, and their interconnections, and thus a basis for analysing these issues.

Safety

All ITS applications and services should be considered as being safety-related, until they have been shown not to be, using a process called Preliminary Safety Analysis. The safe use of ITS has three principal components:

- (Functional) System Safety – e.g. relating to design faults or system malfunctions. This is provided by including additional stages in the system development lifecycle during which the probability of a dangerous failure is reduced to an acceptable level.
- Human-Machine Interaction (HMI) – relating to usability, e.g. perception, overload, underload. A key question is how much information can be presented to a driver before it stops being a help and starts to be a distraction from the main driving task.
- Traffic Safety – all components of the traffic system working together. This relates to the direct or indirect effects of the ITS on the safety of the traffic situation.

Security

Security abuse commonly includes, but is not limited to, unauthorised disclosure of information (loss of confidentiality), unauthorised modification of data (loss of integrity), and unauthorised deprivation of access to the asset (loss of availability). Users and owners of ITS Systems must have confidence that there are countermeasures that will minimise any security risk. Whilst security is necessary for privacy, it is not sufficient.

Privacy

Through their frequent use of vehicle identities, Cooperative Systems need to include the requirements for privacy right from the start of the initial designs. Care will have to be taken to ensure that the requirements of the European Privacy Directive is considered at every stage of the design process. A particular issue is that just making the identity of a vehicle “anonymous” is not always sufficient to ensure privacy in all situations.

PROJECT MEMBERS

Project Coordinator

Peter Jesty Consulting Ltd (UK)

Project Partner

AustriaTech – Federal Agency for Technological Measures Ltd. (AT)

Czech Technical University in Prague (CZ)

MIZAR Automatizione S.p.A. (IT)

Siemens plc (UK)

Rijkswaterstaat Dienst Verkeer en Scheepvaart (NL)

Centre d'Etudes sur les Réseaux, les Transports, l'Urbanisme et les constructions publique (CERTU) (FR)

Imprint

Content

Peter Jesty Consulting Limited

Warwick Lodge, Towton, Tadcaster, LS24 9PB, UK

Phone +44 1937 833640   E-Mail phj@peterjesty.com

Layout & Print

AustriaTech – Federal Agency for Technological Measures Ltd.

Donau-City-Strasse 1, 1220 Vienna, Austria

Phone +43 1 26 33 444-48   www.austriatech.org