The missing link

The CVIS Project is defining the future of vehicle-to-infrastructure and vehicle-to-vehicle cooperative systems in Europe. A unique aspect of its work will be the development of a single mobile communications router which can be used at the roadside and in-vehicle

Cooperative acceleration/ deceleration and the provision of earlier green phases will lead to better-balanced urban networks

The CVIS (Cooperative Vehicle-Infrastructure Systems) Integrated Project is defining future European technologies for real-time communication between vehicles and the roadside. Launched in February this year and co-funded under the European Commission's (EC's) FP6, the Project is worth some Euro42 million. It will develop use cases for vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications, create a single router platform for both roadside and in-vehicle applications, and lead to real-world demonstrators in three years' time.

The project will look at core technologies (this will account for around half of the total budget), the development of applications, and testing of these at sites in France, Germany, Italy, The Netherlands/Belgium, Sweden and the UK. With 61 partners, it is among the largest of the EC's e-safety programme projects. The public website is at www.cvisproject.org.

The large number of parties involved should ensure that a critical mass is achieved to ensure that a consensus can coalesce around common European standards, says Paul Kompfner, Head of Efficiency and Environment at ERTICO, which is the project coordinator.

"Countries like Sweden and the Netherlands have some active integrated vehicle-highway systems programmes, while Germany has had INVENT and now ACTIV which concentrate on driver support including third-generation off-board route guidance to the individual vehicle.

"There are quite a number of industry and national projects looking at two-way real-time communications. A number of these have come together under the EC project umbrella because there's a realisation that the only way forward is to communicate and cooperate - autonomous systems can only do so much.

"Like previous European projects, we're taking a non-proprietary approach. GSM came about because the whole industry agreed to collaborate, and what we're trying to do in CVIS is to come up with the 'GSM standard' for the mobility market."

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Standards and a universal router

CVIS has adopted the ISO's Continuous Air interface for Long and Medium distance (CALM) protocols for its main technology.

"CALM ensures the best available connectivity at all times, and which bearer happens to be used is transparent to the user. UTMS and GSM technologies are already available but in terms of V2V and V2I there are problems with these: the cost, the need to pass by a central operator, the bandwidth and the lack of direct local connectivity," says Kompfner. "What we're after is a permanent 'cloud' of IP connectivity via whatever is the nearest "hotspot" to a user's vehicle or navigation aid. That hotspot could be, for instance, on a street lamp or on the nearest traffic light junction controller.

"CVIS is building on the successes of the ERTICO-coordinated GST (Global System for Telematics) project that finishes next year. That has demonstrated open access applications such as E-call and B-call at several locations. It allows service providers to provision services safely and securely - that's important, as we don't want to create a conduit for viruses that could attack vehicle systems."

When comparing the approach with the US's VII initiative, Kompfner says that one has to remember that things are more fragmented in Europe - each member state has responsibility for radio frequency regulation, for instance. "The US has one single national programme for cooperative systems," he adds. "Also, I think we're more commercially driven in Europe - there has to be a business case. Proposals are going through the regulatory process here for an allocation of radio spectrum at 5.8-5.9GHz for vehicle-to-vehicle and vehicle-to-infrastructure applications."

A unique aspect of the CVIS project - and a world first - will be the development of a common router platform for both roadside equipment and vehicle.

It's an important concept, Kompfner says: "We want to have basically the same systems for roadside and in-vehicle applications. The only difference is that the roadside unit will have both wired connectivity to local infrastructure and a wireless interface."

Services

With car manufacturers developing V2V solutions, for example within the sister EC SAFESPOT project, the emphasis in CVIS is on V2I. Nevertheless there is close coordination on common interfaces to avoid the need for multiple in-vehicle systems.

"The future is in applications like hazardous materials tracking, incident management and information provision," Kompfner continues. "The basic CVIS technical solution will support an almost unlimited number of applications. The use of extended Floating Vehicle Data (FVD) - to pinpoint each vehicle and where it's going - can revolutionise network management."

There are, he notes, three core elements within the technology platform: wireless communications, accurate positioning and applications management.

"CVIS services fall under four categories: urban; inter-urban; commercial; and cooperative monitoring.

"The project will look at balancing the

Left: The ability to advise and control both individual and platoons of vehicles will significantly enhance network management

Right: Commercial applications of CVIS will look at allocating parking slots at service areas to individual freight vehicles, and to control access to urban areas for loading and unloading

different levels of urban networks and providing individualised end-to-end route guidance. Above that, we'll be looking to manage local areas with cooperative acceleration and deceleration, and looking to provide earlier green phases to whole clusters of vehicles. Dynamic bus lanes are also being considered: drivers may be able to get a 'ticket' to use lanes that aren't heavily used as a means of increasing capacity. They would then be asked to re-merge with the main traffic when a bus approaches. That application would rely on pretty much the whole vehicle fleet being suitably equipped, however."

At the inter-urban level, the delivery of VMS information directly into the vehicle will be demonstrated. And with onboard systems able to give positional information accurate to a single metre, 'ghost' or wrong-way driver detection and resolution times will be dramatically reduced. Meanwhile, cooperative traveller assistance will give travel information a much longer 'reach' allowing better congestion and incident management.

Commercial applications include parking and loading bay management. Kompfner makes an analogy with slot allocation at major airports, in that a vehicle's position will be matched to parking space availability at motorway service areas, or to use of loading bays in urban areas. Hazardous material monitoring will extend to provide dial-up voice services via the internet and automatic crash notification. Finally, vehicular access to sensitive areas, governed by both physical and virtual barriers, will also be looked at. CVIS is not actually looking at E-call or road charging, although it could theoretically support these services.

The cooperative monitoring activity will research the fusing of extended FVD with existing network monitoring techniques.

"We're also going to be looking at the use of WiFi to improve positional accuracy," says Kompfner. "Triangulation using WiFi has already been demonstrated in the research community.

"One technology which hasn't been looked at yet but which would allow not just drivers but also passengers to go online is WiMax. That could offer an exciting potential as an enabler for bundles of applications and also vehicle-to-vehicle voice communications on the move."

Implementation and technologies

The EC favours large-scale deployments but above all, there is a need to get the value chain and technologies right, Kompfner adds: "At every set of traffic lights, for instance, you'd need a beacon. We're working on and defining those interfaces, the power needs, bandwidths and so on.

"It depends on what you mean by 'the system'. If for whatever reason someone else were to implement a compatible metropolitan wireless 'mesh network', then great, we could use that. If, though, local authorities have to implement this at the traffic light level then the business models and costs are very different.

"I like the idea of several business models converging and sharing the use of one communications box. It depends on the 'killer app' and customer attitudes. UMTS has been a flop until now; handset sales are much lower than was expected. People are still happy with voice and text rather than streaming data. How can CVIS be expected to come up with the killer app when no one has managed it for 3G, which has been around for quite some time?

"I'm curious to see how user acceptance will pan out. This is a big issue for deployment. Is it acceptable to the individual to send FVD from his or her car? That depends on guaranteeing anonymity and data security.

"We need to focus on the driver in CVIS. If we look to cluster vehicles at an intersection or divert vehicles selectively, compliance will be voluntary. We're not looking to control. Acceptance is key; that's why we're seeking an end solution which is inexpensive, can be miniaturised, works through one antenna and can support numerous applications.

"We're still defining whether people will have an 'account' of some sort, how FVD will be gathered and clearinghouse issues - network managers haven't done this before, so who will? We need to be very open as to who we involve as business partners."

Education

None of this matters, of course, if no-one knows about what's going on. Kompfner says that we have to have a clear strategy for how CVIS approaches the education process.

"The first group targeted has to be the providers of transport networks. POLIS is a partner in CVIS and is already running training courses to teach their city partners and regional partners about interactive infrastructures. That'll allow them to sell the idea to their customers.

"Next are the car companies, telcos and some players that don't even exist yet, because there's a big space here for the entrepreneur. The car companies might use cooperative systems to provide remote diagnostic services but it's down to individuals' imagination to come up with new ways of providing services. That's why very high levels of safety and security will be built into the CVIS solution. If you enable a wide range of services, it's potentially a two-edged sword. You have to counter that virus threat.

"In terms of the public, if people don't know what CVIS is then they don't know to ask for it. That's why we need the demonstrations and application bundles. The project is technology-led in this first stage of development, and trials and outreach could be a task for FP7, the next round of European Framework Projects" ■