One in, all in

CALM forms the backbone, if not the heart, of Europe's Cooperative Vehicle-Infrastructure Systems Project. Here, we take a high-level look at what it is and what it is intended to do

The Continuous Air interface for Long and Medium distance (CALM) is not so much a series of wireless communications protocols as an architecture and a series of management functionalities for existing protocols. It emerged out of an initiative started in 2001 by the International Organization for Standardization's (ISO's) TC 204 Working Group 16 which was looking to find out how to fit the internet into moving vehicles, as well as other applications such as GSM communications, Wireless Local Area Networks (WLANs) and Dedicated Short-Range Communications (DSRC - and 'DSRC' in the European sense, reflecting the name of the European working group which developed a set of standards for 5.8GHz DSRC - less than 20m and roadside/vehicle only - not the 5.9GHz/WAVE solution which is termed DSRC in the US).

Although it is possible to buy commercial systems that provide some of the functionalities of CALM, there was an identified requirement for global interoperability. This takes account of the international nature of vehicle manufacturing and of handheld devices as a part of the ITS 'network'. That is where ISO came into play, as it was felt that it was the only body able to supply global standards at a sufficient level and complexity.

The main driving force was a desire to get away from the one application/one box situation prevalent at the time, and to isolate applications from specific radio interfaces such that users and applications do not 'see' which communications interfaces are being used. A key part of CALM is that it continues to offer several channels of communication simultaneously. This means that vehicles and infrastructure can continue a two-way dialogue even when, for whatever reason, individual channels are unavailable. This is an important consideration in the case of real-time safety applications.

CALM and CVIS

CALM is effectively the working backbone of the European Commission's new Cooperative Vehicle-Infrastructure Systems (CVIS) Project. Without it, CVIS would not exist - at least, not in anything like its present form. CALM provides the communications stack and management layers and CVIS will be used to validate the CALM standards and to integrate more European technologies and applications, such as those from the Global System for Telematics (GST) Project (see Sidebar, 'The GST Project') which is due to finish in 2007.

CALM actually involves somewhere around 25 different standards at present. These are at various stages of completion but, broadly, two-thirds are now at the final committee stage. The CVIS Project is widely held to be extremely timely in terms of evaluation therefore, as issues such as backwards-compatibility can be addressed.

The final architecture will use a suite of middleware which will be partly a legacy of the GST Project and partly new work to be carried out in CVIS. The intention is to provide a very rich platform-independent applications environment. Part of that environment is an intelligent agent which will switch between a number of protocols and use the most efficient or least costly to form a link. That means, for example, that a vehicle's Java-based interface can receive a very broad set of services which it can then deliver onboard to the driver and passengers via whichever means are deemed most appropriate - on-screen, aurally and so on. Through the provision of probe data, local map data (with multiple information layers on accident hotspots, services and so on) and various other services, an appropriately equipped vehicle will be totally aware of its local environment wherever it may be and at any time.

A key factor has been ensuring security and that only those with appropriate permissions can carry out exchanges; it is important to allow the downloading of functionalities without exposing vehicle systems to the risk of hacking or viruses. The middleware is set up to not only serve vehicles. It can also deliver services to handheld devices and this reflects the broader multimodal thinking behind CVIS when compared with the US's Vehicle Infrastructure Integration (VII) initiative, for example.

Status

In terms of implementation, Japan has carried out proof-of-concept work and several part studies have been carried out in Europe; Efkon has carried out some development work on the infrared and M5 (active microwave) segments of CALM. Norwegian company Q-Free has also conducted work on the M5 standard and together with the Norwegian Public Roads Administration has deployed small pre-CALM test systems in Lillehammer and Trondheim. CVIS and the cluster projects, however, will be the first real test of CALM in any meaningful sense and work on integration of the first true CALM communications infrastructure commences in July 2007.

VII - a comparison

There are numerous differences in comparison with the US's VII initiative - both in terms of concept and business cases. VII, as noted earlier, will focus totally on 802.11p WAVE technology. It is, effectively, a WLAN operating at 5.9GHz. It does not have an overall CALM concept built in, in that mobile phone/GSM interoperability are absent. The emphasis is on local-type applications but this is not to say that VII is fundamentally flawed. It is more a case of a difference in thinking: VII concentrates on applications which cover the majority of 'Day One' safety issues - those which will bring about the greatest safety improvements per investment dollar. Where VII is oriented towards vehicle-to-infrastructure and vehicle-to-vehicle applications, CALM is both multimodal and more network-oriented. The 'features list' for Europe will be different because the driving priorities there are different. However, many of the applications within CALM will be recognisable to VII users. This is hardly surprising, as many regard CALM as a 'superset' of what is being done in the US. Behind this (and something which underlines the fact that in many ways CALM and VII are not as different as some would suggest) is the US requirement that whatever is being done within CALM must also work in the US - and that includes all US functionalities ■

http://www.tc204wg16.de/

www.calm.hu

The GST Project

The GST (Global System for Telematics) Project, which ends next year, was set up to create the technology and facilitate the cooperation necessary for the creation of an open market for online telematics services. The project's vision is of a future where all vehicles are equipped with the communication means to interact with each other and their environment based on a common architecture and standard interfaces.

In recent months, a series of showcases have highlighted the Project's work. The downloading (or provisioning) of telematics software and services to a GST-compliant platform via a GPRS link was recently demonstrated publicly in Sweden, for instance.

In terms of road information services for safety applications, the Project has made great strides. For example, when a car breaks down or has an accident, the technology developed within GST allows it to send a road hazard warning to approaching vehicles, even those around blind corners, while simultaneously informing nearby traffic management centres and allowing the information to be broadcast more widely. In a jointly developed rescue scenario, BMW and Renault have in the last year demonstrated communications between vehicles from two different manufacturers - the first time that this had happened at a European level.

www.gstforum.org

Behind the glass – getting the MOST from the car

Just as there needs to be a common infrastructure outside the vehicle, it is important that the vehicle provides an internal backbone to distribute data coming in from the outside. The MOST (Media-Oriented System Transport) bus is generally held to be state of the art and is the most widely used. The technology is developed and brought to market by the MOST Cooperation, an association of carmakers and their premier suppliers; 16 vehicle makers participate and there are now close to 40 different vehicle models shipping well over 10 million devices per year. The current version of MOST uses a plastic optical fibre physical layer that runs at 25Mbps but there is also a version being deployed that uses an electrical interconnection running at 50Mbps over unshielded twisted pair wires. A 150Mbps system is on the way.

The move to digital

MOST is a whole system architecture that includes standard network management functions to effect connections between devices - it is more than just the physical interconnection between various devices. This makes it easy to migrate between various speed grades and physical layers, since at the application level very little needs to be changed to accommodate the different physical interfaces. MOST provides all layers of the ISO Open Systems Interconnect reference model for networks.

Now an open standard, MOST has its roots in the desire by top-end German OEMs (DaimlerChrysler and BMW) to differentiate their products by loading them with multimedia equipment. As multimedia went digital, existing buses (such as the CAN bus) were left unable to cope. The need to run a high-speed digital databus in such an electronically noisy environment as a car led to MOST being optical fibre (light)-based, although Toyota is using a copper-based (electronic) version. Industry observers have expressed concerns over the costs of doing this - which increase in line with data rate - but concede that there is some merit in this approach in that most OEMs and their suppliers 'know' copper; there is also a limit to the number of inline connectors that can be spliced into fibre (for passing through vehicle bulkheads) and it better reflects Toyota's modular approach to installation (the German OEMs tend to build, install and test a complete harness).

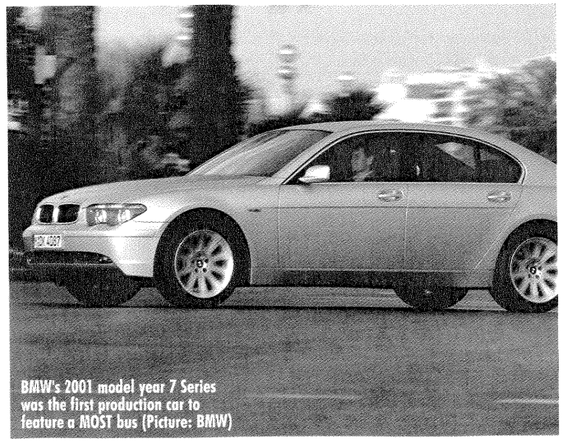
Use of MOST started in higher end vehicles from German carmakers. The first introduction was in the 2001-model BMW 7 Series. DaimlerChrysler followed shortly thereafter with the S-Class. MOST quickly spread to mid-level vehicles, with even some versions of the Smart sporting the technology. All of Ford's premium automotive lines (Volvo, Jaguar, Land Rover and Aston Martin) have implemented MOST. Other brands using MOST include Audi and Porsche, and Asian manufacturers will start to come online within the next two years.

Competing technologies

French manufacturer Renault has shown prototype vehicles that use IEEE1394 or Firewire, a consumer technology originally invented by Apple. This technology originally required electrical interconnection with shielded twisted pair wires. The shielding is very expensive for automakers to implement so an optical version has been developed. It is not yet clear when the first production vehicles will come to market and if anybody besides Renault and Nissan (its subsidiary) will pick up the technology.

'Pimp my ride'

MOST also reflects the German and Japanese manufacturers' desire to provide a fully provisioned multimedia solution up to whatever standard the buyer specifies. There is a significant advantage in doing so - mark-ups ensure a healthy profit margin - but in the US the situation is slightly different. There, the tendency is to buy a base-level car, take it to the nearest after-sales specialist and ask him to install a top-end multimedia package. It means that take-up of multimedia buses on the western side of the Atlantic has been much slower as a result.



BMW's 2001 model year 7 Series was the first production car to feature a MOST bus (Picture: BMW)

The consumer imperative

The next challenge is for the OEMs to factor in the much faster evolution of consumer electronic products - a development which sees them being completely driven by a market that doesn't belong to them. Providing secure gateways to the vehicle bus for iPods, Bluetooth phones and the like is the next 'enabler'. Bluetooth gateways already exist and other gateways (such as for iPods) are already in development and we can expect to see these in next-generation high-end cars a few years from now. To that effect, the MOST Cooperation has been working closely with the Consumer Electronics Association (CEA) to standardise the use of MOST for aftermarket applications. The CEA R6 Mobile Electronics committee, which is an ANSI-approved standards organisation, has already published the CEA 2012A MOST Network Application and is currently working to standardise connectors and serial protocols for various media players that can be brought into the car.

MOST is a key enabler of robust vehicle systems that decouple long vehicle development timeframes from the quick-paced consumer world. Carmakers can concentrate on enabling the distribution of audio and video over a reliable and thoroughly tested backbone while quickly building interface boxes to the emerging consumer technologies - technology that can change several times in the course of a single vehicle design cycle. It also enables the data from systems such as CALM to be distributed to the occupants of the vehicle using standard interfaces across vehicles from many different manufacturers ■

www.mostcooperation.com

www.firecomms.com

www.ce.org