

transport telematics

New standard for ITS provides tailored network management

Paul van Koningsbruggen and Peter van der Perre introduce GST (Global System for Telematics), a new standard for an open telematics platform.

Traffic is a stream of people; individuals with their own thoughts and motives, who during a journey from their origin to their destination react to and anticipate upon each other and the changing circumstances. 'Guiding' individuals in this stream with the intention of influencing their choices to optimally use the traffic network is a difficult task. However, standardised telematics offers interesting opportunities for continuous communication between the traffic centre and the road user.

Telematics, the combined approach of telecommunications and informatics, is by no means a new concept, but the promise that two-way communication between road systems and vehicles would improve traffic has not yet become a reality: a number of technological development phases are still needed. The stand-alone systems (car radio, satellite navigation systems, mobile telephones) from the 1990s have now become multifunctional systems. However, this involves closed systems that include the mobile communication channels, protocols, payment facilities, service management, user registration, and etcetera. These systems still need to be developed from start to finish. And the result? A jumble of 'point-to-point' solutions for various types of communication.

Global System for Telematics (GST) is a new standard for an open telematics platform. The most important goal for GST is in providing 'standardised openness', enabling traffic managers to communicate with every vehicle irrespective of its make and class, and vice versa. GST wants to realise this

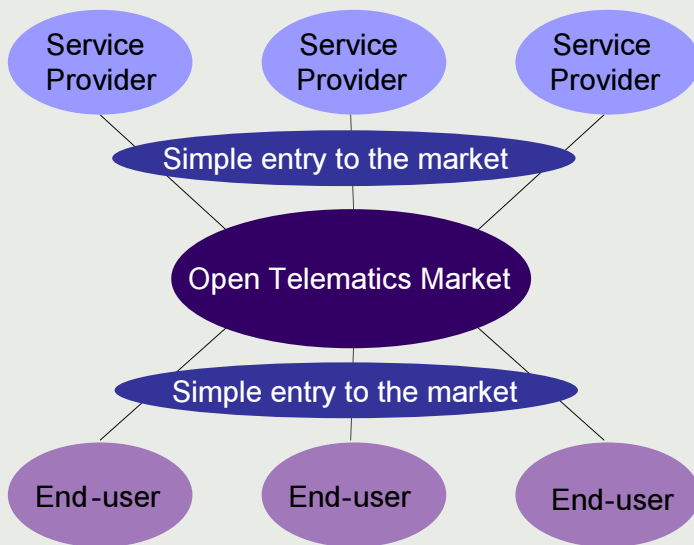
openness by decoupling, creating flexibility and harmonisation (later on standardisation).

Decoupling

GST attempts to decouple the user's hardware and operating system from the services being offered. It is not really important here whether the hardware is an integral part of the vehicle or is a component of a hand-held computer (PDA) or a smart mobile telephone (smart phone). Neither the available processing power nor the memory (ie the hardware capacity) is very restrictive. The trick is to cleverly distribute the functionality required to operationalise the service across the service centre (the home base for the service provider) and the end-users platform ('client system'). If the end-users use a client system with limited hardware capacity then the bulk of the functionality will be carried out by the service centre and the client system will have to communicate more frequently with the service centre. On the other hand, if the end-users use a client system with a large hardware capacity, a lot of functionality will run autonomously on the client system and communication with the service centre will be limited. It is therefore a matter of balance between hardware costs and communication costs. Services can be offered on virtually every platform, irrespective of the available hardware capacity.

This approach implies that an operational service requires a so-called 'back-end' service application at the service centre, in combination with a 'front-end' service application on

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GST creates openness in the market.

the client system. Different instances of the same applications allow us to serve a range of devices.

Flexibility

The required flexibility arises through the possibility of remotely downloading the front-end service application to the client system, and unpacking, installing and executing it there. The functionality required by the client system to make this possible is specified within GST. The end-user has the opportunity to select the services he requires, after which the associated front-end service applications are downloaded. A 'control centre' (home of the service aggregator) is installed between the service and client system in order to keep a check on the applications downloaded. After all, viruses, worms and Trojan horses are also applications and we would rather not see them downloaded onto our client systems. A 'service aggregator' (the organisation bundling and offering services to clients) is used to prevent such attacks and to guarantee the quality of service. This creates a trustworthy environment, in which flexibility in service provision and choice are assured.

The procedure is that an end-user logs in at the control centre. This control centre then checks the currently used client system and its actual location, installs the already selected services and issues the list of the other (for this specific client system and this location) available services. The end-user can select (additional) services from this list, which are then installed by the control centre,

An interface has been defined for communication between the client system and the vehicle sensors (through the so-called CAN bus; a system which enables multiple signals to be used from a single link) in order to complete the communications with the vehicles. This will enable a front-end service application to use the data originating from the vehicle sensors, such as the odometer, ABS, rain sensors, etc. The top half of this interface is standard, the bottom half (the physical connections to the CAN bus) is unfortunately still custom-made.

Harmonisation – as a first step towards standardisation

To enable these entities to communicate with each other irrespective of the make, type and year of manufacture, the interfaces between service centres and control centres and the client systems are being harmonised. Harmonisation such as this consists of protocol stacks, in which each protocol has its own objectives. For instance, one protocol allows the service

centre, control centre and/or client system to locate each other, another allows the actual connection to be established, and another protocol enables the message exchange, and so on. This creates an open market where service providers can offer services to a whole range of vehicles and nomadic devices (generically speaking: client systems), and where drivers can choose from a range of service providers – see the adjacent figure.

Use for network management

The combination of decoupling, creating flexibility and harmonisation results in an open telematics platform that offers important added value to network management. The GST openness ensures that we are able to communicate with individual road users and their vehicles. In the short term this allows services such as:

● **Enhanced Floating Car Data**

Selective requests from the vehicle for traffic data to supplement the data already available from inductive loops, video cameras, radar, mobile telephone network and/or online traffic flow models. This allows the traffic controller to achieve substantial cost savings on his communication costs. If the client system is connected to the CAN bus, the data from the vehicle sensors may be used, for instance, to determine whether the vehicle is running into a traffic jam, or is stuck in or just leaving a traffic jam, whether it is raining, whether the road surface is wet, etc. If this connection does not exist, but there is, for instance, a GPS connection then the actual speed of travel can be calculated and relayed.

● **Reporting incidents or breakdowns en route**

The quicker it can be established that an accident or incident has occurred, and above all where this has occurred (down to the level of the individual traffic lane), the quicker casualties can be helped and the quicker the road can be cleared again. If the client system is connected to the CAN bus, a critical data set from the shock sensors can be transmitted to provide an idea of the seriousness of the accident.

● **Enhanced driver awareness**

Information currently transferred via Variable Message Signs (VMSs) (both dynamic information and signalisation), can be transferred directly to individual passing or approaching vehicles. Drivers are then individually informed tailored to the route they are following and along this route warned for traffic jams and other non-regular states of traffic and advised to re-route once needed to safeguard their estimated or required time of arrival.

In the Netherlands this principle has been demonstrated by a consortium managed by Technolution in the 'Road Wise' (Dutch: Wijzer op Weg) Pilot from Rijkswaterstaat (director-general within the Dutch Ministry of Transport, Public Works and Water Management).

● **Optimising the traffic performance on the road network as a whole.**

By adding the vehicle-to-vehicle communication standard (or a related standard) to the road side equipment (RSE) direct on-the-spot intervention between road segments and vehicles can be enabled. By doing this we step into the world of the co-operative vehicle – infrastructure systems (CVIS). Here GST will be used for remote management of the road side equipment.

Not all of these traffic management measures are immediately understandable to the individual road user. Similar to route navigation, explanatory information can be provided for some of the traffic management measures.

By the time vehicle-to-vehicle communication becomes available, vehicles will be able to mutually adjust to each other and issue warnings about unexpected incidents (such as emergency braking) and conditions (such as a local, slippery road surface) to their surroundings.

Parties needed to operationalise GST

As is apparent from what has been described so far, GST requires five roles in order to provide an actual operational service provision. We only need to describe the role of the manufacturer client system briefly: he has to provide a GST-compliant platform. There are no foreseeable technological barriers here given that a GST client system can be composed from existing, proven technologies.

The remaining roles are:

- Service developer
- Service provider
- Service aggregator
- End-user (the driver)

In order to define a role it has to be clear what is expected from the role: A service developer establishes a service via a back-end and front-end application, suitable for a range of devices (client systems). Both applications must be able to communicate and continue to communicate with each other both remotely and wirelessly. Communication occurs through the GST-standard protocols. A service developer creates a front-end application in 'bundles' that have to be downloaded to the client system. The GST middleware layer on the client system ensures that the bundles are unpacked, installed, are mutually referenced and executed. The manner in which the front-end application is configured depends on the definition of middleware layer technology. Within the GST-project the Java Virtual Machine and OSGi (Open Services Gateway Initiative) platform have been chosen for the definition of the middleware layer. This takes care of the entire lifecycle of the service (application). In practice, the virtual machine and the service lifecycle platform may also be implemented by means of other technologies.

The service provider markets to the public and operates the service free of charge or on commercial basis. Because GST allows freedom of choice for the hardware and operating system platforms to be used, as well as for the virtual machine and service lifecycle layer, a service provider will have to provide each service in various 'shapes and sizes'

(instantiations), suitable for various devices (hardware and operating system platforms). Segmenting a service application in software bundles can help with this. A service provider can only offer his service through a service aggregator: the party who bundles the services and offers them to end-users. This means that a service provider will have to establish a relationship based on trust with this service aggregator, who basically is entitled to certify both the services offered and the service provider involved. Assuming a situation in which multiple service aggregators will arise, a service provider will have to establish a relationship of trust with all of the relevant service aggregators. This may also mean that a service provider will sometimes have to adapt the services offered to the 'brand' that the service aggregator wants to market.

End-users register with the service aggregator and provide information about which client system they are currently using. The service aggregator then offers each end-user an overview of the services that are currently available for that location and with that client system. Once an end-user has selected a service, the service aggregator downloads the appropriate front-end service application(s), records use of service(s) and initiates payment(s). The control centre thus allows the service aggregator to offer a trustworthy and safe environment ('circle of trust') for providing, selecting and using services.

Who will take the first step?

It is anticipated that the car manufacturers will act as service aggregators or will enter into partnerships with organisations that act on their behalf. It is certainly not unthinkable that an organisation from a completely different field will develop as a service aggregator, even more so since GST may be operationalised with mobile devices (PDA, Smartphone). This is certainly an interesting option in the short-term.

Technolution has developed for the sake of demonstration and clarification an 'enhanced driver awareness' service (see above) and a 'rewarding' service (rewarding a driver for their compliance to the actual traffic rules as opposite of punishing the driver for not being compliant). More information on these services can be found on www.technolution.eu

More information on the Global System for Telematics in general is available at the following web addresses: www.gst-project.org, www.gstforum.org, www.osgi.org

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THE ROAD USER AND GST

What would GST mean for the road user? A brief vignette from road user Marloes is provided below as a possible scenario.

Please note that services may extend to more than just traffic related services (in this case, radio, but it could include games for the rear seats). This will increase the appeal of the services and thereby increase the chance of a breakthrough in the market.

Marloes has just subscribed to a service aggregator. She has registered for services such as route navigation, radio and automatic parking payments. She gets in her car and enters the address of her service aggregator together with her unique user name and password into her client system.

Once she has logged in, the service aggregator ensures that service applications are downloaded and installed on the client system. Marloes is now able to use the road navigation system: this not only provides her with directions, but also informs her of traffic jams on her route and provides a quick diversion due

to an accident. In the meantime she listens to her favourite radio programme.

The service aggregator records Marloes' use of services (eg paid per download for the road navigation system and payment for the time she listens to the digital radio) and initiates the payment system at fixed intervals. Once she arrives at her destination Marloes logs out and the service provision stops.

During the afternoon Marloes goes out to lunch with a couple of colleagues. They use the company car and Marloes gets behind the wheel. She logs in to the new car and the aggregator verifies the current client system and downloads the appropriate applications for the services Marloes is subscribed to. Marloes can then be directed to the restaurant whilst her favourite music plays in the background.

Once she has parked Marloes selects a parking service. She leaves the car behind in the knowledge that the service will pay for the parking.