Global System For Telematics

Release

DEL 1.3 Final Report

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Abstract	The final report summarises the project activities and results over the full duration of the project. It includes a summary description of project objectives, contractors involved, worked performed and end results. It also briefly describes the methodologies and approaches employed, and relates the achievements of the project to the state-of-the-art. Finally, it explains the impact of the project on the industry and telematics research sector.
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Control sheet

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Chapter 1 - INTRODUCTION

1.1 Intended audience

This document is aimed at the European Commission, the Steering Committee, the Core Team, the Core Architecture Group and the General Assembly. It can also be published outside of the project.

1.2 Organisation

The document is structured as follows:

- Project Details
- Description of Project Objectives
- Methodology and Approach (Brief Description)
- Project Achievements & State-of-the-Art
- Impact on Industry and Research Sector
- Publishable Results (Overview Table)
- General Conclusions and Next Steps.

1.3 Typographic conventions

The following typographic conventions are used in this document:

A word starting with a capital letter	Indicates a specific term explained by the Terminology paragraph.
`Code Examples`	Code examples are printed in a courier font
`C:\Project\MyCode.c`	Filenames are represented in a courier italic font.
Locales	Words that have a specific meaning are printed in an italic bold font
[1]	Numbers in-between square brackets are references to publications mentioned in the literature list published on page

1.4 Objectives

The final report summarises the project activities and results over the full duration of the project. It includes a summary description of project objectives, contractors involved, worked performed and end results. It also briefly describes the methodologies and approaches employed, and relates the achievements of the project to the state-of-the-art. Finally, it explains the impact of the project on the industry and telematics research sector.

1.5 Terms and Abbreviations

CT	Core Team
DG INFSO	Directorate-General Information Society and Media
EC	European Commission
FP6	Framework Programme 6
GA	General Assembly
IP	Integrated Project
IPM	Integrated Project Management
IPWPM	Integrated Project Work Package Manager (eg IPWP2M)
IPWPMT	Integrated Project Work Package Managers Team
OCT	Online Collaboration Tool
QP	Quality Plan
SC	Steering Committee
SP	Sub-Project
TS	Test Site
WP	Work Package

Chapter 2 - PROJECT EXECUTION

2.1 Project Information

2.1.1 Project Data

- Contract Number: 507033
- Starting date: 01/03/2004
- Project Duration: 37 months (until 31/03/2007)
- Budget: 21 million Euros (11 million Euros in EC funding)
- Websites: www.gstproject.org, www.gstforum.org

2.1.2 Project Coordination

- Organisation: ERTICO
- Coordinator name: Peter Van der Perre
- Contact Details: p.vanderperre@mail.ertico, +32 2 400 07 36

2.1.3 Project Organisation

GST is an integrated project that essentially consists of 7 sub-projects and 7 test sites that work together towards a common purpose. Sub-projects exist to support a specific knowledge area and work towards a subset of the GST specification. Test sites exist to carry out an end-to-end implementation to test specifications.

GST Sub-Projects (SP)	GST Test Sites (TS)
Open Systems	Munich
Security	Aachen
Safety Channel	Gothenburg
Certification	Paris
Service Payment	Torino
Enhanced Floating Car Data (EFCD)	Stuttgart
Rescue	UK

The project has created a number of "special entities" to make it possible to reach a high level of integration between the sub-projects.

- The Core Architecture Group (CAG) has been established to advise on technical integration.
- The Steering Committee (SC) consists of representatives of all sectors, and has the overall responsibility for the project.
- The Core Team (CT) is responsible for the operational (day-to-day) management of the project. It consists of all SP managers and TS managers.

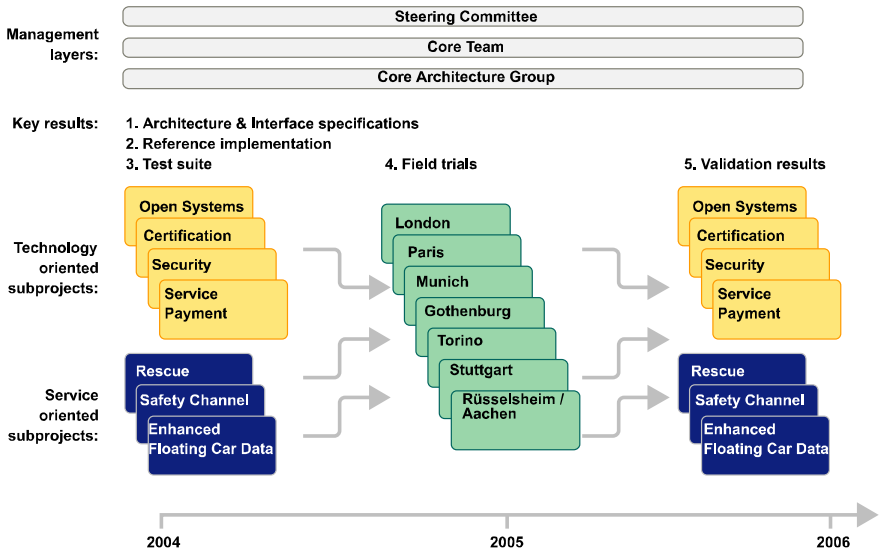

Figure A – Overview of the GST project

The project work has been divided into 7 work packages (WP). WPs exist to break down work to manageable structures, targeted to achieving specific results (deliverables), support a project phase and mobilise specific competences.

- WP 1 - Project management
- WP 2 - Use cases and system requirements
- WP 3 - Architecture and interface specifications
- WP 4 - Prototype development
- WP 5 - Field trials
- WP 6 - Validation
- WP 7 - Dissemination and exploitation.

2.1.4 Project Consortium

The following table lists the project partners in numerical order.

Partic. Role*	Participant number	Participant name	Participant short name
CO	1	EUROPEAN ROAD TRANSPORT TELEMATICS IMPLEMENTATION COORDINATION ORGANISATION SCRL	ERTICO
CR	4	Allianz Zentrum für Technik Gmbh	ALLIANZ
CR	6	ave Verkehrs- und Informationstechnik Gmbh	AVE
CR	7	BMW Forschung & Technik Gmbh	BMW
CR	8	Robert Bosch Gmbh	BOSCH
CR	9	DaimlerChrysler AG	DAIMLERCHRYSLER
CR	11	European Broadcasting Union	EBU
CR	12	Centro Ricerche Fiat Societa Consortile per Azioni	FIAT CRF
CR	13	Ford Forschungszentrum Aachen Gmbh	FORD
CR	14	France Telecom	FRANCE TELECOM
CR	16	Gewi Hard- und Softwareentwicklungsgesellschaft Gmbh	GEWI
CR	18	ISTITUTO SUPERIORE MARIO BOELLA	ISMB
CR	19	Kreis Offenbach. Eigenbetrieb Rettungsdienst	KREIS OFFENBACH
CR	20	Katholieke Universiteit Leuven	KU LEUVEN
CR	22	Mizar Automazione S.P.A.	MIZAR
CR	23	Motorola Electronics Spa	MOTOROLA Italy
CR	24	NAVTEQ B.V.	NAVTEQ
CR	26	Orange SA	ORANGE
CR	30	PTV Planung Transport Verkehr AG	PTV
CR	31	Q-Free	Q-FREE
CR	32	REGIENOV	RENAULT
CR	35	SES ASTRA	SES GLOBAL
CR	38	Swedish Road Association	SRA
CR	39	Sussex Police Authority	SUSSEX POLICE
CR	41	Telediffusion de France	TDF
CR	42	Technische Universität München	TUM
CR	43	Interconnect Communications LTD	TELCORDIA
CR	44	Telecom Italia Spa	TELECOM ITALIA
CR	45	Telematics Cluster VZW	TELEMATICS CLUSTER
CR	48	TNO Netherlands Organisation for Applied Scientific Research	TNO

CR	49	Trialog	TRIALOG
CR	50	Trusted Logic	TRUSTED LOGIC
CR	51	TÜV InterTraffic Gmbh	TUV
CR	52	Vialis Verkeer & Mobiliteit bv	VIALIS
CR	53	IT-forskningsinstitutet Viktoria AB	VIKTORIA INSTITUTE
CR	56	Volvo Technology AB	VOLVO
CR	58	WirelessCar Sweden AB	WIRELESS CAR
CR	59	RSA Security Ltd	RSA Security
CR	60	Tele Atlas NV	Tele Atlas
CR	66	Aircraft Development &Systems Engineering (ADSE) B.V.	ADSE
CR	67	Appello Systems AB	APPELLO
CR	68	Petards Ltd	Petards
CR	69	Prosyst Software GmbH	PROSYST
CR	70	Gatespace Telematics AB	Gatespace Telematics
CR	71	Advanced Technologies for Wireless	AT4Wireless
CR	72	OPEN MOBILE CERT – OMC - jTest	jTest
CR	73	B2i Ingenierie Informatique	B2i
CR	74	T-Systems Enterprise Services GmbH	T-Systems
CR	75	7Layers AG	7Layers
CR	76	Universidad de Málaga	UMA

Table 1 – Partner List

2.2 Project Objectives

2.2.1 High-level Objectives

GST seeks to achieve the following high-level objectives:

- Creation of a horizontal market for on-line services based on open standards.

  The purpose of GST is to create an environment in which innovative telematics services can be developed and delivered cost-effectively, and hence to increase the range of economic telematics services available to manufacturers and consumers. The focus of GST is on developing "open systems"; the openness relates to the ability of the architecture to support common mechanisms for the removal, updating and installation of new services and applications. Standards are necessary for the key interfaces allowing to hide the complexity and heterogeneousness of the supporting technologies.

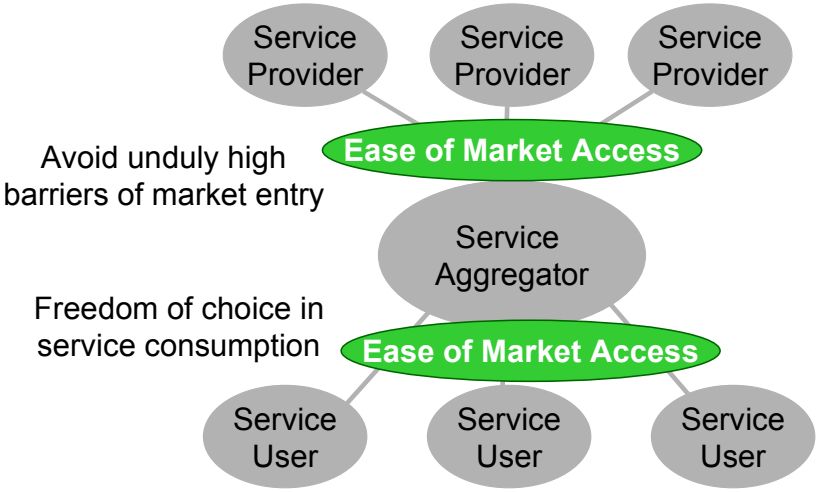

Figure B – Aspects of an Open Telematics Market

- Help this market to reach critical mass by enabling the deployment of safety services reducing the number of fatal accidents.

Empowered with an open telematics architecture, a user may begin his service load with a low-cost set of relatively few services, and dynamically upgrade the services during the system life cycle for a rich complement of up-to-date services, all with the original hardware platform. This architecture considerably expands market opportunity to new service provider entrants who seek access to the vehicle space with their telematics offerings. Furthermore, service providers have the opportunity for continuing upgrades of their services throughout the lifecycle by an efficient "over-the-air" version management process, a major cost reduction advantage for managing changes over the life of a service. The capability of open-system telematics architectures provides the end user uncompromised access to many sources of content and service function. Continuously upgradeable functionality at the vehicle shows great promise of achieving the features and flexibility desired by many parties involved in the telematics value chain, including 3rd party service providers, OEMs and others.

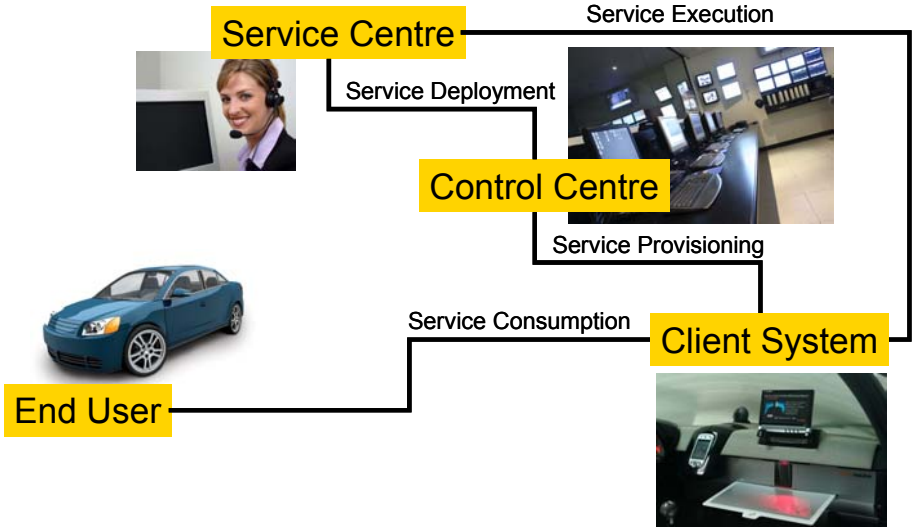

Figure C – Technical View

2.2.2 Sub-Project Objectives

GST is organised in a number of sub-projects, 4 of which are technology-oriented and 3 of which are service-oriented. The objectives of these sub-projects are summarised below:

- The **Open Systems sub-project** (OS) seeks to develop the overall GST architecture for end-to-end telematics, assigning development work for sub-systems to sub-projects where relevant.
- To deploy 3rd generation telematics more rapidly, the industry needs efficient mechanisms to certify that products and services comply to the agreed open standards and meet automotive requirements. The **Certification sub-project** (CERTECS) prioritises the certification requirements of the telematics industry, develops the organisational architecture for the certification of telematics components in Europe and produces first certification tools that are used for testing purposes within the project.
- Telematics can only be commercially successful when services can be priced related to the perceived value to the customer, and billed and paid accordingly. Therefore, payment and billing systems and the cost related to their operation are key to the success of telematics deployments. As cost levels are linked to the level of standardisation, the **Service Payment sub-project** (S_PAY) develops a transparent payment architecture as part of the overall GST architecture, facilitating the co-operation between the participants of the telematics value chain.
- Establishing a commonly understood and sufficiently high-level of security and trust is a conditio sine qua non for telematics in general and for the open systems that GST seeks to establish in particular. The objective of the **Security sub-project** (SEC) is to design and agree an overall security and trust architecture for European telematics relying as much as possible on existing standards but defining add-on security specifications where necessary.
- Telematics allows to develop a totally-integrated incident response chain, which ensures the fastest and most effective response to an incident. This includes the availability of incident data at all levels in the emergency chain, the provision of a fast and safe route to the incident, support for the interaction between emergency vehicles and other road users, and the exchange of information between rescue units and control rooms for e.g. medical intervention. The objective of the **Rescue sub-project** (RSQ) is to prepare the standardisation proposals necessary to put this chain in place across Europe.
- The use of the car itself as a floating traffic sensor where vehicles monitor and report the road network status situation in their vicinity is necessary as a complement to traditional infrastructure-based approaches such as traffic cameras, inductive sensors and satellite surveillance system that are typically only provided on places with structural problems. The objective of the **Enhanced Floating Car Data sub-project** (EFCD) is to greatly reduce the equipment and communication costs through standardisation efforts as this is a pre-condition to realise the high density of floating sensors necessary to achieve the desired monitoring coverage and accuracy on all roads.
- The **Safety Channel sub-project** (SAFCHAN) aims to develop and validate cost-effective broadcast mechanisms to communicate safety-relevant information to drivers. Examples are dynamic traffic information, incident warning, dynamic speed limits or recommendations as well as road and weather condition information. In combination with the EFCD project, the Safety Channel sub-project helps to establish near-perfect and real-time road network status information on the entire road network.

2.3 Methodology and Approach

From the outside the project development methodology looks like a typical waterfall process type. GST applied the Converge V model. The project started with the identification of the user needs/use cases and requirements. from these user needs/use cases and requirements a basic architecture was derived. After this, the architecture was validated by means of a reference implementation and a test suite. The reference implementations served as an input to the test sites who developed their service prototypes and real-live scenarios. Finally the results of the test sites were validated against the original assertions made for this project. This is a typical V shape waterfall type of model where the results from phase n flow into phase n+1. A typical top down approach which starts from an abstract view on the final results and along the way drill down to the practical implementation being the frameworks and service applications running on top of this framework.

GST extended this waterfall methodology by adding a bottom-up approach to the development process. During the Use Cases/Requirements phase, a first high-level entity relationship model already indicated the major interfaces between the different actors or entities constituting a GST platform. A second iteration added an implementation phase to the architecture work package. This implementation exercise, referred to as the reference implementation, allowed to verify the correctness of the architecture even during the architecture work phase. Especially this last activity has some implications towards the consolidation of the results.

As a result, the overall architecture is documented in three views, that are also shown in Figure D:

- The Enterprise View
- The Logical View
- And the Implementation View

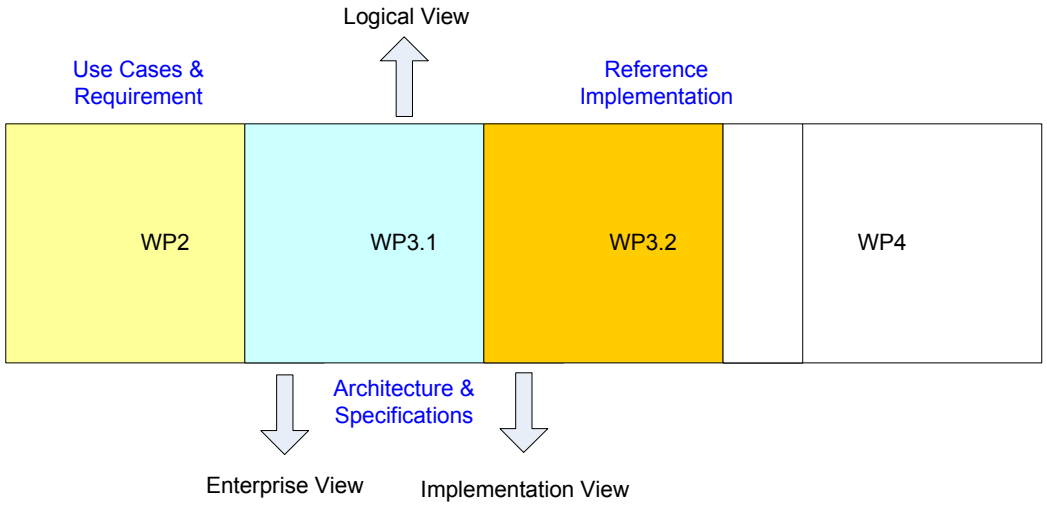

Figure D - Viewpoint relations

The enterprise view, the first viewpoint in the architecture description, links the results of the work on user needs/use cases and requirements to the architectural description developed by the logical view. From the use cases and requirements the enterprise view extracts a system diagram which specifies, at a high level, the different entities that are important for the sub-project as well as their relations. The requirements are translated in functionality which is later grouped in so called work items. These work items simply serve to organize the logical view in consistent and related architecture elements. The implementation view takes the results of the logical view and translates the results into physical components and the deployment of these physical components on the reference software platform.

In general the implementation view prepares the development of the reference implementation and finally helps the test sites in constructing their prototypes.

2.4 Project Results

Figure E shows a high-level overview of the functionality covered by the project.

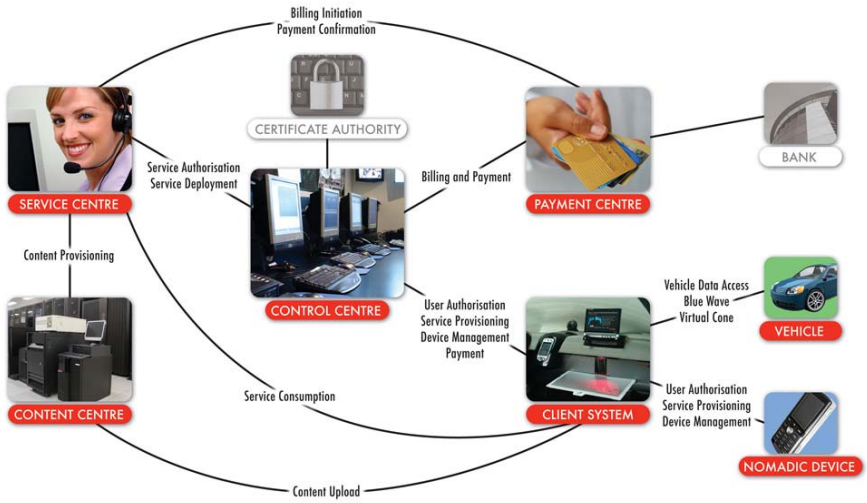

Figure E – Overview of Functionality

2.4.1 High-level Results

The core result of GST are the architecture and specifications that result from the sub-project activities, and that have been validated by sub-projects and test sites. These specifications are the enablers of interoperability and they are the basis of standardisation proposals.

	Result	Short description
1	Final architecture and interface specifications (DEL_GST_3_2)	Overall architecture, specifications for interfaces between control centres and services resp. control centres and terminals a.o.
2	*User needs and system requirements*	
3	*Prototypes of control centres*	*GST-compliant control centres*
4	*Prototypes of services*	*GST-compliant services*
5	*Prototype of in-vehicle terminals*	*GST-compliant in-vehicle terminals*
6	*Validation results*	*Results of the filed trials – basis for finalising the final architecure and specifications*

Table 2 - Overview of Results

2.4.2 Sub-Project Results

	Result	Short description
OPEN SYSTEMS		

1a	Deployment and Provisioning	A prototype Control Centre which allows Service Providers to deploy and provision their Service Applications to the consumer.
1b	Application Runtime Environment	A set of Services, which assist a Service Application developer to implement a Service Application in the most cost effective way.
1c	Protocol Definition	Some of the most important protocols to be used are SyncML OMA DM, SOAP and light-weight Web Services, and SAML
1d	Nomadic Device Integration	Proof of concept for a nomadic device gateway with main features Authentication and Authorization of a Nomadic Device on an in-vehicle embedded system, and discovery and use of basic services (e.g. eCall).
1e	Vehicle Interface	This vehicle interface allows Service Applications to access data obtained from the vehicle sensors.
1f	Message Encoding	This work item proposes some standardized elements on the application protocol level.
	CERTIFICATION	
1a	The Business Model	The Business Model takes into account all the investments and operational costs which are necessary to start the certification business and to operate it.
1b	The organisational model	The organisational model is consistent with the European Commission Certification Global Approach (part of the new approach).
1c	The technical system model	The technical model is composed of the Certification Information System (CIS), the test system and inspection methodologies.
1d	The technical mock-ups	These consist of the Certification Information System (CIS), the Protocols Conformance Tester and the security test and inspection tester.
1e	The Automobile Telematics Certification Reference Framework	This is a guide to the certification process of components, systems and services, the product / service conformance statements contained in the SLA (Service Level Agreement) of the considered services (e-Call, EFCD, Road Hazard Warning) and the product / service technical descriptions contained in SLS (System Level Specification).
	SERVICE PAYMENT	
1a	The Trustable Running Environment	The core of in-car sensitive operations, providing a trustable running environment to host, run and protect sensitive functions and data in a small, security-oriented area, including means to load /

		unload sensitive portions of code
1b	Billing Agent	An application that collects service-driven billing information from the telematics services running on the GST Service Platform and reports it to the GST Billing Centre.
1c	Billing Centre	A scalable enterprise application providing billing functionality to the GST Service Payment.
1d	GST payment agent for micro-payment and macro-payment	This payment agent intends to provide a generic, scalable interface to perform payment transactions, supporting different payment methods.
	SECURITY	
1a	Final architecture and interface specifications	Overall architecture, specifications for interfaces between control centres and services resp. control centres and terminals a.o.
1b	Initial SEC Framework architecture and interface specifications	SEC specific architecture Based on Trusted Components Based on Middleware Approach Support Trusted Domains
1c	Reference Implementation	Reference Implementation Client System Middleware Based on OSGi, with a trusted component Control Centre/Service Centre Middleware
1d	Validation Results	Including trust value chain associated with a certificate authority hierarchy
	RESCUE	
1a	Vehicle eCall	It provides the capability to retrieve all data needed to be sent to the PSAP1 and to prepare the data message in the appropriate format.
1b	PSAP eCall	Received data is visualised at the PSAP Operator workstation showing the vehicle location on a map support.
1c	PSAP Rescue management	Provide the capability to transmit emergency data on board to the emergency vehicles.
1d	PSAP to vehicle communication	It provides the capability to detect and alert the Emergency Service Personnel of an incoming Data Message from the PSAP 2 and to establish automatically the voice link with the vehicle, and to manage the received Emergency Data Message.
1e	ESV rescue management	It provides the capability to display on board the emergency data related to the incident.

1f	ESV driver support	It calculates the best trip to reach the incident point.
1g	Vehicle to vehicle communication	It provides the capability to prepare warning data message for Blue Wave and Virtual Cones functionalities.
1h	PV driver support	It provides the capability to receive, and handle a warning message from an Emergency Service Vehicle.
1i	Vehicle to Centre Communication	It provides the capability to prepare data message using the selected transmission protocol and to "enlarge" information to be sent.
	EFCD	
1a	EFCD Activation	EFCD service bundling for data provider's benefits and possibility to pause and restart of the application by the end-user.
1b	EFCD in-vehicle framework	Open framework for the implementation of algorithms with all required interfaces to in-vehicle technologies for data processing and messaging.
1c	EFCD service centre	Interfaces to content centres for detection orders and content distribution, interfaces to clients for detection control and message reception, message interpretation and strategy management.
	SAFETY CHANNEL	
1a	Channel Provision	Provision of an on-the-air channel allowing the SC-enabled terminals to receive the SC messages. Investigates available transmission protocols and how they map on the SC requirements.
1b	Content Provision	Provision of a standardised data communication channel allowing SC service providers to receive contents from content providers extending on available protocols
1c	Location Referencing	Analyses the available location referencing methods and comes to a recommendation for best candidate for SC needs
1d	Service Provision	Similar to Channel Provision, but dealing with the interface between the Service Provider and the Play-out centre. (internet connection)
1e	SC Definition	Provides a non-ambiguous definition of the different priority messages included in the SC
1f	User Interaction	Defines the policy of presenting Safety Channel messages to the user
1g	Object Management	Management of the SC messages (e.g. validity, life-

		cycle)
1h	Client Data Interface	Provides bearer independency to the client system.

Combined, these results make it possible for service providers, control centre providers and manufacturers of client systems – as well as for the other stakeholders involved in the telematics ecosystem – to develop, provide and manage services in service centres, control centres and on client systems in an interoperable way. This has been demonstrated in the project by the test activities within the seven sub-projects and at the seven test sites, as well as by the project's service submission contest, in which external companies successfully used the GST toolchain to develop and provide services running on GST-compliant infrastructure.

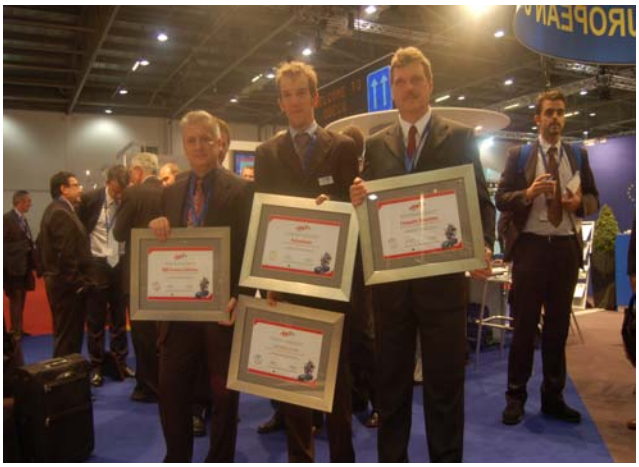

Figure F – Service Submission Contest

2.5 Project Achievements & State-of-the-Art

These results can be categorized in more detail as follows. Starting from the top, the definition of the design pattern by the enterprise view, the architecture becomes more and more concrete and finally exists as a concrete implementation on a specific platform. The pyramid diagram provided by Figure G shows this categorization.

The different levels in this picture are defined as follows:

Level 1 – A high level abstraction of the results, in this document referred to as the design pattern[1]. In general this level corresponds with the results documented by the Enterprise view and mainly is a collection of the entities and functionality which constitute the design pattern. As concrete examples: For Open Systems the top level of the pyramid contains deployment and provisioning as part of GST. For Security this will be the Circle of Trust concept while for Safety Channel this includes the end-to-end value chain for transmitting high priority messages.

Level 2 – The concrete protocols and standards that allow the different parts of the system, also referred to as entities, to interact with each other. This level is one of the most important levels in the context of sustainable results. This level contains the protocols and standards that are applied by the project from other standardization bodies or projects, those standards extended by GST and those specifications which are new and not (yet) part of main stream industry standards. Level 2 mainly corresponds with the logical view. Not only does it document the used protocols, standards and their extensions but this chapter also explains how to use these artefacts. In other words, how they are combined to fulfil the requirements.

Level 3 – This level represents the interface definitions and dynamic (behavioural) interaction between the different entities. The interface definitions are defined in a rather abstract format, not tied to the actual software platform. A good example of such an abstraction is provided by the Open Systems vehicle interface but can also be found in the definition of the Safety Channel Message Data Interface. The dynamic interaction between entities is specified by means of UML[2] activity, sequence and life cycle (state) diagrams. Together with the protocol and standards captured by Level 2 this level will also contain part of the GST sustainable results.

Level 4 – Corresponds with the implementation view and is also reflected by the Reference Implementation. In general the information found on this level is linked to the Java/OSGi reference implementation platform and as such does not offer a "generic" set of specifications. However, some of the results in this level might be of interest to the OSGi organization itself and might complete the OSGi framework with the GST Design Pattern.

Note that most of the sub-project results presented in the previous chapter are situated at level 4.

[1] The term design pattern can be replaced by concept or high-level archtecture
[2] GST uses UML 2.0 diagrams to visualize the architecture

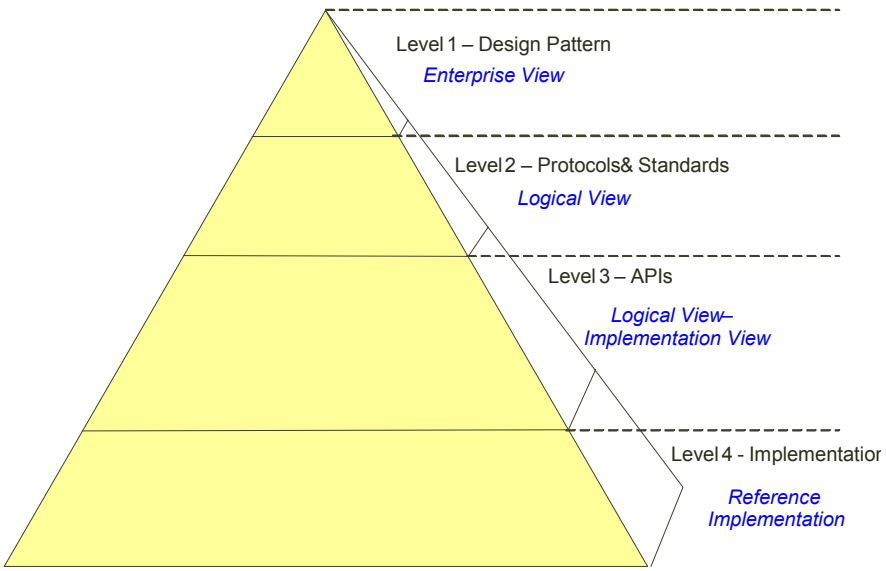

Figure G - Characterisation of GST results

A more comprehensive overview of results according to these 4 levels is included in Appendix A.

The contribution of GST to the state-of-the-art can be seen as follows:

Clear definition of a high level enterprise view – A high level enterprise view offers a comprehensive description of the GST System. The enterprise view serves as the entry point for the architecture and specification document. This chapter captures the results obtained during the Use Cases and Requirements work phase into a high level system architecture. This makes it easy to determine the high level durable results of GST.

Use of industry proven protocols and technology - From the beginning it was very clear that GST would not start with a blank paper but rather look into the results of its predecessor project, 3GT and the technology available on the market today. This results into an architecture which is built on existing, industry endorsed specifications. Some example specifications used are:

- Protocols such as the Open Mobile Alliance, Device Management protocol, SOAP, HTTP, IPv6, SAML and XAML, TPEG-TEC etc.
- Dynamic functionality models such as the provisioning life cycle model, the connection manager workflow etc.
- Deployment description based on XML

The rationale for using these protocols is document by the logical view. In many cases these protocols are extended and fitted towards the GST requirements.

Definition of APIs at an abstract level – the specifications of the sub-projects typically define interfaces at a high level of abstraction.

Availability of a certification process – Certification, from the start of GST, has been part of the project development. The CERTECS sub-project investigated a procedure for certifying those parts of GST which are a candidate for standardization.

Example implementations of the previous concepts – A reference implementation allowed GST to verify and validate the architecture developed by the sub-projects.

2.6 Impact on Industry and Research Sector

2.6.1 Competitiveness

Open telematics systems, enabled by telematics platforms compliant with open standards for software management, have been demonstrated by GST as providing superior solutions to the delivery of telematics. They also allow very significant cost reductions (as common functions can be centralised) as well as much more rapid deployment of new services. In addition to providing rich offerings of services to the user, open systems also create numerous opportunities for service providers seeking access to users, and provides further benefit to parties in the value chain.

With all the technological and business benefits offered by open systems in the telematics market, several obstacles to mass adoption remained.

- The perception remains that the middle layer function of service aggregator must become very dominant in order to define and drive compliance of all the interface standards needed for effective services and terminals. Clearly, the role of a service aggregator is desirable as a legal and business entity facilitating one-stop shopping and simplifying administrative procedures for the telematics customer. GST complemented it by open protocol specifications and system definitions that serve as the foundation corner stones to implement the respective infrastructure.
- The entry of a significant number of competitors in this market, each motivating somewhat different methods and interfaces, would seriously undermine the convergence toward standards which is critical to service providers and terminal developers. In order to cope with this "law of jungle" mindset, GST created some industry-wide interface standards at the different layers to which all providers and developers must adhere. At the same time, GST promoted further competition at the middle layer, but with complete confidence in interoperability. There is strong assurance of multiple sources for this essential function, and little chance for monopoly.

Competition for a place in the interoperable telematics market will spur developments at all levels in the value chain, motivating growth in the market. Service providers and terminal manufacturers will be sensitive to position their products as "GST-compliant", and will realise the significant benefit of being able to operate on many compliant platforms but having to develop their solutions only once.

Consumers of services will realise the opportunity for rich choices in their potential service offerings, at far less cost than previously imagined. Commercial fleet operators, with properly equipped and compliant smart terminals, will see new service offerings aimed at significant productivity improvements to improve efficiency and lower cost of operations. Finally, vehicle OEMs will realise the benefit of multiple sources for the critical middle layer, protecting their investments in all areas of developments.

In the GST era, the automotive telematics industry will see the growth of value-based service opportunities with solid business case support, and the confidence of multiple sourcing at all layers protecting its investment.

GST therefore puts the European telematics industry in a good position to address the growth market of on-line services.

2.6.2 Societal impact

Many sectors have an interest in providing a wide range of on-line services to the vehicle. All services have a strong impact on the well-being of European citizens in terms of safety, efficiency and comfort.

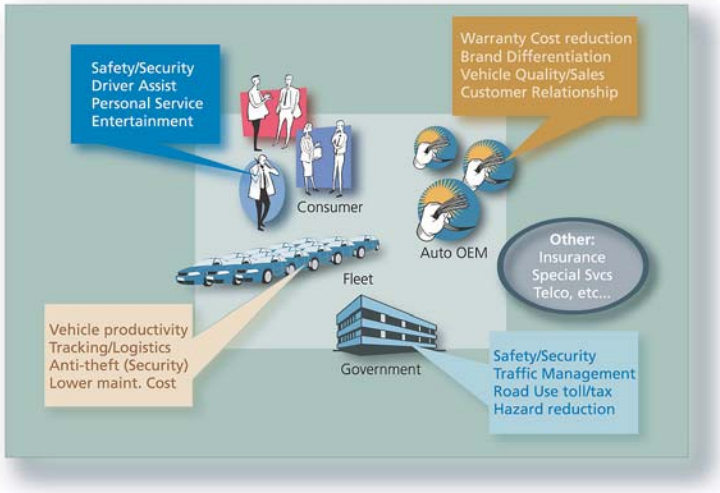

Figure H – Sectors and service domains

Since the early days of telematics which focused largely on safety and security functions, the interest of government/ public sector agencies has steadily increased. Early visionaries saw opportunities through telematics to positively influence automotive trends in various ways, to the benefit of society as a whole. Some of these trends include:

- The reduction of traffic fatalities via emergency assistance services
- Breakdown assistance with rapid response, on-road repair
- Reduction in accident frequency through active (in-vehicle) speed/road advisories
- Use of moving vehicles as "floating car data" probes for traffic monitoring and real-time traffic management
- In-vehicle "real time" driver education and error correction
- Electronic toll-collection systems with improved efficiency
- Road taxation systems based on on-board telematics intelligence
- Monitoring and route tracking of hazardous vehicles
- …

In addition to government, various other business interests have been seeking access to the motoring public to derive further benefit. These interests include insurance companies, car-sharing companies, parking facility managers, and a host of others. In seeking to implement their visions in isolation based on solutions from the prior generations, each faced the same uphill challenges of technical vehicle access and cost-effective solution development. Under these circumstances, only modest progress has been achieved to date.

In the GST deployment era, the adoption of standards for telematics, combined with the emergence of "smart-client" terminals, provides rich opportunity to serve the potential needs of many such entities. Given the capability within the terminals and access rights to consumer vehicles, the desired function can be achieved by simply downloading the proper service agent, and executing the service.

2.6.3 Equipment & Technology Innovation

The GST architecture enables the business of downloadable services into vehicles and efficiently manage the virtual organisation, composed by content & service providers, service aggregators and consumers. Automakers worldwide and other sectors that want to interact with the vehicle and its occupants foresee great value in providing services to their customers while they are in their vehicles. The GST architecture is a protocol-neutral framework, that makes specific communication protocols invisible for the users of the system, but internally makes use of existing communication protocols available (e.g. UMTS or GPRS protocol stack, DAB protocol stack, DSRC protocol stack ...).

2.6.4 Organisational Innovation

The GST architecture includes three tiers: the service & content provider, the provisioning platform with its control centre servers and the terminal layer. Among and within each of those tiers, GST identified the need for open interfaces and protocols and then specify, implement and validate those interface specifications.

The 3-tiered architecture advocated by GST abstracts all aspects of service delivery and administration into a new layer: that of control centre operator. More specifically, this control centre operator focuses on:

- Communication aspects: or establishing a physical connection to the vehicle or group of vehicles using the most appropriate communication bearers
- Administrative aspects: this involves database-centreed operations such as handling the registration procedures (platform registration, vehicle registration, subscription), management of user profiles and support for billing operations
- Value-added utilities: basically exploiting the pivotal position of the control centre, special utilities can be developed to handle logging information, accounting information, security and other issues.

This new model does not only allow that all key roles can be occupied by separate actors that focus on their respective areas of competence, but also opens the door to free competition and sector-wide revenue maximisation. As an example, a company that currently assumes the roles of network operator, control centre operator and service provider may be subject to pressures not to offer any competing services.

Future telematics will involve a very large number of functions, applications and services such as emergency and breakdown assistance, localisation-based services, Internet connectivity, on-board diagnostics, remote software upgrading, car park management, cargo tracking, dynamic navigation, improved insurance policy support, on-board traffic signs, dynamic traffic management, variable road tax and many others. A large number of service providers, many of which are not on the market today, therefore need to be offered an open access to a module within the vehicle and their customers/drivers.

2.6.5 Innovation in business opportunities

In this section, the advantages offered by GST for some of the key sectors are described.

For car manufacturers:

- Helps to solve the conflict between lifecycles of vehicles and telematics components, thereby making it more attractive to drivers to purchase in-vehicle terminals
- Allows users to easily subscribe to new services or "instant gratification" - and to only pay for services of their choice
- Minimises the need for users to provide administrative information or "zero local administration"
- Changes in pricing and bandwith availability of network carriers can be exploited by changing the "thickness" of the client
- Likely increase in the number of service providers to choose from, allowing to build more attractive service portfolios
- Facilitates the use of a common platform for the European and worldwide market through increased flexibility to customise to local markets
- Offers new opportunities for customer relationship management.

For control centre operators:

- Allows to create a new business with access to the mass market
- Possibility to reduce the high operational costs of control centres as substantial economies of scale can be realised by sharing infrastructure, for instance:
- Between different vehicle brands, either based on special agreements or between brands within the same group of car manufacturers
- Between all vehicle brands - the operations of the control centre could be completely outsourced to specialised companies that are implemented at locations optimised for service delivery across Europe - car manufacturers would focus on quality monitoring and assurance.

For middleware providers:

- Allows to create a new business with access to the mass market
- Reduction of development cost because of standardisation
- Create new streams of revenue because more clients can be served.
- For service providers (including "new" sectors that wish to provide on-line services such as fleet managers, insurance companies, public authorities …):
- Allows "pure" service providers to enter the market, focusing on innovative services
- Allows a quick deployment of services as a common infrastructure is defined
- Entry barriers are lowered thanks to the use of open specifications, allowing more companies to enter into the market
- Emergence of the concept of true automotive portal offering necessary security and safety mechanisms.

For telecom operators:

- Introduction of new data services increasing the use of the existing network infrastructure
- Allows to leverage existing investments and infrastructure (telco operators are well-suited to take on the role of control centre operators)
- Ensurance that telematics standards build on mainstream telecommunications standards.
- For terminal manufacturers:
- Reduction of development costs as the same platform can be used to support many different specifications
- Potential of higher market take-up
- Shorter times to market.

Chapter 3 - CONCLUSIONS AND NEXT STEPS

3.1.1 Market Characterisation

At the start of the project, actors on the telematics market have had a sense of disillusion, as the predicted market growth depicted in earlier years did not materialize. However, a turning point has been noted in the last years, for a more mature market where increased awareness together with the availability of attractive applications are raising the consumer demand. One of the driving applications are navigation systems which are steadily being more integrated both as embedded terminals and aftermarket solutions. From the sales figures for Western Europe presented in Figure I it can be seen that during 2003 over one million new cars with an embedded navigation system were sold, and in addition over 500,000 were sold as aftermarket solutions. More recent figures show that more than 2 million embedded systems were sold in 2006, with a healthy 12% growth rate foreseen in 2007. With about 16 million new cars sold in Europe every year it is a realistic belief that this growth figure is stable also in years to come. On the market of portable navigation devices (PNDs), 11 million systems were sold in 2006 with a growth of more than 50% foreseen in 2007. While portable navigation devices compete with embedded systems, they are typically an aftermarket product that help to accelerate the take-up of embedded systems in new cars as well. As a result, the sale of embedded navigation systems that was once associated with the high-end of the market is clearly becoming a medium market phenomenon.

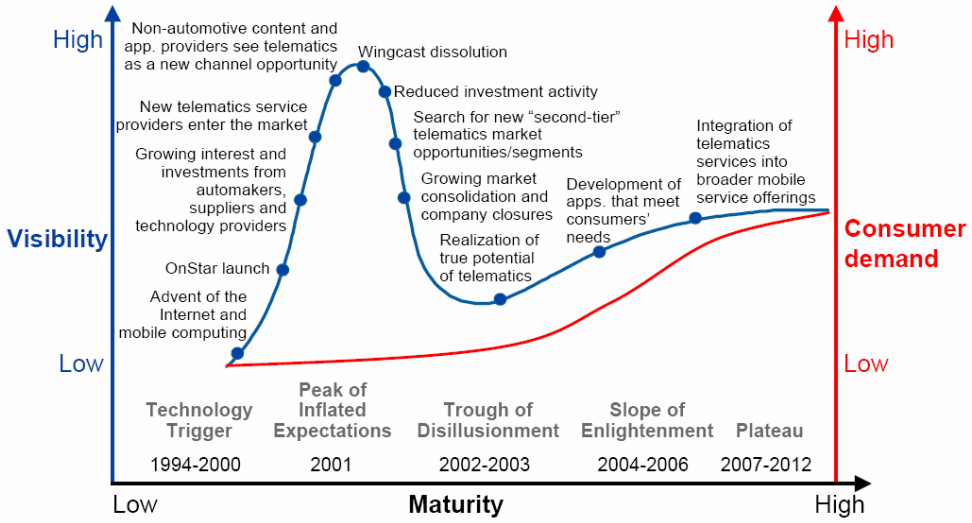

Figure I - Telematics market evolution

Applications for safety and security are also a potentially strong market where a growing customer awareness and willingness-to-pay have been noticed. This holds true also for public authorities, the support for e.g. in-vehicle eCall is firm and growing, and different measures can be expected that will stimulate a broad-scale implementation. Many of these are under discussion in the European Union's eSafety initiative (http://www.esafetysupport.org), that is driving and bundling the European ITS community efforts with the safety and security domain.

All in all, this upwards-going trend for individual telematics applications will benefit the telematics market as a whole. The in-vehicle units will evolve towards dynamic platforms that can serve several applications and this will reduce investment cost and the final price for the end-users.

The GST results will affect:

- Terminal makers
- Service providers
- Control centre operators
- Middleware providers
- Car makers – as the central actors that put the service delivery chain together and assume overall responsibility towards the customer

The GST consortium believes that its results will help to transform the market for on-line services from a closed market based on proprietary approaches to an open one based on public standards. As such, the potential market for the GST solution is huge as we believe that all vehicle manufacturers can at one point in the future decide to factory-install GST-compliant terminals in their vehicles.

3.2 Dissemination

The main dissemination activities of GST have been as follows:

- Created a GST Forum consisting of both project participants and non-project participants. Invited vehicle manufactures, service providers, automobile clubs, automobile associations, telecommunication operators, public authorities, governmental organisations, and others that could have an interest in the project and that could contribute to the findings.
- Organised user forum at key stages in the project to consolidate the user needs analysis phase and to validate and disseminate the final results of the project.
- Set-up a project web site, which documents project objectives, activities and results. Keep the web site up-to-date. Provided a specific area for project participants only as a consortium-internal document archive.
- Prepared a take-up brochure and CD-ROM at the end of the project to disseminate GST's final results and recommendations.
- Presented GST achievements regularly at national and international magazines, seminars and workshops.

Figure J Dissemination activities

- Demonstrated the final project results at the GST Final Validation Workshop (two days). The two-day event, attended by more than 160 experts representing all major stakeholders in Europe, focused on how GST's solutions can greatly facilitate the development, remote installation and updating of innovative services on a broad range of telematics platforms. It featured an extensive set of presentations and demonstrations of the GST achievements.

Figure K GST Final Validation Workshop

- Liaised actively with all relevant standardisation bodies and industry associations, such as: CEN, ETSI, ISO, Telematics Forum, AMI-C and MOST.
- Organised and attend meetings to liaise with related projects and initiatives.
- Created the necessary international co-operation.

3.3 Exploitation

3 key scenarios for exploitation are:

- The "OEM-driven" scenario: In this view the car manufacturer, is in charge of the client device that is controlled by the Vehicle Management System (VMS). It owns the customer data and authenticates the end user. The billing functionality and the federation manager, which enables single sign on, is delegated to a White Label operator (Operation Support System, OSS). A credit card company is responsible to handle service payment based on payment tokens, such as e.g. credit cards etc.

- The "Associated Aggregator-driven scenario": In this model the car manufacturer, e.g. Opel owns the customer data and offer additional, vehicle related services, which are downloaded via an external service aggregator, here OnStar (in the US). In the US, OnStar is the operator of the client system and offer an own set of services. OnStar gets a subset of the customer data from the car manufacturer to be able to authenticate and bill the customer. OnStar is also responsible e.g. for subscription, authentication, billing etc.
- The "Aftermarket-driven scenario": In this scenario, Client Systems are not embedded devices but are added later to the vehicle. From a technical perspective this does not change a lot but how the services are distributed to the end-user differs from the previous scenarios. In this case Service Aggregators such as e.g OnStar organize the "Services Market Place" while vendors such as e.g. Bosch and Siemens VDO provide the aftermarket products such as in-vehicle terminals etc.

3.4 Conclusions and Next Steps

After 3 years of work, GST can be successfully concluded as it has reached its objectives.

While the deployment of GST results is being taken forward by the consortium partners, several additional initiatives have also been taken in the last few months to further facilitate and accelerate deployment:

- Creation of additional deliverables:
  - System Design Definition (SDD)
  - Standardisation Report
- Creation of a new working group on "Service-oriented architectures" under the eSafety Forum
- Initiation of discussions within ERTICO to re-launch the Telematics Forum.

3.5 Two additional documents

The System Design Definition (SDD) is a high-quality document that describes the design and key functionality of the GST system. It is an ideal entry point to the extensive documentation of the project, and will as such facilitate also the take-up of GST results.

The Standardisation Report highlights on-going as well as additional, recommended standardization and take-up activities for GST. An external consultant, Mr Peter Kriens, has been contracted to write this report. He has extensive experience working with standardisation bodies as well as with industry initiatives such as OSGi (where he is one of three OSGi fellows) that are important users of the results of GST.

3.6 eSafety Forum: Creation of a Service-Oriented Architectures Working Group

The eSafety Forum is clearly the most important and visible initiative in Europe today to take eSafety solutions forward. Within the Forum, a "Service-Oriented Architectures (SOA)" Working Group has been proposed to and approved by the Steering Committee.

In the Terms of Reference of the group, Service-Oriented Architectures (SOA) were defined as architectures for installing, starting, stopping, updating and removing vehicle- and traveller-related services. A service is defined as a unit of work done by a service provider to achieve desired results for a service consumer, whereas vehicle-related services rely on in-vehicle functionality (examples of vehicle-related services are eCall, incident warning, floating car data, blue wave and virtual cone). As a rationale for the group, it is explained that common architectures and interface specifications help overcome market fragmentation and enable cooperation among specialised parties.

The objective of the working group is to use the extensive eSafety Forum community to describe the state-of-the-art – and in particular GST results - and identify what is missing to facilitate market introduction of the GST solutions. Key activities will be:

- Definition of SOA for vehicle-related and traveller-related services
- Description of state-of-the-art
- Provide market outlook
- Identify missing elements for deployment
- Identify steps to facilitate market introduction

After:

- a consultation of vehicle manufacturers (in cooperation with ACEA)
- a consultation of telco operators
- agreement of the scope of the working group
- the identification of an "industry chair" (Deutsche Telekom)
- and the development of a work plan

the working group is now ready to start working.

3.7 Telematics Forum

The Telematics Forum brings together leading service providers, control centre operators, middleware providers, terminal manufacturers and the automotive industry to work on the definition and market adoption of enabling standards for telematics service delivery.

The Forum has been very active up to the start of the GST project (in 2004), particularly to:

- Standardise and promote the adoption of automotive technologies for the telematics market.
- Develop the Global Telematics Protocol (GTP) for telematics service delivery, merging the two leading protocols – Application Communication Protocol (ACP) and Global Automotive Telematics Standard (GATS).

Forum members in 2004 included: Adam Opel, Alpine Electronics (Europe), Autoliv, BMW Group, Cofiroute, Dekra AG, Fiat Auto SpA, Ford Forschungszentrum Aachen, Mitsubishi Electric, Mizar Automazione, Motorola, Navteq - Europe, Nokia Mobile Phones, Panasonic Industrial Europe, PTV, Renault, Robert Bosch, Siemens VDO Automotive, TeleAtlas B.V., Thales Telematics, Toyota Motor Europe, Vodafone, Volvo.

More information can be found at:
http://www.ertico.com/en/activities/safety/telematics_forum.htm

ERTICO is now actively investigating how the Telematics Forum can be used for the maintenance and deployment support of the GST specifications and reference implementations. This seems the most appropriate way to keep the 200+ member companies of the GST Forum together, and initiate practical measures to support the introduction of GST solutions on the market.

These members include ao: 7 layers AG, AB Volvo Group, Accenture, ACEA, Adelard, ADSE, Airbiquity, Alcatel, Alcatel Space, Allianz Zentrum für Technik GmbH, ALLIANZ/Mondial Assistance, Altea S.A., ANWB, Appello, arsenal research, ASTIM Telematica B.V., Atena Engineering GmbH, Athens Information Technology, ATKINS Highways and Transportation, Audi, Auto Bild Spain Car magazine, Autoliv Electronics, Automotive Telematics, Autostrade S.p.A. // Infoblu S.p.A., B2i, Beacon Tech Ltd., BMW, BMW Forschung-und Technik GmbH, Bombardier Transportation UK Ltd Services, Booz - Allen - Hamilton (BAH), Bosch, BRISA, BT, BT Group Chief Technology Office, Capgemini Finland Oy, Centre for Research & Technology Hellas (CERTH)', Centro de Tecnología de las Comunicaciones, Centro Ricerche FIAT, Cofiroute, COMPUCON SA, Computer Associates, Coventry University, CTAG, Dai Telecom S.p.A., DaimlerChrysler, DBV-Winterthur, DEKRA, DELTA, DG Passenger Transport, Ministry of Transport, Public Works and Water Management, DigiUtopikA, Lda, D-Mun bvba, Draco Systems, DrikTech LLC, Dutch Ministry of Economic Affairs, EC, Ecole Polytechnique De Lausanne, EC-Tools Oy, Efkon, Embedded & Mobile Java, OSGi, ERTICO, ETSI, EUGIN, EURISCO, Fitsa, Ford, Forgis GmbH, France Telecom, Freesoft, Fundacion CESGA, Gatespace Telematics, Geomatika, Halmstad University (student), Harman/Becker Automotive Systems GmbH, Highways Agency, Hitachi Europe SAS, HiTec, HLSV, Honda R&D Europe GmbH, Hrdeu, Hyundai, Ian Catling Consultancy, IBM, IMA BENELUX, IncGEO, Infomobility.it S.p.A., Infotech – InfoMobile, ,Inria/Imara, Institute of Communication Network (TUM), Intel GmbH,

Interuniversitair Micro-Electronica Centrum vzw (IMEC), InTraffic B.V., ISMB, ITS Finland, jTest, K.U. Leuven, Kapsch Trafficcom AG, KeyResearch, KLPD, KNV, LAAS-CNRS, LOGIBALL GmbH, LogicaCMG, Magnetti Marelli, Mapflow, Ministerie van Verkeer en Waterstaat Rijkswaterstaat, Ministry of the Flemish Community, Ministry of Transport and Communications Finland, Mizar Automazione SpA, MM-Lab, Monash University, Mondial Assistance Group, Motorola, Mott MacDonald, My Way, Navigon GmbHn Navteq, Neo-Trac AB, NetXcalibur Srl, Nomura Research Institute Ltd., omp computer gmbh, Opel, Open Business Innovation, Orange, Panasonic, Peek Traffic B.V., Petards Limited, PHOENIX ISI, Pioneer, Polimi, Prosyst Software GmbH, PTV, Q-Free, Receptec, Renault, Research Academic Computer Technology Institute, Robert Bosch GmbH, Robotica, RSA Security, SBD, School of Computing, University of Tasmania, Secured by Design (SBD), SENDA - Infostructure For Transport, SES Astra, Shadow Creek Consulting, Siemens,, Siemens VDO Automotive, Singular Software, Skysoft Portugal, SA, SMRS/ convergence network team, ETRI, Softlab, Sogaplast, Sona College of Technology, Steria, STOK International bv, Strategiestm, Sunit Oy, Sussex Police, Swedish Road Administration, Systems Engineering & Assessment Ltd, TATA Elxsi Limited, TDF, TEAM INTELLECT, Technische Universität Berlin, Technische Universität München, Technolution, TELCORDIA (InterConnect), Telcordia Technologies Inc., Tele Atlas, Telecom Italia, Telefónica Investigación y Desarrollo, Telematics Cluster, Telematics Software Architect, Telematics Valley, The AA, Thetis, Thomas Miller, TNO - Mobiliteit and Logistiek, Transics N.V, Trialog, Tritel, Trusted Logic, T-SYSTEMS, TUM, TUV, Ulyces, Universidad de Murcia, Universität Hohenheim, University of Applied Sciences Saarbrucken (HTW), University of Bremen, University of Malaga, University of Stirling, University of Thessaly,Via Donau, Vialis, ViaMichelin, Viktoria Institute, Visteon Deutschland GmbH, Vodafone Group R&D,Vodaphone, Volvo, VTT Industrial Systems, Waterford Institute of Technology, Wavecom, Webtechiwireless Europe Ltd, Wireless Cars, Wiseram Inc., WIT-Software, WSP LT-Konsultit Oy, WSP-Intelligent Transport Systems, Ygomi LLC, Zadic Innovations.

Appendix A - RESULTS

	Design pattern (Concepts)	Key protocols and standards	Interfaces	Reference Implementation (components)

	Design pattern (Concepts)	Key protocols and standards	Interfaces	Reference Implementation (components)

Open systems	• Service Aggregation
	  ○ Deployment
	  ○ Provisioning
	• Nomadic Device Integration
	• Positioning
	• Vehicle Data Interface
	• Mobile Communication Management
		• OMA DM with GST extensions
		• SOAP
		• Deployment Descriptor
			• Vehicle Interface
			• Positioning Interface
			• Connection Manager
			• Provisioning Client
				• Provisioning Client
				• Vehicle Interface
				• Connection Manager
				• Positioning Interface
				• Control Centre

Security	secure control centre interaction with client system	• SAML
		• XACML
		• SOAP
			• Secure communication engine
			• Security module
				• Secure Communication Engine (2 versions)
				• Security module
				  - smart card version
				  - software version
				  - S-Pay TRE version (based on the STIP industrial standard)

	Design pattern (Concepts)	Key protocols and standards	Interfaces	Reference Implementation (components)
Service payment	• Secure Billing and Payment	• HTTP/ HTTP-S • SOAP • Web Services • specific payment protocols, e.g. 3D-Secure standard, ePurse / NFC payment,...	• billing and pricing module	• Billing Agent • Billing Centre • Payment Agent • Payment Centre • TRE
Certification	Telematics Certification and validation best practices	• Protocol conformance testing • Geographical Data Quality Inspection	Not applicable	Certification Information System
EFCD	• In-Vehicle probe data detection and content centre interfacing • Remote algorithm management	SOAP XML	Basic EFCD detection algorithms In-Vehicle framework API	EFCD service centre – client system interface EFCD in-vehicle framework
Safety Channel	• Dynamic Location Referencing • Extensible Safety Channel Receiver	• TPEG-TEC • AGORA-C • DATEX 2	• Message Data Interface • TPEG-TEC Object model	• Message Data Interface • Safety Channel Demonstrator

	Design pattern (Concepts)	Key protocols and standards	Interfaces	Reference Implementation (components)
	• High Priority Message Provisioning			
Rescue	• The ASN.1 encoding/decoding of eCall components (MSD, ACK, EOS) of the transaction	Protocols: • USSD • SOAP • GML • TPEG	• eCall Activation, Emergency Data Handling (Vehicle & PSAPs) • VAD Transmission • Emergency Data Visualisation (HMI at PSAP and ESV)	• PV eCall Client, Location Data Handler (Route Guidance) • PV & ESV - Blue wave and Virtual cones Service

Appendix B - DELIVERABLES

Below is an overview of all deliverables during the GST project:

Reference	Title	Last update delivery date
DEL_GST_1_1	GST Quality handbook (incl. Maintenance)	15/06/2004
DEL_GST_1_2	GST Progress reports	Every quarter
DEL_GST_1_3	GST Final report	15/05/2007
DEL_GST_1_4	GST On-line collaboration tool	01/04/2004
DEL_GST_2_1	GST Operational Concept definition	06/11/2006
DEL_GST_2_2	GST Use cases and system requirements (incl. Maintenance)	04/11/2004
DEL_GST_3_1	GST High-level architecture (incl. Maintenance)	23/10/2006
DEL_GST_3_2	GST Framework architecture and interface specifications (incl. Maintenance)	18/10/2005
DEL_GST_6_1	GST Validation plan	17/07/2006
DEL_GST_6_2	GST Validation results	05/02/2007
DEL_GST_7_1	GST Communication plan	10/03/2005
DEL_GST_7_4	GST Dissemination and use plan	05/09/2005
DEL_GST_7_5	GST TIP	15/05/2007
DEL_OS_1_1	Quality Plan	10/03/2005
DEL_OS_1_2	Quarterly reports	Every quarter
DEL_OS_1_3	Final report	15/02/2007
DEL_OS_2_1	Use cases and system requirement	14/01/2005
DEL_OS_3_1	Architecture and Interface Specifications	22/09/2006
DEL_OS_3_2	Reference Implementations	05/01/2006
DEL_OS_6_1	Validation Plan	22/03/2006
DEL_OS_6_2	Test Suite Description	22/03/2006
DEL_OS_6_3	Validation Results	23/11/2006
DEL_OS_7_1	Communication Plan	26/01/2005
DEL_OS_7_4	Dissemination and Use Plan	04/07/2005
DEL_OS_7_5	Technology and Implementation Plan	29/11/2006
DEL_S_PAY_1_1	Quality Plan	15/06/2004
DEL_S_PAY_1_2	Quarterly reports	Every quarter
DEL_S_PAY_1_3	Final report	15/02/2007
DEL_S_PAY_2_1	Use cases and system requirement	24/11/2004
DEL_S_PAY_2_2	Telematics Service Provider Requirements	02/08/2005

DEL_S_PAY_2_3	Legal Framework	25/07/2005
DEL_S_PAY_2_4	Complete European Market Overview on Existing, Planned and Future M-PAY systems	02/08/2005
DEL_S_PAY_3_1	Architecture and Interface Specifications	23/10/2006
DEL_S_PAY_3_2	Recommended System	30/11/2005
DEL_S_PAY_3_3	First Business Case Input	24/11/2006
DEL_S_PAY_3_4	Reference Implementations	22/03/2006
DEL_S_PAY_6_1	Validation Plan	22/03/2006
DEL_S_PAY_6_2	Test Suite Description	17/05/2006
DEL_S_PAY_6_3	Validation Results	18/12/2006
DEL_S_PAY_7_1	Communication Plan	15/06/2004
DEL_S_PAY_7_4	Dissemination and Use Plan	29/07/2005
DEL_S_PAY_7_5	Technology and Implementation Plan	11/12/2006
DEL_SAFCHAN_1_1	Quality Plan	10/03/2005
DEL_SAFCHAN_1_2	Quarterly reports	Every quarter
DEL_SAFCHAN_1_3	Final report	15/02/2007
DEL_SAFCHAN_2_1	Use cases and system requirement	26/04/2005
DEL_SAFCHAN_3_1	Architecture and Interface Specifications	24/03/2006
DEL_SAFCHAN_3_2	System Message Specifications	22/03/2006
DEL_SAFCHAN_3_3	Reference Implementations	07/04/2006
DEL_SAFCHAN_6_1	Validation Plan	13/06/2006
DEL_SAFCHAN_6_2	Test Suite Description	01/09/2006
DEL_SAFCHAN_6_3	Validation Results	25/01/2007
DEL_SAFCHAN_7_1	Communication Plan	04/03/2005
DEL_SAFCHAN_7_4	Dissemination and Use Plan	01/08/2005
DEL_SAFCHAN_7_5	Technology and Implementation Plan	30/11/2006
DEL_RSQ_1_1	Quality Plan	15/06/2004
DEL_RSQ_1_2	Quarterly reports	Every quarter
DEL_RSQ_1_3	Final report	15/02/2007
DEL_RSQ_2_1	Use cases and system requirement	08/11/2004
DEL_RSQ_3_1	Architecture and Interface Specifications	23/03/2006
DEL_RSQ_3_2	Reference Implementations	15/02/2006
DEL_RSQ_6_1	Validation Plan	22/03/2006
DEL_RSQ_6_2	Test Suite Description	22/03/2006
DEL_RSQ_6_3	Validation Results	08/01/2007
DEL_RSQ_7_1	Communication Plan	15/06/2004
DEL_RSQ_7_4	Dissemination and Use Plan	08/07/2005

DEL_RSQ_7_5	Technology and Implementation Plan	29/11/2006
DEL_SEC_1_1	Quality Plan	15/06/2004
DEL_SEC_1_2	Quarterly reports	Every quarter
DEL_SEC_1_3	Final report	15/02/2007
DEL_SEC_2_1	Use cases and system requirement	08/11/2004
DEL_SEC_2_2	Configurations & Standards	30/09/2005
DEL_SEC_3_1	Architecture and Interface Specifications	30/09/2005
DEL_SEC_3_2	Reference Implementations	22/12/2005
DEL_SEC_6_1	Validation Plan	15/02/2006
DEL_SEC_6_2	Test Suite Description	22/03/2006
DEL_SEC_6_3	Validation Results	15/01/2007
DEL_SEC_7_1	Communication Plan	04/03/2005
DEL_SEC_7_3	Input for Standardisation	26/04/2007
DEL_SEC_7_4	Dissemination and Use Plan	30/06/2005
DEL_SEC_7_5	Technology and Implementation Plan	15/12/2006
DEL_EFCD_1_1	Quality Plan	15/06/2004
DEL_EFCD_1_2	Quarterly reports	Every quarter
DEL_EFCD_1_3	Final report	15/02/2007
DEL_EFCD_2_1	Use cases and system requirement	05/11/2004
DEL_EFCD_3_1	Architecture and Interface Specifications	30/09/2005
DEL_EFCD_3_2	Reference Implementations	22/12/2005
DEL_EFCD_6_1	Validation Plan	22/02/2006
DEL_EFCD_6_2	Test Suite Description	21/03/2006
DEL_EFCD_6_3	Validation Results	26/11/2006
DEL_EFCD_7_1	Communication Plan	17/01/2005
DEL_EFCD_7_4	Dissemination and Use Plan	04/07/2005
DEL_EFCD_7_5	Technology and Implementation Plan	22/12/2006
DEL_CERTECS_1_1	Quality Plan	30/03/2004
DEL_CERTECS_1_2	Quarterly reports	Every quarter
DEL_CERTECS_1_3	Final report	15/02/2007
DEL_CERTECS_2_1	Convergence for telematics certification	08/11/2004
DEL_CERTECS_2_2	Test Sytems and Method Contests	01/03/2005
DEL_CERTECS_3_1	Process Specification & Contest for the Supporting Information System	01/03/2005
DEL_CERTECS_3_2	Technical Environment Specification	18/02/2005
DEL_CERTECS_3_3	Detailed Specification of Inspection Methodologies & Test System	16/03/2006

DEL_CERTECS_3_4	Detailed Specification of CERTECS I.S.	22/03/2006
DEL_CERTECS_4_1	Certification Process Implementation Report	30/11/2006
DEL_CERTECS_4_2	Certecs Test System Mock-up Ready	12/10/2006
DEL_CERTECS_4_2S	Certecs Test System Mock-up Ready for Security	24/01/2006
DEL_CERTECS_4_3	Certecs IS & inspection supporting tools ready	05/02/2007
DEL_CERTECS_5_1	Results of Capitalization and Analysis Report	18/01/2007
DEL_CERTECS_5_2	Training Material	15/09/2005
DEL_CERTECS_6_1	Certification Evaluation Report	31/01/2007
DEL_CERTECS_7_1	Communication Plan	06/05/2004
DEL_CERTECS_7_4	ATCRF Initial Version	06/02/2007
DEL_CERTECS_7_5	Dissemination and Use Plan	16/01/2007
DEL_Gothenburg_TS_1_3	Final Report	15/02/2007
DEL_Gothenburg_TS_4_1	Technical Dscription of Prototypes	25/10/2005
DEL_Gothenburg_TS_4_3	Description of Prototypes Implemented	05/07/2006
DEL_Gothenburg_TS_5_1	Preparation of Test Site Activities	22/03/2006
DEL_Gothenburg_TS_5_2	Test Site Results	13/02/2007
DEL_Aachen_TS_1_3	Final Report	15/02/2007
DEL_Aachen_TS_4_1	Technical Description of Prototypes	21/10/2005
DEL_Aachen_TS_4_3	Description of Prototypes Implemented	30/06/2006
DEL_Aachen_TS_5_1	Preparation of Test Site Activities	24/03/2006
DEL_Aachen_TS_5_2	Test Site Results	30/01/2007
DEL_Munich_TS_1_3	Final Report	15/02/2007
DEL_Munich_TS_4_1	Technical Description of Prototypes	03/11/2005
DEL_Munich_TS_4_3	Description of Prototypes Implemented	28/06/2006
DEL_Munich_TS_5_1	Preparation of Test Site Activities	27/03/2006
DEL_Munich_TS_5_2	Test Site Results	11/01/2007
DEL_Paris_TS_1_3	Final Report	15/02/2007
DEL_Paris_TS_4_1	Technical Description of Prototypes	22/03/2006
DEL_Paris_TS_4_3	Description of Prototypes Implemented	28/07/2006
DEL_Paris_TS_5_1	Preparation of Test Site Activities	27/03/2006
DEL_Paris_TS_5_2	Test Site Results	31/01/2007
DEL_Stuttgart_TS_1_3	Final Report	15/02/2007
DEL_Stuttgart_TS_4_1	Technical Description of Prototypes	21/10/2005
DEL_Stuttgart_TS_4_3	Description of Prototypes Implemented	30/09/2006
DEL_Stuttgart_TS_5_1	Preparation of Test Site Activities	22/03/2006
DEL_Stuttgart_TS_5_2	Test Site Results	16/01/2007

DEL_UK_TS_4_1	Technical Description of Prototypes	14/10/2005
DEL_UK_TS_4_3	Description of Prototypes Implemented	03/07/2006
DEL_UK_TS_5_1	Preparation of Test Site Activities	16/01/2006
DEL_UK_TS_5_2	Test Site Results	05/02/2007
DEL_Torino_TS_1_3	Final Report	15/02/2007
DEL_Torino_TS_4_1	Technical Description of Prototypes	05/02/2007
DEL_Torino_TS_4_3	Description of Prototypes Implemented	05/02/2007
DEL_Torino_TS_5_1	Preparation of Test Site Activities	05/02/2007
DEL_Torino_TS_5_2	Test Site Results	05/02/2007