Global systems for telematics,
ITS – Intelligent Transport Systems

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GST – GLOBAL SYSTEM FOR TELEMATICS – REVIEW OF CHOOSEN TELEMATICS STANDARDS

At this paper there will be presented project major assumptions and their three areas: Rescue – there are guided works at subproject E-MERGE focused on emergency, SAFETY CHANEL for transfer and displaying information's concerned at road consumer safety; E-FCD- Enhanced Floating Car Data. Mentioned tasks will be realized at four technology platforms: open architecture systems, safety, payment, certification. There will be also presented interaction between GST and COOPERS (Co-operative Systems for Intelligent Road Safety).

GST GLOBAL SYSTEM FOR TELEMATICS – PRZEGLĄD WYBRANYCH STANDARDÓW TELEMATYKI

W pracy zostaną zaprezentowane główne założenia projektu, omówione jego trzy obszary: Rescue- w ramach którego prowadzone są prace w podprojekcie E-MERGE zajmującym się awaryjnością, SAFETY CHANEL – dla przesyłania i wyróżniania informacji dotyczących bezpieczeństwa dla użytkowników dróg, E FCD-Enhanced Floating Car Data- identyfikacja zmieniających się danych systemu. Realizacja powyższych zadań będzie realizowana w oparciu o cztery platformy technologiczne: systemów o otwartej architekturze, zabezpieczenia, płatności, certyfikacja. Zaprezentowana zostanie interakcja pomiędzy projektem GST a COOPERS – Co-operative System for Inteligent Road Safety.

1. INTRODUCTION

The GST (Global System for Telematics) project is developing an open standardised end-to-end architecture for vehicles, their drivers and passengers. GST is creating an open environment by decoupling service development, service operation, delivery infrastructure, payment, in-vehicle software, in vehicle hardware and in-vehicle networks. The main part of Global Services for Telematics within GST is the vehicle and its occupants for information services. The methodology adopted by GST

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uses a version of Reference Model – Open Distributed Processing (RM-ODP) that offers the opportunity to decouple different business areas, business rules, technology infrastructure and to accommodate legacy, heterogeneous and federated system components. A viewpoints concept proposed by the ITU-T rec.X.901, ISO/IEC 10746 standards is used to build the High Level System Architecture and the different sub-project architectures and specifications.

RM-ODP considers the system from different viewpoints: enterprise, information, computational, engineering, and technology. Each viewpoint produces a different abstraction of the original system, without the need to create one large model describing it and all viewpoints together provide the complete description of the system.

Three viewpoints have been selected for the specific needs of the GST project:
• Enterprise: Functional description of the system. The stakeholders are marketing people of service providers, car manufacturers etc.
• Logical: Represents the informational and computational viewpoint and describes blocks of functionality and the relation between the blocks. The stakeholders are system integrators.
• Implementation: Actual technical implementation of the system. This viewpoint overlaps with the technology and engineering RM-ODP viewpoints. The stakeholders are system developers.

Reference to the enterprise view, GST is an initiative involving more than 50 key stakeholders. GST

has three main services for improving road safety via telematics services:
• Rescue
• Enhanced Floating Car Data
• Safety Channel

One main part of the logical view is the structural aspect of the architecture and how the work needs to go and the definition of the boundaries of the GST system (the Musts, Mays and Shoulds) in combination with the use cases of the enterprise view.

The result of the implementation view is the detailed ITS system architecture and design implemented by the software development team. This kind of view does not abstract the physical conception of the system but defines the technological concepts suitable for constructing a GST compliant framework.

2. OBJECTIVES

Project Acronym: GST
Project Reference: ICT-2002-07033
Start Date: 01/03/2004, end date: 28/02/2007, Project Cost: 21,55 Mio EUR, Project Funding 11,10 Mio EUR.

GST seeks to achieve the following high-level objectives:
• Creation of a horizontal market for on-line services based on open standards, and,
• Help this market to reach critical mass by enabling the deployment of safety services reducing the number of fatal accidents. An open telematics market guarantees prompt access to content and service functions through interoperable equipment across standardized access and carrier networks. The use of new technologies cannot achieve the

EU target of a 50% reduction of road fatalities by 2010 alone, but it can make a very important contribution as advocated in the eSafety action plan.

GST has therefore introduced a number of serviceoriented sub-projects that seek to contribute to achieving the White Paper target: Rescue, Safety Channel and Enhanced Floating Car Data.

Description of the work

a) Identify the requirements of users, car manufacturers, control centre operators, middleware providers, terminal manufacturers and service providers

b) Define an overall framework architecture for open telematics across the 7 sub-projects as well as specifications for the key interfaces

c) Develop a common validation plan to ensure that the site validation results can be aggregated and compared at project level

d) Develop, test and validate open telematics services, control centres, middleware and invehicle integrated platforms at different test sites

e) Address relevant operational and business aspects for market introduction of open telematics

f) Finalise the project's architecture and specifications and propose them to the relevant standardisation body

i) Promote the adoption of the solutions agreed across Europe and worldwide.

3. GST HIGHT LEVEL ARCHITECTURE

Figure 1 shows the GST high-level architecture [6]. This is the starting point to select a subset of the previously mentioned reference points to be considered for standardization by GST.

This prioritisation work took into consideration the fact that we can't reasonably expect to specify all interfaces/reference points in a GST system and, in any case, we wouldn't want to because (a) we still want other agencies to be esponsible for elements of an overall implementation and (b) we are unlikely to have domain expertise for some of these interfaces.

The identified reference points are indicated in the picture with a name related to their functional meaning and described in detail in the next paragraphs.

This solution is not final and could be modified later promoting or downgrading some interfaces or sharpening their definition if this will be required in a later stage of the project(for example to cover specific needs of the sub-projects).
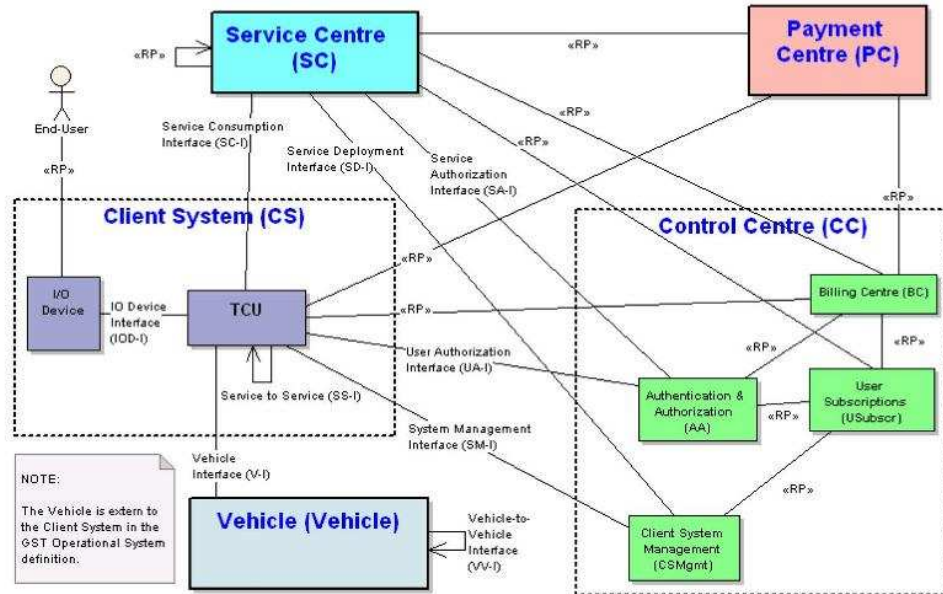
Fig. 1. GST Height Level Architecture [3].

Tables below, provides an overview of the context of the GST System. The Context of the GST System is presented as a Hierarchy Diagram and contains both the GST System as well as the environment that the GST System interacts with. Note that the environment of the GST System has been divided into an Environment for the GST Operational System, an Environment for the GST Realization System and an Environment for the GST Commercial System.

Table. 1. Environment of GST Operational System [3]

Component	Description
Vehicle	In general a vehicle is a means of carrying or transporting something. In the context of GST a vehicle contains vehicle sensors and the Client System and is able to interact with the external world.
Communication Infrastructure	Provides wide-area network connectivity between the Service Platform and outside parties. Outside parties include the Operator and other Service Providers. In the case where the Service Platform is connected via the Internet, the Network Provider is assumed to include the Internet Service Provider (ISP) functionality. A Service Platform that connects to the Internet using DSL might have (in the aftermath of deregulation) five companies responsible for the various layers: the phone company responsible for the copper wires to the home, the DSL service provider responsible for the ATM connectivity, the ISP responsible for Internet connectivity, the Operator responsible for operation of the Service Platform, and finally the other Service Provider(s) responsible for the value added service(s) running. This model applies to both IP and non-IP network layers and to both continuous and intermittent availability. Every effort is made to avoid making assumptions that the network service is Internet (IP) or that it is continuously available.
End-User	Is an actor using GST services on a Client Device. Depending on the situation, this actor may take on various roles.
Content Centre User	Is an actor that interacts with the Content Centre. Depending on the situation, this actor may take on various roles.
Control Centre User	Is an actor that interacts with the Control Centre. Depending on the situation, this actor may take on various roles.
Service Centre User	Is an actor that interacts with the Service Centre. Depending on the situation, this actor may take on various roles.
Public Service Access Points	Are the Centres where 112 calls are received, assessed, routed and help is dispatched in the RSQ subproject
Certificate Provider	Allows the entities of the GST Operational System to verify the authenticity of service applications and users.

Table. 2. Environment of GST Realization System [3]

Component	Description
Existing standards and specifications	Must be met in order to develop GST compliant services/software and equipment.
Service Developer	Is an actor that interacts with the Development Centre and the Certification Centre in order to develop GST-compliant service applications. Depending on the situation, this actor may take on various roles
Equipment Manufacturer	Is an actor that interacts with the Development Centre and the Certification Centre in order to develop GST-compliant equipment. Depending on the situation, this actor may take on various roles. It may be a manufacturer of electronic devices.
Vehicle manufacturer	The manufacturer of the vehicle.
Certification Authority	Is an actor that interacts with the Certification Centre in order to validate compliancy of a GST Entity to the GST specifications. Depending on the situation, this actor may take on various roles.
Automotive Telematics Stakeholders	For example rulemaking organization - like Safety Forum TCWG - that develop and approve standards and specifications.
Test laboratory	The laboratory where the compliance with the GST Services Level Agreements and Services Level Specifications is tested.

Table. 3. Environment of GST Commercial System [3]

Component	Description
Customer	The Customer is the Actor who signs a contract with a Service Distributor order to use certain services. Depending on the situation, this actor may take on various roles.
Data Owner	The Data Owner holds the rights on the raw data. In case of loop detections this is the road infrastructure operator, in case of FCD the driver and in case of Network FCD this is the mobile Network Operator. The Data Owner has to authorize the Content Provider to use his data, independent from a third actor in the value chain, who has to provide a piece of hard- or software for the generation of the data. The Data Owner can be a human or an external system. Depending on the situation, this actor may take on various roles.
Service Distributor	This is the actor that has the contact to the Customer. He distributes the provided services to the Customer and therefore is the one that has the contractual relationship to the Customer. Depending on the situation, this actor may take on various roles.
Service Provider	The Service Provider procures services including the corresponding content. The Service Provider represents a business related entity. He supplies the necessary means to provide the business related support of a specific service application. He is also responsible for delegating the task of service deployment. This actor is allocated to GST Commercial System Environment. The Service Provider is in this case a commercial entity, because he acts in a commercial way with buying different services (without having the technical background for them) and then repacks them into new more complex services according to the special needs of his customers. This is so to speak a business layer between the technical provision of different services and the final distribution of them. Depending on the situation, this actor may take on various roles.

4. GST ARCHITECTURE DECISIONS AT COOPERS PROJECT

4.1. Coopers project

Acronym: COOPERS, Co-operative Systems for Intelligent Road Safety. Number of partners: 38, including TU of Lodz, Department of Vehicles, Fundamentals of Machine Design; project budget 16,8 Mio EUR, 9,8 Mio EUR Funded, Start 1 February, duration 4 years.

COOPERS project vision:

Vehicles are connected via continuous wireless communication with the road infrastructure on motorways, exchange data and information relevant for the specific road segment to increase overall road safety and enable co-operative traffic management.

European road network faces a traffic demand increase up to 50% over the next 15 years. At the same time road operators have the national and European obligation to improve the level of service, to improve safety and to decrease the number of fatalities and injured persons in road accidents by 50% till 2010.

That's why new techniques and methods are requested to move increasing number of vehicles safe, efficient and environmentally sustainable through the existing network. Co-operative systems enabled by enhanced telematics (vehicles and infrastructure) allow to handle dense traffic safe and efficient. Complementing the running research for in-vehicle technology and vehicle to vehicle communication (V2V) innovative solutions for communication between infrastructure and vehicles (I2V) have to be established to explore these options targeting a better use of the available infrastructure capacity.
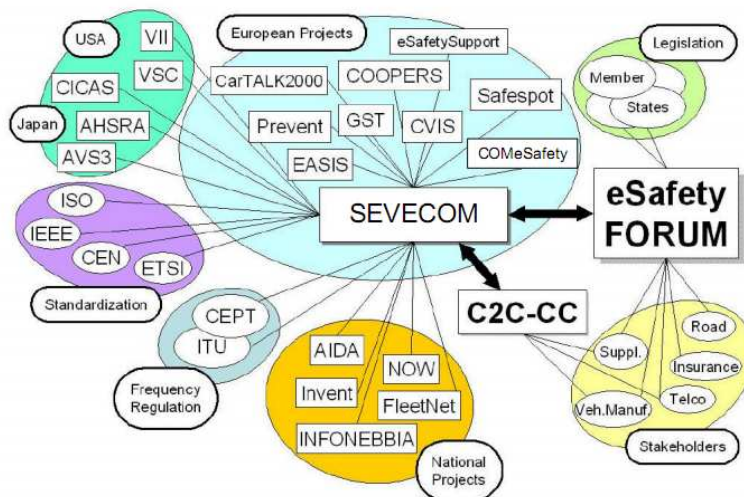

Fig. 2. European Project focused in SAVECOM – safety area [14].

Fig. 2 shows the place of GST and COOPERS projects according to European safety area focused at SAVECOM project.

4.2. GST architecture decisions

The GST architecture consists of a set of loosely coupled components with its own world view and solves the issues from its specific problem domain. The benefit of the different decoupled components is that they are replaceable without disturbing the correct functioning of the system and that the communication between those components and interfaces have to be defined precisely. The GST solution(s) do(es)n't depend on an implementation specific technology. The GST consortium produces also software – called Reference Implementation, which is realised to the following technologies:
• Java: J2SE (Java 2 Platform, Standard Edition) for client developments and J2EE (Java 2 Platform, Enterprise Edition) for server developments
• The Open Systems Gateway Initiative (OSGi) framework for client side developments.
One of the main goals of GST is that different manufacturers can integrate their own modules and the service providers can offer their own services to the end-users. Java is used because it is an object-oriented programming environment that has widely dispersion by developers. Java applications are compatible to nearly any operating system. Combined with OSGi Java could realise the GST goals.
The OSGi specifications define a standardised, component oriented, computing environment for networked services. An OSGi service platform combined with a networked device offers the opportunity to manage the software components within the device from anywhere in the network.
These software components can be installed, updated or cancelled without interrupting the operation of the device. The main focus of OSGi for GST is an open, standard, non-proprietary, software component framework for manufacturers, services providers, and developers. This concept has been taken up by the CVIS project.

4.3. Safety Chanel in GST

The safety channel concept has to use previous developed travel and traffic information broadcast dissemination systems like RDS-TMC. It uses a very simple flagging method to flag all events. Two extensions of the flagging procedure are used:
• **Driver AWARENESS: Flag "A"**
Definition according to GST: "Message content is of an informative nature, which, in itself, requires no definable action but will inform a driver to be aware of any unexpected or unpredictable events that may affect safety. Knowledge of this message may be a contributory factor in providing a driver with information prior to self-motivated safety related actions."
• **Driver WARNING: Flag "W"**
Definition according to GST: "Message content is of a warning nature, which may require potential actions by a driver to avoid (before message receipt) unexpected or unpredictable events that will affect safety. Knowledge of this message should be a significant factor in providing a driver with information prior to self-motivated safety-related actions."

The RDS-TMC event listings are modified to a list which is delivery mechanism independent, therefore the RDS-TMC specific control messages were removed. The reduction of the RDS-TMC list resulted in a list of 112 messages.

The referencing of location is an important part of traffic related information – different categories of applications have different requirements on location referencing. For this

reason the different on the fly location referencing methods (AGORA-C, TMC) in a safety channel message has to be stored in a hierarchical container structure that allows different data structures. A content centre obtains the content and transmits it to the service centre that means that the content centre is responsible for pre-formatting the content. DATEX 2 seems to be the preferred choice by GST for transmission between traffic centres, service providers and clients. DATEX 2 provides the necessarily flexibility for the Safety Channel requirements.

Especially the results on the safety channel in GST could be relevant for COOPERS, because of the strong focus of road safety relevant information services. The principle of defining road safety relevant information and messages has been taken up in COOPERS and been extended to the 12 service categories.

5. SUMMARY

According to presented information there can be said:

a) Conscience of solid definition of GST Global Systems for Telematics helps at design and operating of ITS, (table 1,2,3);
b) GST systematize telamatic trade of ITS. Gives a large basis at building new applications of ITS, (table 1,2,3). This way there is defined a role of each participant of ITS system according to telamtic problems;
c) There are a solid interactions between a lot of EU project at ITS area (figure 2);

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