

Project no.: IST-FP6-STREP- 26979
Project full title: Highly dependable ip-based networks and services
Project Acronym: HIDENETS
Deliverable no.: D7.2
Title of the deliverable: Standards Contributions Report

Contractual Date of Delivery to the CEC:	31 st December 2008
Actual Date of Delivery to the CEC:	22nd December 2008
Organisation name of lead contractor for this deliverable	Fujitsu Siemens Computers
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Work package contributing to the deliverable:	WP7
Nature:	R
Version:	1.0
Total number of pages:	8
Start date of project:	1 st Jan. 2006 Duration: 39 months

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Abstract:

Participation in standards was a key goal in the course of the HIDENETS project. Through the broad HIDENETS approach, these communities became aware of HIDENETS technologies and methods and started integrating them in their ongoing work.

Keyword list: SAForum, C2CCC, standards.

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1. Goals and Objectives for Standards Contributions in Hidenets

For the Hidenets project, one of the key objectives was to make use of existing standards, provide feedback to the standards organisations and if possible, contribute to the evolution of standards.

Relevant HIDENETS results to be reflected in the standardisation work of SA Forum and car-to-car communication. (quoted from [1])

From the beginning, the project set a clear focus on two standards organisations it needed to interface with:

- the Service Availability Forum™ (SA Forum, <http://www.saforum.org/>)
- the Car-2-Car Communication Consortium (C2CCC, <http://www.car-to-car.org/>)

The SA Forum (see [2]) is a consortium of industry-leading communications and computing companies working together to develop and publish high availability and management software interface specifications. The SA Forum then promotes and facilitates specification adoption by the industry. Without giving a complete list, it is worth noting that in SA Forum are represented most major telecommunications equipment vendors (Nokia Siemens Networks, Ericsson, Alcatel-Lucent, Huawei and more) and most middleware and hardware vendors focusing on high-availability components to be used on commercial off-the-shelf based application development (GoAhead, RadiSys...).

The SA Forum is unifying functionality to deliver a consistent set of interfaces, thus enabling consistency for application developers and network architects alike. This means significantly greater reuse and a much quicker turn around for new product introduction.

The SA Forum's mission is to foster an ecosystem that enables the use of commercial off-the-shelf building blocks in the creation of high availability network infrastructure products, systems and services.

Also the standardisation work of C2CCC is industry driven (see [3]) with the automotive industry as its key constituency. The mission and the objectives of the C2CCC are:

- to create and establish an open European industry standard for Car-2-Car communication systems based on wireless LAN components and to guarantee European-wide inter-vehicle operability
- to enable the development of active safety applications by specifying, prototyping and demonstrating the Car-2-Car system
- to promote the allocation of a royalty free European wide exclusive frequency band for Car-2-Car applications
- to push the harmonisation of Car-2-Car communication standards worldwide
- to develop realistic deployment strategies and business models to speed-up the market penetration

Partners FSC and BME actively participated in activities of the Service Availability Forum, while Carmeq concentrated on the C2Car Communication Consortium. Project partners are members of the mentioned standards fora and used their influence and contacts to create visibility for HIDENETS project results as well as contribute directly to the standards evolution in the respective consortium. By integrating project results in the work of the standards bodies, it is expected that in future Requests for Quotation or Requests for Proposals as well as in project implementations, dependability aspects will be an explicit mandatory element.

2. Participation in the Service Availability Forum

From the outset, interaction with the SA Forum was seen as key for the success of the Hidenets project for a number of reasons. The most important are

- SA Forum requirements were input for establishing Hidenets research and work topics.
- SA Forum programming interfaces were referenced in the Hidenets architecture to leverage existing industrial state of the art technology.
- At the same time, it was assured that the Hidenets architecture and project results were in synch with ongoing industrial projects and could fit to industrial standards (w.r.t. architecture or programming interfaces) or enhanced for industrial use.
- A number of Hidenets results were achieved with the clear vision in mind that they respond to important requirements as established by SA Forum member companies or which have evolved in the course of the SA Forum interface specification work.
- Last but not least, Hidenets expertise was made available to enhance SA Forum specification work.

To achieve the challenging goals mentioned above, Fujitsu Siemens Computers (FSC) and Budapest University of Technology and Economics (BUTE) are members of the SA Forum (actually, Fujitsu Siemens Computers is a foundational member of the SA Forum and Manfred Reitenspiess was elected president of the SA Forum in 2004). Both Hidenets partners participated regularly in SA Forum f2f membership meetings and leadership meetings. FSC and BUTE hosted SA Forum leadership meetings as well as membership meetings in the course of the project. Hidenets research results were regularly presented during the f2f meetings. With Robert Seidl, Nokia Siemens Networks and Francis Tam, Nokia, two major contributors to SA Forum work are members of the HIDENETS Advisory Board.

In parallel, ISAS, the International Service Availability Symposium (see [15]), was established in 2004 as a yearly event for the exchange of research results, industrial trends and requirements between practitioners and academia. ISAS is sponsored by the SA Forum. Beginning with the third ISAS event in 2006 (start of the Hidenets project), hosted by Nokia, Helsinki (also an SA Forum foundational member), ISAS became an important platform for face-to-face (f2f) discussions between various Hidenets partners and SA Forum industrial members (see <http://www.isas-conferences.org/>). Targeted sessions have been included in the program. In 2008, the Panel: "*Standards for High-Availability Services*" was moderated by Andras Pataricza, BUTE with the participants Asif Naseem (GoAhead Software Inc., USA), John Fryer (Emerson Network Power, USA), Jim Lawrence (ENEA, USA), Ulrich Kleber (Nokia Siemens Networks, Germany). Andras Kövi, BUTE presented the paper "*Introducing Dynamic Behaviour to AIS Cluster*", a direct result of the cooperation between Fujitsu Siemens Computers and BUTE.

FSC engineers contributed to SA Forum specifications and formulated important Hidenets research requirements (e.g. the requirement for the automated generation of SA Forum compliant configurations). BUTE researchers (lead by Andras Kövi) were contributing to the validation of SA Forum specifications through their Hidenets work (see below for details) as well as to the industrial dissemination of SA Forum specifications through giving SA Forum lectures to a wide industrial audience (see [3, 4, 5, 6]). Also, BUTE and FSC contributed heavily to SA Forum educational material ([7]).

In the project, the SA Forum Application Interface Specification (AIS, [8]), was integrated as a standardised interface component of the Hidenets platform (see [9], Hidenets Architecture). Based on this foundational design decision of the Hidenets architecture, the following research results have been achieved in the course of the Hidenets project:

- **WP2 (Resilient Architecture and Middleware)**
 - ✓ *Mapping of Hidenets services to AIS services has been created.* Two architecture patterns have been created that enable the Hidenets platform to provide its services through the standardised AIS interfaces [10].
- **WP5**
 - ✓ *Application example for the interfaces has been created.* The Platoon Driver Support System [11] has been developed that exercises both Hidenets and AIS services.
 - ✓ *Metamodel of AIS services has been refined and clarified.* The Information Model [12] as defined by the SA Forum does not conform to the requirements of a metamodel. Ambiguities and syntactic errors were corrected and the resulting model has been extended with the secondary level semantic connections between entities (e.g. component-checkpoint relation)
 - ✓ *Ways to introduce mobility/dynamicity in AIS-based systems have been shown.* As the AIS currently supports only rather static environments, and Hidenets mostly focuses on mobile and dynamic environments, ways have been worked out to introduce this dynamicity in today's AIS based systems [13].
 - ✓ *Model-driven development framework with configuration and code generation facilities has been created.* Both configuration and coding is complex for AIS-based systems. Automatic model-based configuration and code generation facilities have been worked out [14] for this reason.
- **WP6**
 - ✓ *Experiments have been conducted with AIS implementations that were aiming to answer the question of how easily could those be adapted/used in dynamic environments.* To prove that the theoretic results of WP5 are applicable to real life, experiments have been conducted in a proof of concept environment [13].
 - ✓ *A demonstrator application was created that exercised the Availability Management Framework, the Checkpoint and the Message services of AIS.* The PDSS application was developed as a proof-of-concept demonstrator.

Targeted meetings have been held with a number of SA Forum member companies in 2008 to present Hidenets results overall and in particular related to the dynamic adaptations of AIS, automated generation of SA Forum AIS compliant configurations, automated test generation support as well as the automatic generation of AIS compliant applications (see [3,4,5,6]).

3. Participation in the Car-2-Car Communication Consortium

The Car-2-Car Communication Consortium (C2C-CC) is the central standardisation organisation for car-to-car and car-to-infrastructure communication. It is mainly organised by the automotive industry, but also ETSI and national regulatory authorities as well as a set of research institutions are contributing to the efforts. Carmeq is a subsidiary of Volkswagen, one of the nine C2C-CC partners. In the course of the HIDENETS project, Carmeq has provided input to Volkswagen in regular meetings with Volkswagen working group chairs of the consortium. With Gerard Segarra, Renault, a major contributor to the C2C-CC is a member of the HIDENETS Advisory Board.

A huge amount of stakeholder requirements needs to be taken into account due to the large number of C2C-CC partners and associated members. The establishment of a unified European frequency band took top priority at C2C-CC. As a result, the standardisation process is slow-going and main research activities of the consortium were related to physical and link layer challenges. Therefore it was a key task for HIDENETS to attract and inform the consortium on ongoing research topics like enhanced middleware services or the development of sophisticated node architecture and on other suitable dependability means, which have been investigated within HIDENETS.

The HIDENETS node architecture has been presented to the C2C-CC architecture working group in February 2008. A cooperative link has been established to the COMeSafety Project in spring 2008. COMeSafety is responsible for evaluating project results of projects not integrated in the C2CCC and for making recommendations on their importance for the consortium. The link to COMeSafety is maintained on a continuous basis. A key result of the cooperative link is the publication of a HIDENETS article in the COMeSafety newsletter [18] which addresses the wider C2C-CC audience.

The HIDENETS node architecture, being one of the most sophisticated architectures in the car to car communication domain, will be input to a later version of the COMeSafety architecture document [20]. This architecture document serves as a **basis for decision-making** in the C2C-CC as well as for other new projects derived from the consortium like PRE-DRIVE C2X[19].

As a result of the regular meetings with Volkswagen experts, HIDENETS was able to support the physical layer working group of the C2C-CC. HIDENETS results influenced the decision on the specification of the on-board car equipment. Results on a development of a multi-radio multi-channel solution were submitted to the working group as input and driver of the ongoing discussion.

In the second half of 2008, HIDENETS results were presented to the security working group of Volkswagen Research responsible for car-to-car communication. The HIDENETS business impact analysis has been attracted by a business team of Carmeq. Represented by Carmeq, HIDENETS participates the Car-2-Car Communication Consortium forum as well as the demonstration of the first car-to-car prototypes at the OPEL test centre. Furthermore Carmeq generated a condensed internal report about HIDENETS to Volkswagen to underline the opportunities of the results in the car to x domain.

4. Other Standardisation Activities

IETF standardisation

The solutions for efficiency enhancements of proactive routing (E-OSPF, see D3.1.2 [16]) were brought forward to IETF standardisation, specifically to the ospf-wireless-design mailing list of the OSPF Working Group. The technical content of the discussion contribution was linked to the protocol description and efficiency analysis published at Globecom in Dec 2006 [17]. The contribution led to selected individual discussions with researchers connected to the mailing list.

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