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Priority 2.5.3
INFORMATION SOCIETY TECHNOLOGIES
Unit G3 Embedded Systems



Project Acronym:

SOCRADES

Project Full Title:

**Service-Oriented Cross-layer infRAstructure for
Distributed smart Embedded devices**

Proposal/Contract No: EU FP6 IST-5-034116 IP SOCRADES

Deliverable 11.2b

Project Report

| | |
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| Date: | 28.09.2007 |

Organization Name of the Lead Contractor for this Deliverable: **Schneider Electric**

¹ See p.5 for explanation of Dissemination Levels

Status Description:

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² As defined in the DoW

³ Scheduled date for approval

⁴ A list of company short tags can be found in DoW

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Dissemination Level:

| | |
|--------------|--|
| PUBLIC | Public |
| PP | Restricted to other programme participants (including the Commission Services) |
| RESTRICTED | Restricted to a group specified by the consortium (including the Commission |
| CONFIDENTIAL | Confidential, only for members of the consortium (including the Commission Services) |

1. Executive summary

This progress report presents activities and results achieved by the SOCRADES consortium during the second 6-monthly reporting period (March 2007 until August 2007). It is based on the Guidelines for preparing project reports for FP6 (<http://cordis.europa.eu/fp6/find-doc-management.htm#reporting>).

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|------|--|---|---|--|---|---|--------------------------------|---|---|----|----|----|----|----|----|----|----|----|
| WP1 | Trend screening, requirements, state-of-the art, technology assessment | | | | | | | | | | | | | | | | | |
| WP2 | Framework specification for ad-hoc networking service platform | | | | | | | | | | | | | | | | | |
| WP3 | | | | Wireless service-oriented sensor/actuator networks | | | | | | | | | | | | | | |
| WP4 | Device Centric Infrastructure | | | | | | | | | | | | | | | | | |
| WP5 | | | | | | | Service-centric infrastructure | | | | | | | | | | | |
| WP6 | Enterprise Integration | | | | | | | | | | | | | | | | | |
| WP7 | System engineering & management | | | | | | | | | | | | | | | | | |
| WP8 | | | | | | | | | | | | | | | | | | |
| WP9 | Dissemination | | | | | | | | | | | | | | | | | |
| WP10 | Exploitation, standards & roadmapping | | | | | | | | | | | | | | | | | |
| WP11 | Project Management | | | | | | | | | | | | | | | | | |

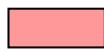

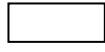
-  = current period
-  = work packages already started
-  = work packages not started

Figure 1: Work plan schedule - Overview

1.1. Summary of the Objectives of the Reporting Period and Related Activities

Based on the work plan addressed in the Annex1 of the SOCRADES DoW, and taking into account the results of two Technical Workshops held in conjunction with PCC meetings, as well as the recommendations of the evaluators after the first 6-monthly EC Review meeting, the following main objectives have been addressed in this period:

- SOCRADES General Framework specification (first project milestone);
- Identification of the major RTD values addressed in SOCRADES, against the background of the current market and competition state, as documented in current public reports.
- Initiation of the first specifications and developments of the necessary steps for demonstrating the innovation aspects of the SOCRADES related technologies:
 - Improvement and modularisation of the architecture of the DPWS stack.
 - Application of the SoA paradigm at the device level (for real and virtual devices).
 - Enterprise integration (integration of devices and IT systems) using WS technology.
 - Application of a Petri Net-based modelling and analysis/validation approach to formally specify service orchestration and agent-based service choreography at device level.

- Initiation of the mapping of application of the framework into the three industrial scenarios (electronic assembly, car manufacturing, continuous process);
- Implementation of a first set of early prototypes coming from the works performed in the individual work packages.
- Strong publishing activities and dissemination of the first research results.
- Proposal of an approach to generate and conduct a consortium internal and external roadmap and exploitation plan.
- Initiating the first actions for conducting standardization activities.

From the management point of view, the project consortium's situation was stabilized.

1.2. Short evaluation of the status achieved & lessons learned

The project's first yearly milestone (SOCRADES Framework Specification) has been reached.

After a first analysis of the market and the state of the competition, the consortium is aware that this initiative is the first (world-wide) to address the application of the SoA paradigm at the device level and the integration of such SoA-compliant devices into enterprise architectures. SOCRADES is a new technology and for that reason, it is in the hands of the partners to spread it as a real innovation. It is worth emphasizing that the SOCRADES consortium is marking the RTD direction (world-wide) in this domain.

“Roadmapping for the adoption of the SOCRADES paradigm” was proposed as one of the essential activities planned for being conducted during the first project year in work package 10 (Task 10.3). However, due to the innovative aspects of the SOCRADES technology, only a few sets of Key Enabling Features (KEFs) were identified till now, which precludes the completion of the corresponding deliverable (D10.4a). Indeed, it is impossible to define a roadmap for the adoption of a paradigm, as long as the necessary technology roadmap does not exist.

The consortium reached a stable structure and a fruitful cooperative atmosphere. Nevertheless, continuous day-to-day management work is necessary for the integration of the major technically oriented work packages. This is mainly due to the broad spectrum of innovative aspects addressed in the different work packages, making it a real challenge to maintain all technical developments under an integrative approach, particularly so because the technical work is being performed in a collaborative manner by the major players/ stakeholders of the automation value chain.

1.3. Matters arisen and measures taken

Technical matters:

The SOA paradigm involves many new concepts and introduces a vocabulary that is now well known in the IT world but difficult to assimilate in the automation area. Consortium-wide technical workshops have been set up with a period of three months and weekly exchanges of information within work packages have taken place in order to reach a common understanding within the consortium.

Since it was impossible to conduct the preparation of the “Roadmapping for the adoption of the SOCRADES paradigm”, the WP10 leader, in agreement with the PCC, decided to slightly modify the aim of Task 10.3 in order to develop a Technological Road map of the SOCRADES paradigm and the related technologies; a corresponding modification will be introduced in the DoW for the 2nd project phase.

During the first months of the project, by screening the SoA-related technologies, the consortium has observed a strong correlation between the DPWS and OPC UA technologies. The topic has been discussed during the last two SOCRADES technical workshops and a Working Group has been set up, which has started analyzing that correlation and concomitant ISO/IEC standardization actions are being initiated, also as a part of the plan of activities addressed in WP10.

Organizational matters:

SAP was coming two months later into the project, but it was not necessary to take corrective measures owing to the successful work of this partner.

Jaguar was officially coming six months later into the project. Similar situation to the case of SAP, there were no necessary measures to be taken due to the contributions of Jaguar through the common work with Loughborough University that was carried out from the very beginning of the project.

In both cases, the budget/funding transferred to the respective partners was the initial one addressed in the SOCRADES EU Contract.

Management matters:

- The reporting procedures proposed at the beginning consisted mainly in internal three-monthly project progress reports with focus on technical issues, and six-monthly project progress reports (official deliverables). This generated considerable overhead. For the second year, it was decided to skip the internal three-monthly progress reports.
- Due to the broad spectrum of scientific and technical aspects addressed by the project, a continuous exchange of information among the partners was explicitly set up. The number of meetings within the consortium was strongly increased, i.e., the 1-day technical workshops associated to each of the PCC meetings were complemented with internal work package meetings as well as with peer-to-peer meetings.
- During the last PCC meeting, it was decided to incorporate into the deliverable “6-monthly project report”, starting with the next report, a list of all meetings held by the partners. This decision is related to one of the evaluators' recommendations given after the first 6-months EU review.
- The project management handbook does not provide measures for motivating the weak partners. This deficiency is being addressed by a more periodic contact (phone and email) between the co-ordination and the partners.

1.4. Next Steps**Technical steps:**

- Initiating major developments based on the framework specification addressed in Project Milestone 1.
- Improvement/extensions of the early prototypes that should conduct to the first prototype demonstrators during the second year.
- Improvements and extension of the exploitation plan.
- Finalization of the roadmap, but focusing explicitly on the SoA technology.

Management steps:

- Negotiation of the 2nd phase DoW.

1.5. Analysis of the effort Consumption

The analysis of the efforts and the related costs discovers an uneven consumption for the first reporting period. Concerned are the employed resources as well as the dedicated costs. Compared to the planned efforts some tasks have required less manpower; on the other hand there had to be spent more work on other tasks, partly the efforts are increasing significantly.

Compared to the budget, the relevant costs are also varying. Some partners show significant increase in their PM-Rate, some partners have decreased their PM-Rate; in some cases the PM-Rate decrease compensates the PM increase largely.

The overall picture can not yet be presented because of the still ongoing lack of reports or incomplete reports from the partners. This overall picture will be presented by the Project Finance Manager during the 1-Year EC Review meeting.

2. Work Progress Overview

This section includes a summary of objectives for the considered reporting period and the actions carried out, based on the work packages which were active, as well as some indications for future activities. For each work package, the following information is given:

- Work package objectives and starting point of work at beginning of reporting period;
- Progress towards tasks worked on and achievements made with reference to planned objectives, identifying contractors involved;
- Deviations from the project work programme, and corrective actions taken/suggested: identifying the nature and the reason for the problem, identifying contractors involved;
- List of deliverables, including due date and actual/foreseen submission date;
- List of milestones, including due date and actual/foreseen achievement date;

2.1. WP1 – Trend screening, requirements, state-of-the art, technology assessment

2.1.1. Work package objectives, starting point of work

This work package is dedicated to analyzing state-of-the-art of the overall projects subjects, identifying relevant use cases as a basis for requirements specification and finally trend screening throughout the overall project.

2.1.2. Tasks progress

Task 1.1: State-of-the-art and technology assessment

Work carried out in Task 1.1 during this reporting period was dedicated to state-of-the-art analysis in different directions to identify the starting point for the work to be done within the other working packages. The work started in reporting period 1. The results of this work were documented in D1.1, which has been submitted in advance to the first interim review meeting for the SOCRADES project. After this meeting, comments from the reviewers were taken into consideration. An updated version of D1.1 has been build.

The state-of-the-art, as described in D1.1, gives an overview about technologies and aspects, which enables service oriented architectures with the main focus on networked embedded systems. Therefore the deliverable starts with a description of the service oriented architecture to provide a common understanding of the subject to the entire project team.

The work done also covers the engineering view of both control and business levels.

To establish an entire service oriented systems, a broad range of technologies like distributed control platforms, agent-based control, IP-based networks, Service oriented Architectures for devices, networked control, wireless technologies and industrial device profiles have been investigated.

In addition, effort was spent to initiate a glossary. It is the intention that these terms shall be used in the entire project in each working package.

The deliverable D1.1 is a collection of contributions of the experts involved in the project. It shows therefore also the view to the state-of-the-art at the beginning of the project. Mutual understanding has increased writing this deliverable and gave a starting point for the detailed work in the other working packages.

The other work packages partly precise and extend the technical content of the specific topics, so that the complete knowledge of the technologies can only be acquired reading D1.1 and the other related deliverables.

The work on state-of-the-art analysis, as started in Task 1.1, will be continued throughout the overall project. This work is dedicated to Task 1.3 with related contributions from all technical and scientific oriented working packages.

Task 1.2: Requirements assessment

Within Task 1.2 at first a general guideline for use case definition has been defined. This is to guarantee easy reading and understanding contributions coming from several partners representing different domains. Based on this approach, use cases for networked embedded devices have been investigated. To cope with all the life time of targeted components, different life cycle phases have been identified to be considered by the selection of use cases. Investigations were done in several fields of application of networked embedded devices, as there are industrial automation, flexible car manufacturing, process control, high-level management through MES and ERP systems, wireless applications and flexible manufacturing of electronic components.

Based on these use cases, requirements on distributed smart embedded devices and their use have been specified. Following the same idea of a common approach for defining all the requirements (as done for use cases), firstly the introduction of the approach applicable to requirements specification within D1.2 as well as to be used within other working packages was done. Requirements were defined in a hierarchical manner starting with general and use case related requirements. Discussion of these requirements led to more specific functional and non-functional requirements.

The result of the work done in Task 1.2 has been documented in D1.2 and submitted in advance to the first interim review meeting for the SOCRADES project.

During this review, comments arose to indicate the source of the requirements, to cluster requirements actually distributed across several deliverables in a common document and to prioritize them. This work has been started with the introduction of the originators of the requirements into D1.2. The new version of D1.2 will be delivered for the next review. Work on clustering started with the target to provide a complete list of SOCRADES requirements for the Milestone 2 deliverable.

Task 1.3: Trend screening and self-evaluation

Work on Task 1.3 has been continued during the present reporting period. This work is dedicated to the continuation of the work on state-of-the-art analysis as started with Task 1.1 as described above. Results of this work will be documented in D1.3, due during the next reporting period.

2.1.3. Deviations of the project work program (if applicable)

Not applicable.

2.1.4. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type | Security | Due date | Actual date |
|----------|--|--------|--------------|-------------|----------|------------|-------------|
| D1.1 | State of the art | 1 | ifak | deliverable | RE | 31.03.2007 | 10.04.2007 |
| D1.2 | Requirements of end users and component vendors/system integrators | 1 | ifak | deliverable | CO | 31.03.2007 | 10.04.2007 |

2.1.5. List of milestones for the reporting period (if applicable)

| MS No. | Milestone name | Lead partner | Due date | Actual date |
|--------|---------------------------|--------------|------------|-------------|
| M1.1 | Requirement Specification | ifak | 31.03.2007 | 10.04.2007 |

2.2. WP2 – Framework specification for ad-hoc networking service platform

2.2.1. Work package objectives, starting point of work

The goal of WP2 has been to provide a set of specifications that will define the service-oriented infrastructure that will be used to implement all interactions between the SOCRADES components. The tasks that were initiated during this reporting period, and their respective main objectives, are:

- Task 2.2: specify a service orchestration framework which provides machine-readable description of the conversations that a service supports – initiated in M10.
- Task 2.3: specification of a framework for implementing management functionality – initiated in M12.
- Task 2.4: specification of a framework for implementing a lightweight service-oriented agent system – initiated in M9.

Three tasks were concluded during the reporting period:

- Task 2.1: specifications of extensions to the existing standard Devices Profile for Web Services (DPWS) – concluded in M12.
- Task 2.5: specification of a Semantic Web Services framework, which is built on top of the DPWS layer to provide semantic descriptions of devices and their Web Services – concluded in M12.
- Task 2.6: Service gateway framework, which specifies harmonized guidelines for developing technology-specific gateways to legacy or back-end protocols – concluded in M8.

The deliverable D2.2 “Specification of service gateways for non-service enabled devices” was successfully completed and submitted for an internal review (contributors and PCC members) on April 27th 2007. Although the deliverable D2.1 is planned for M18, the preparation of the draft has been started and a coherent draft was produced. During the present reporting period, the milestone MS1 was reported. On 1-2 August 2007 (Tampere), the partners held a meeting, dedicated to technical and management issues of WP2.

2.2.2. Tasks progress

Task 2.1 – Enhancement of the existing device-level service framework

The task focuses on the extension and the enhancement of the existing device-level service framework relevant to service-based ad hoc networking, enabling communications between embedded devices at the application level. Partners have started studying the existing device-level service framework; Schneider Electric has established a first list of technical requirements for improving the current DPWS-based service infrastructure. In the reporting period, APS has concentrated their activities related to WP2 on the development of a basic framework for device-level services applicable for the mechatronic trials planned to be performed in WP8.

The task was reported in the internal task report 2.1 and summarized for the current version of D2.1 (Schneider Electric).

Task 2.2 – Service orchestration framework

The task has started in the reporting period. The service orchestration framework is responsible for the control and coordination of distributed services. The approach dealt with in this task applies to systems with a high necessity of dynamicity and flexibility, hence production cell or line level. A service orchestration framework highly modular and covering all potential scenarios has been introduced. The feasibility of this framework is yet to be tested but the risks have been thoroughly analyzed and different possibilities have

been proposed in order to overcome the technical problems that the actual implementation of these frameworks may pose. Although the task is planned to be reported in M18 a coherent draft of internal report 2.2 was introduced and summarized for the deliverable D2.1.

Task 2.3 – Service management framework

The task has been initiated by the end of the present reporting period, in accordance with a decision from the partners who met on 1-2 August. The task is led by Schneider Electric.

Task 2.4 – Service-enabled agent framework

The task has started during the reporting period. An approach was presented to describe semantically processes, their requirements for invocation and their effects in the world and a mechanism to facilitate cognition in the absence of sensorial information by propagating events that are associated to explicit description of their effects on the world. Schneider and Loughborough University had held a meeting in June 2007 with aim to discuss the possibility for a common demonstrator. During the reported period Loughborough University has done an analysis of the use of agents and the DPWS stack's ability to support agent frameworks when compared to other SOA application business environments. Examining applications that also use both service to service collaboration within domains and outside domains in business environments where applications such as ERP dictate, the investigation has led to the IFAC paper that addresses perceived issues with DPWS and the use of agents in automated manufacturing environments. Although the task is planned to be reported in M18, a coherent draft (with the inputs from Schneider Electric, TUT, Loughborough University) of internal report 2.4 was generated and summarized for the current version of the deliverable D2.1.

Task 2.5 – Semantic Web Services framework

The main goals of the task were accomplished in the reporting period. There was done a specification which is based on TUT's previous work utilizing the Ontology Web Language (OWL) and the OWL-S Web Service ontology. The several scenarios were run out to illustrate the introduced approach. APS has been generating the foundation for semantic Web Services. Focus has been given to the definition of ontologies related to the environment of the mechatronic trial site.

The results were reported in an internal task report 2.5 and summarized for the deliverable 2.1 in its current version.

Task 2.6 – Service gateway framework

In April 27th 2007 the partners completed and submitted the Deliverable 2.2 "Specification of service gateways for non-service enabled devices" for internal review (contributors and PCC members). The paper was approved on 11 June 2007.

Architecture of a gateway using the approach of device and virtual machine proxies was presented; the description of the use case of a PC-based SOCRADES gateway including device proxies and virtual machine proxies; and the state machines for the PC-based SOCRADES gateway. FPGA platform was introduced as the most cost effective method to build a flexible design platform. The preliminary specification for the platform along with the associated resource plan has been prepared.

2.2.3. Deviations of the project work program (if applicable)

Not applicable.

2.2.4. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type | Security | Due date | Actual date |
|----------|---------------------------------------|--------|--------------|-------------|----------|------------|-------------|
| D2.2 | Specification of service gateways for | 2 | TUT | Deliverable | CO | 30.04.2007 | 27.04.2007 |

| | | | | | | | |
|------|---|---|-----|-------------|----|------------|------------|
| | non-service enabled devices | | | | | | |
| D2.1 | Framework specification for the device level service platform | 2 | TUT | Deliverable | CO | 31.12.2007 | 26.09.2007 |

2.2.5. List of milestones for the reporting period (if applicable)

| MS No. | Milestone name | Lead partner | Due date | Actual date |
|--------|--|--------------|------------|-------------|
| MS1 | Specification of the service oriented infrastructure | TUT | 31.08.2007 | 13.09.2007 |

2.3. WP3 – Wireless service-oriented sensor/actuator networks

2.3.1. Work package objectives, starting point of work

As mentioned before in this document, the goal of the SOCRADES project is to create new methodologies, technologies and tools for the modelling, design, implementation and operation of networked hardware/software systems embedded in smart physical objects. Currently it can be noted that *wireless technology* conquers the embedded systems field within a wide range of applications. As one of these application areas e.g. the domain of industrial communication follows this trend and adopts the investigated wireless technologies to networked embedded automation devices. Against this background, especially solutions for the very special conditions in the harsh environment of automation installations are of high interest – wireless industrial communications based on IEEE 802.15 standards are in the focus of this kind of research and development. Combining this with SOCRADES' objective of distributed smart embedded systems to be applied in perception and control systems in intelligent environments – which are enhanced with system intelligence achieved by co-operation of smart embedded devices towards common goals – especially wireless sensor networks (WSN) are a research area to be investigated closer.

Against that background, the following research topics are addressed within this WP:

- Node architecture, sensor integration and the interface between sensors and the network,
- Wireless Network topology, self-configuration, self-management, routing, scalability,
- Communication technologies for Wireless Sensor/Actuator Networks (WSN) in industrial environment (especially IEEE 802.15.4),
- New services with Wireless Sensor Networks,
- Demonstrator set-up.

2.3.2. Tasks progress

Task 3.1 – Analysis and trend screening for wireless sensor/actuator networks

Finished. The final deliverable D3.1 was submitted to EU in June 2007.

Task 3.2 – Architecture and functional specification of wireless DPWS-oriented sensor/actuator networks

The task is running according to plan. The corresponding deliverable is structured into the following chapters:

1. INTRODUCTION
2. USE CASE FRAMEWORK
 - 2.1. APPLICATION RELATED USE CASES
 - 2.2. MANAGEMENT RELATED USE CASES
3. SYSTEM ARCHITECTURE
 - 3.1. GENERAL OVERVIEW
 - 3.2. GATEWAYS
 - 3.3. SENSOR)
 - 3.4. TOPOLOGIES

- 4. DPWS INTEGRATION
- 5. FUNCTIONAL SPECIFICATION
 - 5.1. PROFILES
 - 5.2. NETWORK VIEW
 - 5.3. SENSOR VIEW
 - 5.4. ENGINEERING
- 6. SUMMARY / CONCLUSION

A first demonstration will be shown at the review in October 2007.

2.3.3. Deviations of the project work program (if applicable)

Not applicable.

2.3.4. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type | Security | Due date | Actual date |
|----------|--|--------|--------------|-----------|----------|----------|-------------|
| D03-1 | Analysis and trend screening for wireless sensor/actuator networks | 3 | ifak | document | PU | May 2007 | June 2007 |

2.3.5. List of milestones for the reporting period (if applicable)

| MS No. | Milestone name | Lead partner | Due date | Actual date |
|--------|--|--------------|----------|-------------|
| MS03.1 | Analysis and trend screening for wireless sensor/actuator networks | ifak | May 2007 | June 2007 |

2.4. WP4 – Device Centric Infrastructure

2.4.1. Work package objectives, starting point of work

The main purpose of WP4 is to control continuous processes with wireless communication technology.

2.4.2. Tasks progress

The **administrative activities** in the WP4 during this period include the following planning and coordination activities:

- A meeting for assessing the M4.1 was held in Västerås on March 28-29, 2007, with the participation of the Project Coordinator, Project Technical Manager and representatives of ABB.
- A short Teleconference with LTU to review our chapter in the deliverable D3.1 on April 11, 2007
- A meeting with the PCC members to prepare the EU review of the project, Frankfurt Airport, April 23.
- An EU Review meeting in Brussels, April 23.
- Work package organization and progress was reported at a third PCC meeting in Västerås, June 11-12.
- Participation in a WP2 meeting in Tampere, August 1-2.
- A one-day conference in the WP4 group at Arlanda airport, August 27.
- Introduction to a couple of Master Thesis students from Sienna, Italy, August 29.
- Frequent contacts with LTU and KTH to get their tasks in the Work package aligned with ABB's intention.

Technical activities

This period has included discussions with LTU on possible simulation scenarios and environment, as well as discussions with KTH on control cases that need to be studied.

One thing to comment is that the use of real base scenarios has allowed the partners to provide realistic requirements, though their different backgrounds. This has, so far, proven to be a very useful approach.

ABB have been visiting Luleå Technical University, June 15, to discuss technical issues, and have planned to go to the Ore Plant in Garpenberg together to do measurements of the radio environment.

System Architecture

Together with KTH, ABB have identified a number of “critical design choices” that have to be made to achieve a sustainable control solution.

2.4.3. Deviations of the project work program (if applicable)

Not applicable.

2.4.4. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type | Security | Due date | Actual date |
|----------|---|--------|--------------|-------------|----------|------------|-------------|
| D4.1 | Architecture for fault-tolerant application interaction | 4 | ABB | Deliverable | CO | 2007-08-31 | 2007-09-26 |

2.4.5. List of milestones for the reporting period (if applicable)

Not applicable.

2.5. WP5 – Service-centric infrastructure

This WP aims at bridging application-level functionality and device-level functionality through a common, unifying technological approach, based on the service-oriented architecture (SOA) paradigm, implemented using Web Services and associated technologies.

In essence, it will implement the service-centric infrastructure according to the framework specifications produced by WP2.

2.5.1. Work package objectives, starting point of work

This WP aims at bridging application-level functionality and device-level functionality through a common, unifying technological approach, based on the service-oriented architecture (SOA) paradigm, implemented using Web Services and associated technologies.

In essence, it starts implementing the service-centric infrastructure according to the SOCRADES framework specifications produced by WP2 in Project M1 and D2.1.

In line with the ambitious objectives of the SOCRADES project, a feasibility study is being carried out, in a parallel way to the RTD actions, concerning the development of a generic hardware component – outfitted with a microprocessor, on chip memory, I/O ports and network interfaces – that can be incorporated into a wide variety of devices. Such a component should be able to house several of the software components enabled by Tasks 1 to 5.

2.5.2. Tasks progress

Tasks 5.1, 5.2, 5.3, 5.4 and T5.5 start later.

Task 5.6:

Task 5.6 started the implementation of the platform as proposed in D2.2. The FPGA based prototyping environment has been defined and prepared and test synthesis of Cortex-M1 and chip infrastructure on selected platform has been completed. Task 5.6 is now ready to enter the next phase. In order to complete the chip prototype, a detailed requirements capture with key stakeholders will be conducted. Schneider and

ABB will define use cases and profiles of the device(s) to be prototyped. These inputs are required in order to define the chip configuration with respect to peripheral mix and memory configuration. The specified device(s) will then be implemented as FPGA prototypes with dedicated tools support.

2.5.3. Deviations of the project work program (if applicable)

Not applicable.

2.5.4. List of deliverables for the reporting period (if applicable)

Not applicable.

2.5.5. List of milestones for the reporting period (if applicable)

Not applicable.

2.6. WP6 – Enterprise Integration

2.6.1. Work package objectives, starting point of work

The main thrust of work within WP6 aims at the integration of device-level services with higher-level Web Services and business processes situated at the level of business applications, in particular Enterprise Resource Planning (ERP) systems.

The respective tasks are:

- Task 6.1: Integration concept analysis and design
- Task 6.2: Integration of aggregated services into business applications
- Task 6.3: Integration of non Web Service enabled devices into business processes

All of the tasks have that have been kick-started in the previous reporting period, have continued also in M7-M12. More specifically, Task 6.1 completed on M12, while Task 6.2 and Task 6.3 will continue.

2.6.2. Tasks progress

The main goal of WP6 was focusing on design (e.g. contributing on D6.2) as well as prototyping concepts. In more detail:

- **Task 6.1: Integration concept analysis and design**

Discussions with regard to the integration concept continued in this reporting period. The initial concept presented in D6.1 was further refined and more in depth researched, as this is also depicted in D6.2. The task concluded on M12, however further refinements are expected to indirectly occur in the scope of Task 6.2 and Task 6.3.

- **Task 6.2: Integration of aggregated services into business applications**

The application scenarios depicted in D6.1 were looked more in detail to find out possible technical bottlenecks and problems that may arise at realization of the concepts. As a result, the first version of the integration architecture presented in D6.1 was revised, some components were added and now their role is better understood. In parallel we have started prototyping our concepts, based on this integration architecture, and this will be demonstrated in the project review.

- **Task 6.3: Integration of non Web Service enabled devices into business processes**

The main focus of this task was to take a closer look to non-WS enabled devices. We investigated the motivation behind not putting DPWS everywhere due to constraints, and researched service bridging concepts and services. We refined the integration concept of D6.1, mainly with the aim to fully be able to

integrate non-web service enabled devices in business processes. Finally we also took an economic view on this infrastructure. Details are found in D6.2.

2.6.3. Deviations of the project work program (if applicable)

Not applicable.

2.6.4. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type | Security | Due date | Actual date |
|----------|--|--------|--------------|-----------|----------|------------|-------------|
| D6.2 | Integration concept of non Web Service enabled devices | WP6 | SAP | R | CO | 31.08.2007 | 31.08.2007 |

2.6.5. List of milestones for the reporting period (if applicable)

Not applicable.

2.7. WP7 – System engineering & management

2.7.1. Work package objectives, starting point of work

This work package aims to develop an engineering environment to support distributed embedded devices in automation systems utilising Web-Services based connectivity. Existing state of the art functionality is being utilised where appropriate, for example the Delmia Automation engineering toolset and the PDE/COMPAG engineering approaches are being actively evaluated by in the SOCRADES context. Whilst many aspects of existing applications engineering tools are expected to be appropriate, other aspects notably the potential to allow the much greater distribution of real-time devices and the need to support a web-services oriented infrastructure for communication require new thinking and innovative solutions in order to fully realise the potential benefits. The development of the engineering environment is focused on serving the needs of a set of project demonstrators. E.g., Loughborough University's focus is primarily automotive assembly automation systems. Furthermore, the consideration and capture of user requirements in chosen industry sectors, e.g. the automotive industry with Jaguar, is considered essential. The surveying of enabling technologies available in the engineering tool domain also forms a major aim of this work package.

Two deliverables (D7.1, D7.3) have already been submitted and one more (D7.2) is in its final preparation stage. Following a set of meetings (audio and in person), the underplaying application description for the Loughborough test rig (Ford/Jaguar prototype model) is being specified in close collaboration with Schneider, ifak and SAP with future scoping of the needs of other project demonstrators planned.

It should be noted that major cross-partner and cross-work package activity has been required for example i) planning infrastructural compatibility with the proposed engineering tool functionality, and ii) making provision to enable the selected applications for the engineering tools to be prototyped on laboratory test-rigs in the future.

2.7.2. Tasks progress

- **Task 7.1 - User requirements for system engineering and lifecycle support**

This task was completed by the end of month 12, and the initial results have been documented and submitted as deliverable 7.1 in March 2007.

- **Task 7.2 - Investigation of enabling technologies, methods and tools**

A comprehensive study was initiated to identify major enabling technologies and tools in the domain of applications engineering, relevant to the SOCRADES goals. The study has covered commercial applications and research studies (and their associated proof-of-concepts tools) in the focused domain.

As part of this task, the leading commercial application tools such as V-Sim, Unity and Delmia have been analysed and assessed based on a set of criteria that define the engineering capabilities of these toolsets from different functional perspectives. By the end of the first 12 months of this task, the results of this study are to be presented as deliverable 7.2, which will be submitted in September 2007. Significant contributions from SE and SAP have been received and further contributions are expected from APS, and PoliMi.

- **Task 7.3 - Application description and configuration**

This task started in month 3 by investigating the application engineering functionality necessary for the description and configuration of automation systems in the selected application domains. The provision of an engineering system capable of providing appropriate support for the modularity and configurability of such systems is of major importance together with the provision of predictable and appropriate real-time performance. Work is therefore progressing on a framework which will provide the ability to express, capture and reuse applications in the form of loosely-coupled functional components that can be held in a reuse library. The ability to effectively use and integrate existing engineering tools from vendors such as Delmia and Siemens/UGS has also been studied. Outline specifications for engineering tool functionality have been defined based on the industrial requirements captured in T7.1 and with reference to the WS capabilities being studied and realised in WP2 and WP5.

A number of meetings have been held with Schneider, ifak, and SAP to discuss and define a consistent approach to the specification of application functionality across the SOCRADES partners businesses. As a first stage in this process, a draft application description was created in July 2007 for a university-based powertrain test-rig specified by Jaguar for automotive assembly systems with other application domains to be described and documented as the project progresses. A major focus has been placed on defining the web-services required for the interconnection of engineering and embedded control system components throughout their lifecycle.

- **Task 7.4 - Simulation and verification**

In close coordination with above activity in task 7.3, work is progressing on the definition of required simulation and verification capabilities within the engineering toolset. The integration of modelling capabilities in both proprietary, e.g. Delmia Automation, and more open, e.g., VRML, forms is being considered and prototype implementations have been created for evaluation by both Loughborough University and Schneider Electric in particular. The initial practical focus of this work has been driven by meeting the simulation and verification needs of the laboratory test machine provided by Jaguar as detailed in task 7.3 above. Work is in progress towards the definition of a prototype application description and support methodology which will encompass system simulation and verification. This document and associated demonstrations are due to be delivered in month 18 of the project.

2.7.3. Deviations of the project work program (if applicable)

Due to the summer holidays, there have been some delays on contributions by the partners to deliverable 7.2. However, these delays are not expected to impact on the overall progress of the work package.

2.7.4. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type | Security | Due date | Actual date |
|----------|---|--------|--------------|-------------|----------|-----------|-------------|
| 7.2 | Investigation of Enabling Technologies, Methods and Tools | WP7 | Lboro | deliverable | CO | 31 Aug 07 | 27 Sept 07 |

| | | | | | | | |
|-----|--|-----|-------|-------------|----|-----------|-----------|
| 7.3 | The state of the art in device support and maintenance | WP7 | Lboro | deliverable | CO | 31 Aug 07 | 31 Aug 07 |
|-----|--|-----|-------|-------------|----|-----------|-----------|

2.7.5. List of milestones for the reporting period (if applicable)

Not applicable.

2.8. WP8 – Application pilots, demonstrators

2.8.1. Work package objectives, starting point of work

The main goals of WP 8 are:

- To set up application pilots for selected scenarios of the process industry as well as in the field of manufacturing automation
- To run trials and to test real world situations like automatic set-up and system start; device or system failure; plug & play situations; control failure; hard real-time conditions, staff failure; change of production volume, product type, quality requirements and delivery times, impact of lead times; as well as process monitoring, diagnostic and prognostic capabilities, ad-hoc networking, or service-oriented cross layer communication.
- Comparison with the performance of traditional process automation and control technology provided by the end-users and refinement of the application and demonstrator prototypes
- Evaluation and assessment of results

Starting point is scheduled for month 19.

2.8.2. Tasks progress

Although the activities in WP 8 are scheduled officially for the second half of the SOCRADES project duration, APS in cooperation with Schneider Electric and SAP have started to prepare the technical and technological platform for the mechatronic trials planned in WP8.

The preparatory work is progressing on basis of the SOCRADES integration concept developed within the project. In this context APS has started to implement DPWS technology into existing mechatronic devices like robots, sensors, and equipment selected for the trials. Focus has been given to install WebService-based networking requirements first on device-level.

In parallel wireless networking capabilities have been evaluated through extensive experimental work on different technologies like WLAN, ZigBee and nanoNet. Based on the evaluation results, first wireless communication lines based on WLAN technology have been implemented. They extend the wire-lined Ethernet communication infrastructure of the trial site. Currently wireless interaction between a robot system and process sensors is established. The systems are able to communicate bi-directionally with each other. Furthermore, in view of the cross-layer capabilities of the SOCRADES integration concept a basic functionality has been integrated to access the robots of the trial site also from external places. At the moment this functionality enables to access the robots from outside and to control any robot movement remotely via a force feedback joy stick and with support of visual information.

The activities to set-up the mechatronic trial site will be continued.

2.8.3. Deviations of the project work program (if applicable)

Not applicable.

2.8.4. List of deliverables for the reporting period (if applicable)

Not applicable.

2.8.5. List of milestones for the reporting period (if applicable)

Not applicable.

2.9. WP9 – Dissemination

2.9.1. Work package objectives, starting point of work

This WP is concerned with the dissemination and promotion of the project results. There are three major strands to the activity in this WP, scientific dissemination, industrial promotion and dissemination via centres and networks of excellence. This WP complements the key standardisation and roadmapping work being carried out in WP10. Several Meetings and phone conferences have been made as well as a good regular synchronization with WP10 is well established. International conference special sessions and workshops will be organised to promote SOCRADES with three major events of this type envisaged over the course of the project.

Dissemination of SOCRADES results are performed by the project partners through an active participation in fairs and conference. For a detailed and comprehensive list see section 4.

FlexLink is disseminating information via its network of sales units in 25 countries, by FlexLink News and by other publications, including professional journals. Jaguar Cars is including SOCRADES as a project of special interest in its Technology Cycle Plan (TCP), a five-year initiative beginning in 2005 to specify the requirements and identify future new control system technologies and methods.

2.9.2. Tasks progress

- **Task 9.1: Scientific, technical and general dissemination**

Dissemination, promotion and assessment activities are including the following:

- The innovations in the approach, design, and development of embedded service-oriented control and automation systems achieved in this project are the focus of PhD thesis developments at the research institution partners. For a detailed and comprehensive list see section 4.
- Publications dedicated to results of this project have been generated for presentation at international conferences or in journals. For a detailed and comprehensive list see section 4.
- Workshops and/or special sessions within international conferences were held. For a detailed and comprehensive list see section 4.

SOCRADES partners are currently members of the editorial board of world known IEEE and IFAC journals. Synergies to international Technical Committees and dissemination activities within those committees are being built.

- **Task 9.2: Industrial promotion**

Events specifically tailored to different audiences, e.g., in process automation, electrical distribution and manufacturing automation have been organized. For a detailed and comprehensive list see section 4.

The feedback received from these events is being used to assess industrial reaction to and the applicability of SOCRADES in diverse application sectors. It is foreseen that during this project a minimum of three such public events dedicated to the dissemination of SOCRADES in different countries in Europe will be organised.

2.10. WP10 – Exploitation, standards & roadmapping

Work package objectives, starting point of work

During the last months several activities according to the action plan for WP10 have been initiated, executed and finished. Main focus was on preparation of deliverables for Task 10.1 (Exploitation Plan), Task 10.2 (Standards) and Task 10.4 (Road-mapping). All activities were focused on the preparation of exploitation activities in particular to create good consistency and building an effective deployment of after-project results, define potential business plans and partner strategies and to derive a proper planning for both, dissemination and exploitation. Therefore the regular synchronization between WP10 and WP9 that have been already established during the last period of reporting has been maintained continuously.

2.10.1. Tasks progress

- **Task 10.1: Exploitation plan**

During the last 6 month the preparation of the first release of Exploitation Plan was major activity performed in this task.

A questionnaire among SOCRADES partners has been prepared and issued to partners where major sections are:

- Priorities in the scope of SOCRADES seen by the individual partner
- Application of SOCRADES technologies
- Potential individual activities in the area of dissemination and exploitation
- Individual profile of company/person interviewed

Several activities have been performed:

- Planning (schedule, reviews etc.) of preparation for deliverable 10.1a
- Questionnaire definition and review in close cooperation with WP9 (Dissemination) and Task 10.4 (Roadmapping)
- Publishing the questionnaire
- Performing the questionnaire internally
- Consolidation of partner feedbacks
- Identification and description of major priorities within deliverable D10.1a
- Description of Exploitation Plan Management
- Preparation of Deliverable

- **Task 10.2: Specifications for Standards**

Task leader has performed several actions to define the standardization path for SOCRADES technologies as it will be described in deliverable D10.2.

In fact since several working groups of external standardization bodies are already ongoing the major interest there is to introduce and to synchronize with SOCRADES technology. Some potential or ongoing standardization activities have been identified (e.g. OPC-UA, IEC 65 WG8).

These standardization activities around Web Service technologies and service-oriented architectures (SoA) are seen as most promising path to propose good consistency as well as to reduce risk of complex specifications for users and to allow efficient cooperation even within a competitive environment between partners.

- **Task 10.3: Road mapping for the adoption of the SOCRADES paradigm**

Task 10.3 was initially intended to develop a “Road map for the adoption of the SOCRADES paradigm”. Such task aimed at producing a document that could be able to help the consortium and potential users, in the adoption of SOCRADES results.

Nonetheless, while working on Task 10.3 some issues arose.

The first consideration was related to feasibility: it resulted to be quite hard to determine how to implement project results. This is mainly because, at such an early stage, even if the objectives of the project are perfectly defined, the exact details of final results are still to be exactly determined.

The second issue was related to exploitability: a valid roadmap shouldn't be only addressed to the SOCRADES project Consortium but should also be exploitable by each user of SOCRADES results and by other people working in the same field. Moreover the same European Commission could be positively affected by a Roadmap, that could warrant the possibility to have a better comprehension of the Embedded Systems future features. As a consequence, an auspicated characteristic of the roadmap should be its long term view on future advancement in technology, being able to give to the project not only a vision on how the results will be used, but also the identification of the limit of the developed technology. Therefore, the roadmap should propose and suggest the key enabling feature that will overcome the limit of SOCRADES itself.

These reflections led to the decision of slightly modifying the aim of Task 10.3 in order to develop a Technological Road map of the SOCRADES paradigm and the related technologies. (Such modification is also available on the DoW, 2nd phase). Because of such decision a revision of due dates for the completion of Task 10.3 was carried out. In fact the new vision requires some specific actions to be carried out to warrant best results. Such actions comprehend (but are not limited to) the organization of two workshops with technological and scientific experts coming both from project partners and from the international scene. For the reasons expressed above it was agreed among the partners that the Deliverable 10.4a will be ready by the end of Month 18, while D10.4b will be ready by the end of Month 24. It was also agreed among the partners that such actions will necessitate some efforts from many of them in order to be able to respect the new Roadmap focus.

Several meetings and phone conferences have been organized. Intermediate results and planned actions have been shared and agreed with partners during 3rd and 4th PCC meetings, Västerås (SWE), June 2007 and Seligenstadt (GER), September 2007.

2.10.2. Deviations of the project work program (if applicable)

See above T10.3 and Annex 1.

2.10.3. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type | Security | Due date | Actual date |
|----------|---|--------|--------------|-------------|----------|-----------|-------------|
| D10.1a | 1 st Release Exploitation Plan | 10 | SE | deliverable | CO | 30.8.2007 | 26.9.2007 |
| D10.2 | Specification for Standards | 10 | SE | deliverable | CO | 30.8.2007 | 26.9.2007 |
| D10.4a* | 1 st Release Roadmap for Adaptation of SOCRADES paradigm | 10 | POLIMI | deliverable | PU | 30.8.2007 | 28.02.2008 |

* See Annex 1.

2.10.4. List of milestones for the reporting period (if applicable)

| MS No. | Milestone name | Lead partner | Due date | Actual date |
|--------|--|--------------|----------|-------------|
| MS10.1 | 1 st release of Exploitation Plan | SE | M12 | M12 |
| MS10.1 | 1 st release of Roadmap* | SE | M12 | M18 |

* See Annex 1.

3. Consortium management (WP11 – Project management)

3.1.1. Work package objectives, starting point of work

This WP is concerned with ensuring that the project remains on course and that it is effectively and correctly managed. This includes the following detailed objectives:

- Monitoring, tracking and controlling deviations due to progress, costs, financial and scheduling changes.
- Managing the project according to approved plans.
- Ensuring that the required reporting is prepared and delivered in a timely manner.
- Implementing procedures for quality management.
- Implementing an administration and communication infrastructure to establish a basis for efficient and easy communication within the project. To also ensure that external communication (project Web site, dissemination and exploitation) is done and controlled by the project management.

3.1.2. Tasks progress

Task 11.1: Planning and scheduling (M0-M3)

Task finished.

Task 11.2: Progress and cost reporting (M0-M18)

The objective is to establish a clear reporting structure and processes to the European Commission and for the project activities within the project.

Activities performed in this task were:

- Provide templates for the reporting instances to all concerned participants
- Maintain a document repository for incremental reporting
- Create periodic reports
 - 3-Monthly Project Progress Report. It is an internal document to the consortium.
Remark: The PCC decided to skip this report due to the generated overhead.
 - 6-Monthly Project Progress Report. It is an official deliverable to the EU Commission. This report includes 6-monthly financial report based on the yearly financial report template that will be audited each year.

Task 11.3: Monitoring, control and quality management (M0-M18)

Progress control is being done on WP level by measuring resources and costs.

Activities performed include:

- Progress control
- Cost control
- Checking schedules and milestones
- Risk management
 - Identification of risks and risk management strategies for each WP (included as a part of the 6-monthly report)
 - Identification of risks and risk management strategies for the project as a whole (included as a part of the 6-monthly project report)
- Quality assessment for deliverables and WPs
 - Definition of the assessment procedure for each deliverable and for the assessment of work packages (included in the first version of the project handbook)

Task 11.4: Communication management and administration infrastructure (M0-M18)

To perform fast and effective communication in the project, different procedures and tools have been implemented.

3.1.3. Deviations of the project work program (if applicable)

Not applicable.

3.1.4. List of deliverables for the reporting period (if applicable)

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type* | Security | Due date | Actual date |
|----------|------------------|--------|--------------|------------|----------|----------|-------------|
| D11.2b | Project Report | 11 | SE | report | CO | 21.09 | 28.09 |

3.1.5. List of milestones for the reporting period (if applicable)

Not applicable.

4. Dissemination report

This section includes a cumulative overview of the project's undertaken dissemination activities for the reporting period (if applicable).

| Actual dates | Type | Type of audience | Countries addressed | Size of audience | Partner/Responsible involved |
|--------------|--|--|------------------------|------------------|------------------------------|
| March 2007 | 2 Presentations Brussels, Belgium | | European commission | | SAP |
| March 2007 | Presentation Brussels, Belgium | | European commission | | Schneider Electric |
| April 2007 | International newsletter on micro- nano integration | | International | | SAP, Schneider, ABB |
| May 2007 | Presentation entitled "SOA Middleware for Manufacturing, in Applications in Manufacturing and Industrial Monitoring and Surveillance" MORE Information day, Brussels | General public | Europe | - | TUT, Schneider Electric |
| June 2007 | Presentation Tampere Manufacturing Summit | General public Industry | Europe | 200 | Schneider Electric |
| June 2007 | Paper and presentation at the LANDAMAP 2007, Cardiff | Research, Industry, General Public | International | | Schneider Electric |
| June 2007 | Conference | Research and Industry | International | 250 | Polimi |
| July 2007 | Presentation | Industry (Process Automation), ZVEI AK KfA | Germany | 23 | ifak |
| July 2007 | Paper | The International Journal of Manufacturing | International | | Schneider Electric, Lboro |

| | | | | | |
|-----------|---|---|---------------|----|--------------------|
| | | Technology and Management (IJMTM) INDERSCIENCE PUBLISHERS | | | |
| July 2007 | Paper and presentation at the 3 rd IPROMS Virtual Conference | Research, Industry, General Public | International | | Schneider Electric |
| July 2007 | Paper and presentation at the 5 th IEEE INDIN Conference | Research, Industry, General Public | International | | Schneider Electric |
| July 2007 | Conference ICPCA 07, Birmingham, UK. | | International | | SAP |
| Aug 2007 | Presentation/Speech EPSRC Conference AgentcitiesUK.net | Higher education Research Groups | Bath, UK | 40 | Lboro |

Table 1 Dissemination of knowledge – Overview

4.1. Training activities

| Planned/ Actual dates | Description | Type of audience | Countries addressed | Size of audience | Partner/Responsible involved |
|-----------------------------|--------------------|---|---------------------|------------------|------------------------------|
| Sèvres, 23-25 January, 2007 | DPWS Java Training | Higher education Industrial Sectors Research Groups | All partners | 10-15 | Schneider Electric |
| Grenoble, 6-8 March, 2007 | DPWS C Training | Higher education Industrial Sectors Research Groups | All partners | 10-15 | Schneider Electric |

4.2. Planned activities for the next period

| Planned | Type | Type of audience | Countries addressed | Size of audience | Partner/Responsible involved |
|------------|---|---|-----------------------|------------------|------------------------------|
| Sept 2007 | Presentation Paper submission 4th International Conference on Responsive Manufacturing | Higher education Industrial Sectors Research Groups | Nottingham, UK | 50 | Lboro |
| Sept 2007 | Presentation Paper submission 4th International Conference on Responsive Manufacturing | Higher education Industrial Sectors Research Groups | Nottingham, UK | 50 | Lboro |
| Sept. 2007 | Book: Holonic and Multi-Agent Systems for Manufacturing. 3 rd International Conference on Industrial Applications of Holonic and Multi-Agent Systems HoloMAS 2007. Springer Verlag Series LNCS | Research, Industry, General Public | International | | Schneider Electric |
| Sept. 2007 | Paper and presentation at ETFA 2007, Patras, Greece | Research, Industry, General Public | International | | Schneider Electric |
| Sept. 2007 | Presentation | Industry (Automation), Research, DFAM | Germany | ca. 20 | ifak |
| Nov 2007 | Presentation/ Keynote Speech in International Exhibition & | Higher education Industrial Sectors Research Groups | Nuremberg, Germany | 200 | Lboro |

| | | | | | |
|-----------|---|---|-----------------------|-----|--------------------|
| | workshop atp international Workshop at SPS/IPC/DRIVES | | | | |
| Nov 2007 | Paper and Presentation at SPS/IPC/DRIVES | Higher education Industrial Sectors Research Groups | Nuremberg, Germany | 200 | Schneider Electric |
| July 2008 | 2 Papers and presentations for IFAC World Congress 2008, Seoul, Korea | Higher education Industrial Sectors Research Groups | International | | Schneider Electric |
| July 2008 | Paper and presentation for IFAC World Congress 2008, Seoul, Korea | Higher education Industrial Sectors Research Groups | International | | ifak, Siemens |
| July 2008 | Paper and presentation for IFAC World Congress 2008, Seoul, Korea | Higher education Industrial Sectors Research Groups | International | | Lboro |

Note: For a complete dissemination plan, please see D9.1 (Month12).

5. Standardization and IPR report

This section includes a cumulative overview of the project's undertaken standardization activities for the reporting period (if applicable).

See D10.2

6. Exploitation report/Report on using and disseminating of knowledge

Refer to D10.1a.

This section includes a cumulative overview of the project's undertaken exploitation activities for the reporting period (if applicable).

| Exploitable knowledge (description) | Exploitable product(s) or measure(s) | Sector(s) of application | Timetable for commercial use | Patents or other IPR protection | Owner & Other Partner(s) involved |
|-------------------------------------|---|--------------------------|---|---------------------------------|-----------------------------------|
| | Not applicable of this stage of the project | | Not applicable of this stage of the project | no | |

Table 2 Exploitable knowledge - Overview

6.1. Planned activities for the next period

Refer to D10.1a. (it contains a schedule of the planned exploitation activities until the end of the project)

7. Financial report and allocation of resources for the reporting period

A financial overview about the 6-months period is to be provided as the Yearly Report D11.3 (Due Month 13).

8. Risk management

This section addresses key risks that have been identified for the whole project and summarizes the main risks related to each work package (if applicable), concerning the current face of the project life cycle.

8.1. Risk analysis at project level (Project Coordinator)

| Description of Risk | Consequences and Seriousness | Risk evaluation (H/M/L) | Response actions | WP No | Undertaken actions from the last 6M report |
|--|---|-------------------------|---|-------|--|
| Delay in getting feedbacks for compiling and assessing the deliverables. | The deliverables have been submitted to the EC within the 45 days | M | Not applicable | 11 | Not applicable |
| The framework specified in M1 has not completely been understandable by all partners | Integration of some individual work package-oriented results is difficult | H | Set up of series of technical workshops | 11 | Increased number of bilateral meetings |

8.2. Risk analysis per WP (WP Leaders)

| Description of Risk | Consequences and Seriousness | Risk evaluation (H/M/L) | Response actions | WP No | Undertaken actions from the last 6M report |
|---|--|-------------------------|--|-------|--|
| D1.1 (reviewers request to keep the document a living one throughout the whole project duration) | Low | L | Task 1.3 (D1.3) is intended to care about trend screening. (request is covered by Task 1.3, not a subject of Task 1.1) | 1 | n.a. |
| D1.2 (reviewers request to cluster and prioritize requirements in a common document) | Medium | L | Work in progress | 1 | n.a. |
| Technically too ambitious architecture | Lower level research results | L | Valid fall back option | 3 | n.a. |
| Incompatibility with other WPs, especially WP 4 | Stand alone WP | M | Meeting with WP 4 in Sept. 2007 | 3 | Cf. "Response actions" |
| Solution not demanded by the market | The corresponding research was "pure hobby". | L | Work out of a valid trend and state of the art analysis | 3 | Strong Del. 03-1 (Analysis) |
| WS not reasonably applicable on sensor level | SOA not reaching the sensor actuator level | H | Architecture for WS on Gateway level | 3/4 | Cf. response actions |
| Development of standalone components without considering integration in larger prototypes | Project-wide Integrated prototypes will be difficult to realise | M | Involve all partners when defining services, interfaces and possible interactions of components | 6 | Regular WP6 Conference calls to discuss advances |
| Delays in compilation of D7.2 (Investigation of Enabling Technologies, Methods and Tools) report due to summer vacations | Delayed deliverable | M | Loughborough to cover this will additional resources to compile any outstanding sections | 7 | No action required |
| Insufficient Dissemination | Failure to achieve a widespread diffusion of the project results | Medium to Low | Provide a valid Dissemination Plan and follow it | 9 | n.a. |
| Results later than scheduled | Exploitation activities may impacted | M | Regular review of work package planning and | 10 | Exploitation Plan management description |

| | | | define action plan if necessary | | defined by D 10.1a |
|--|--|---|--|----|--|
| Competition vs. common exploitation of SOCRADES technologies | Individual business interests may lead to unsuccessful exploitation of results | M | Early preparation and share of common activities, Regular reviews with industrial partners of exploitation plan and related actions | 10 | Survey done and identification of priorities to derive complementary actions |

Table 3 Risks analysis

9. Quality management

This section summarizes the results of the quality assessment activities undertaken during this reporting period. As described in Annex 1 of the project plan, the deliverables as well as the work packages status are monitored and assessed.

9.1. Quality Assurance for Deliverables finished during the current period

9.1.1. Used procedure

Each deliverable is sent out by the WP Leader (responsible) to the selected reviewers and contributors for their comments and remarks. After that a call or face-to-face meeting takes place to assess the deliverable and go through the eventual comments for resolution. The following lines from the deliverable's template reflect the approval of the document.

9.1.2. Results of the assessment of deliverables for the current period:

Deliverable 1.1 (revised):

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.09.2007 |
| Suggested improvements: | No suggested improvements | | |

Deliverable 1.2 (revised):

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.09.2007 |
| Suggested improvements: | No improvements suggested. | | |

Deliverable 2.1 (Official Draft):

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.09.2007 |
| Suggested improvements: | No improvements suggested | | |

Deliverable 2.2:

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 11.06.2007 |
| Suggested improvements: | No remarks | | |

Project Milestone report (M1):

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.09.2007 |
| Suggested improvements: | No improvements suggested. | | |

Deliverable 3.1:

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 19.07.2007 |
| Suggested improvements: | No remarks | | |

Deliverable 4.1:

| | | | |
|-------------------------|---|-------|------------|
| Peer review approval : | <input type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) <input checked="" type="checkbox"/> Assessment pending | Date: | 26.09.2007 |
| Suggested improvements: | Pending for assessment (document delivered 2 days before the PCC meeting). Assessed version will be delivered by October, 15 th | | |

Deliverable 6.2:

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.09.2007 |
| Suggested improvements: | Execute summary and Conclusions sections will be revised. | | 27.09.2007 |

Deliverable 7.2:

| | | | |
|------------------------|--|-------|------------|
| Peer Review Approval: | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified above) | Date: | 26.09.2007 |
| Presentation Comments: | Revision of section 11 (SAP). Check the figures. | Date: | 27.09.2007 |

Deliverable 7.3:

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.09.2007 |
| Suggested improvements: | No improvements suggested. | | |

Deliverable 9.1 (M12 revised)

| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 27.09.2007 |
| Suggested improvements: | Approved with the condition to be completely reconstructed following the recommendations of the EC. | | |

Deliverable 10.1a

| | | | |
|-------------------------|--|-------|-----------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.9.2007 |
| Suggested improvements: | | | |

Deliverable 10.2








| | | | |
|-------------------------|--|-------|--------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | [26.09.2007] |
| Suggested improvements: | | | |




Deliverable 11.2b






| | | | |
|-------------------------|--|-------|------------|
| Peer review approval : | <input checked="" type="checkbox"/> Approved <input type="checkbox"/> Rejected (improve as specified hereunder) | Date: | 26.09.2007 |
| Suggested improvements: | Project Coordinator sections to be revised. | | 28.09.2007 |

9.1.3. Summary

In the following table, the current situation of the deliverables is reported

| Del. no. | Deliverable name | WP no. | Lead partner | Del. type* | Security | Due date | Actual date | Status    5 | Approval Project Coord. (date) |
|----------|---|--------|--------------|------------|----------|---------------------------|-------------|---|--------------------------------|
| 1.1 | State of the art (revised) | 1 | ifak | report | CO | 31.08.07 (revision) | 26Sept07 |  | 28Sept2007 |
| 1.2 | Requirements of end users and component vendors/system integrators (revised) | 1 | ifak | report | CO | 31.08.07 (revision) | 26Sept07 |  | 28Sept2007 |
| 2.1 | Framework specification for device-level service platform | 2 | TUT | report | CO | 31.08.07 (official draft) | 26Sept07 |  | 28Sept2007 |
| 2.2 | Specification of service gateways for non-service enabled devices | 2 | TUT | report | CO | 30.04.07 | 14June.07 |  | 14June.07 |
| 3.1 | Report on Trend Analysis and Requirements for Wireless Sensor/Actuator Networks | 3 | Siemens | report | CO | 31.05.07 | 19July07 |  | 19July07 |
| M1 | Specification of the service-oriented infrastructure | | TUT | report | CO | 31.08.07 | 13Sept07 |  | 28Sept2007 |
| 4.1 | Architecture for fault-tolerant application interaction | 4 | ABB | report | CO | 31.08.07 | 27Sept07 |  | 28Sept2007 |
| 6.2 | Integration concept of non Web Service enabled devices | 6 | SAP | report | CO | 31Aug07 | 28Sept07 |  | 28Sept2007 |
| 7.2 | Investigation of Enabling Technologies, Methods and Tools | 7 | Lboro | report | CO | 31Aug07 | 26Sept07 |  | 28Sept2007 |
| 7.3 | The state of the art in device support and | 7 | Lboro | report | CO | 31Aug07 | 30Aug07 |  | 28Sept2007 |








- 5
-  = Deliverable assessed
 -  = Deliverable in pending assessment
 -  = Deliverable not ready

| | | | | | | | | | |
|--------|---|----|--------|--------|----|---------------------|----------|---|------------|
| | maintenance | | | | | | | | |
| 9.1 | Dissemination plan (2 nd release) | 9 | Polimi | report | CO | 31.08.07 (revision) | 26Sept07 |  | 28Sept2007 |
| 10.1 a | Exploitation Plan, 1 st release | 10 | SE | report | CO | 31Aug07 | 26Sept07 |  | 28Sept2007 |
| 10.2 | Specifications of standards | 10 | SE | report | CO | 31Aug07 | 26Sept07 |  | 28Sept2007 |
| 10.4 a | Roadmap for the adoption of the SOCRADES paradigm | 10 | Polimi | report | PU | 31Aug07 | 28Febr08 |  | 28Sept2007 |
| 11.2 b | Project report | 11 | SE | report | CO | 31Aug07 | 28Sept07 |  | 28Sept2007 |




9.2. Quality Assurance of Work Packages

The work package progress is monitored by the status of its corresponding deliverables and milestones.

9.2.1. Work Package Quality Status Overview

| WP No. | WP stage OPEN MS CLOSE ⁶ | Milestone number (if milestone) | Due date | Actual date | Status    7 | Corrections actions (in case if the status is yellow or red) | Approval Project Coord. (date) |
|--------|--|--|------------|-------------|---|--|--------------------------------|
| WP1 | OPEN | | | | | | 28Sept07 |
| WP2 | MS | M2.2 | April 2007 | April 2007 |  | | 28Sept07 |
| WP3 | MS | M3.1 Report on trend analysis and requirements | May 2007 | June 2007 |  | | 28Sept07 |
| WP4 | OPEN | | | | | | 28Sept07 |
| WP5 | OPEN | | | | | | 28Sept07 |
| WP6 | OPEN | | | | | | 28Sept07 |
| WP7 | OPEN | | | | | | 28Sept07 |
| WP8 | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| WP9 | OPEN | | | | | | 28Sept07 |
| WP10 | MS | M10.1 (Exploitation Plan) | Aug 2007 | Aug 2007 |  | | 28Sept07 |
| WP10 | OPEN | M10.1 (Roadmap) | Aug 2007 | Febr 2008 |  | See Annex 1 | 28Sept07 |

⁶ OPEN = See Project Handbook
MS = See Project Handbook
CLOSE = See Project Handbook

⁷  = Stage reached without corrective actions
 = Stage reached with some corrections
 = Stage did not reached

| | | | | | | | | |
|------|------|--|--|--|--|--|--|----------|
| WP11 | OPEN | | | | | | | 28Sept07 |
|------|------|--|--|--|--|--|--|----------|

10. Clarification Given on Comments & Recommendations Made by the Reviewers (Project Coordinator's level)

Although the majority of the PCC members were participating in the first 6-months EC Review Meeting and they remembered some issues discussed in Bruxelles, the Official MoM with all data of that meeting was issued on August 27th, received by the Coordinator on Sept 3rd and distributed to the consortia on September 4th. It means 1 month before the Review Meeting. This implies that the consortia had no enough time to react to all recommendations.

Note: The Project PCC agreed in requesting the EC for shorter delivery time for MoMs of the next EC Review meetings.

In the following paragraphs the consortia addresses those comments and recommendations that can be easily answered at the moment. The rest will be processed during the next 6 months and addressed in the next 6-monthly Progress Report.

Note: Recommendations (in green: Listed during the review; in red: Not explicitly asked during the Review)

Proposed answers:

- *Recommendation 1: elaborate in more detail on what is the precise SOCRADES innovation*

→ Apply WS at the device level technology (today a "proof of concept" only) into industrial automation: Complete infrastructure, prototype device and components, gateways, links to business application implementations, decision and engineering systems, wireless and wired networks, demonstrators, standardization, ... – one slide for the next review. D2.1 addresses all the innovative aspects.

- *Recommendation 2: assign a partner of occupying the role of the project's system integrator*

→ The technical manager addresses the topics common in different applications. For each dedicated application, one partner is in charge of integrating this application (domain expert) in link with the technical manager. E.g., at this moment, the partner TUT is identified in this role for the electronics assembly domain and the partner Lboro for car manufacturing domain.

- *Recommendation 3: a software engineering approach to tie all the SOCRADES software activities is to be agreed upon*

→ To be addressed later on, requesting clarifications from the reviewers.

- *Recommendation 4: cluster and prioritize requirements into one document*

→ WP1 leader provided a complete table from all specification deliverables. The partners will review this table (consistency work required and prioritization): it will be part of Project Milestone 2 - M18 (requirements consistent with D2.1 specifications).

- *Recommendation 5: revise deliverables as outlined*

D1.1 additions required – living document → DONE

D9.1 dissemination plan – considerable revision required (dissemination mantras) → A revision will be available for the review, but a strong restructuration work has to be done for next following review: objectives, major events (not only a list of events).

- *Recommendation 6: define a simple fictive example to discuss and clarify the mapping between business process and hierarchical services down to sensors and actuators, implementing at least two hierarchical control levels (including feedback, logic and sequential control)*
- Posters of real scenarios will be presented at the Review. We will apply the framework specifications to model two of these scenarios and to break it down in services.
- *Recommendation 7: though out of the scope of this project, the ideas of batch control (see IEC61512-I) with the unit-independent master recipe and the unit-associated control recipe could give some hints on how to define unit-independent and hence re-configurable services at higher levels; some extensions, which are applicable also to continuous processes, are contained in the resource management chapters of the former project IFATIS (EU-IST-2001-32122)*
- WP4 should investigate it and propose an answer for continuous process. Should also be looked at for our general control framework? And ask directly the reviewers what they want.
- *Recommendation 8: before conducting experiments with the software the validation procedures and performance measures to be applied in these experiments have to be considered ; among others, a realistic testing scenario involving sensors and actuators and its connecting networks to validate the concept of SoA; the sooner this is done the better It can help to streamline the efforts in wp3)*
- WP2, 5, 7 and 8. Already in the deliverables. WP2 Leader will propose an answer.
- *Recommendation 9: provide paper copies of PPT presentations used at review meetings*
- OK

11. Contractual Matters (Project Coordinator's level)

Change of partner No 5 (Flexlink). It should be officially performed after the last PCC Meeting (26.09.2007).

Annex 1: Deviations of the project work program, WP10, Task 10.3, Deliverable D10.4a**Annex 2: CD-ROM with deliverables produced during the reporting period (Project Coordinator's Level)**

It will be distributed during the next EC Review meeting

Appendices (Cost and Effort Reporting)

It will be delivered as a separate deliverable D11.3 to the EC and its contents will be presented during the next EC Review Meeting.

Seligenstadt, 26th September 2007

Milan, 26th September 2007

Dear Sirs,

the present letter is to clarify the evolution of Task 10.3 (and related Deliverable 10.4a) in order to address new opportunities identified during the development of the assignment.

Task 10.3 was initially intended to develop a "Road map for the adoption of the SOCRADES paradigm". Such task aimed at producing a document that could be able to help the consortium and potential users, in the adoption of SOCRADES results.

Nonetheless, while working on Task 10.3 some issues arose.

The first consideration was related to feasibility: it resulted to be quite hard to determine how to implement project results. This is mainly because, at such an early stage, even if the objectives of the project are perfectly defined, the exact details of final results are still to be exactly determined.

The second issue was related to exploitability: a valid roadmap shouldn't be only addressed to the SOCRADES project Consortium but should also be exploitable by each user of SOCRADES results and by other people working in the same field. Moreover the same European Commission could be positively affected by a Roadmap, that could warrant the possibility to have a better comprehension of the Embedded Systems future features. As a consequence, an auspicated characteristic of the roadmap should be its long term view on future advancement in technology, being able to give to the project not only a vision on how the results will be used, but also the identification of the limit of the developed technology. Therefore, the roadmap should propose and suggest the key enabling feature that will overcome the limit of SOCRADES itself.

These reflections led to the decision of slightly modifying the aim of Task 10.3 in order to develop a Technological Road map of the SOCRADES paradigm and the related technologies. (Such modification is also available on the DoW, 2nd phase). Because of such decision a revision of due dates for the completion of Task 10.3 was carried out. In fact the new vision requires some specific actions to be carried out to warrant best results. Such actions comprehend (but are not limited to) the organization of two workshops with technological and scientific experts coming both from project partners and from the international scene. For the reasons expressed above it was agreed among the partners that the Deliverable 10.4a will be ready by the end of PM18, while D10.4b will be ready by the end of PM24. It was also agreed among the partners that such actions will necessitate some efforts from many of them in order to be able to respect the new Roadmap focus.

Marco Taisch
Politecnico di Milano
T10.3 responsible

Ralf Neubert
Schneider Electric
WP10 responsible

Armando Walter Colombo
Schneider Electric
Project Manager
