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Thematic Priority:  
SIXTH FRAMEWORK PROGRAM



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 11.2c, M2 (1<sup>st</sup> Part)**

### **Project Report**

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

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<sup>1</sup> See p.6 for explanation of Dissemination Levels

### Status Description:

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<sup>2</sup> As defined in the DoW

<sup>3</sup> Scheduled date for approval

<sup>4</sup> A list of company short tags can be found in DoW

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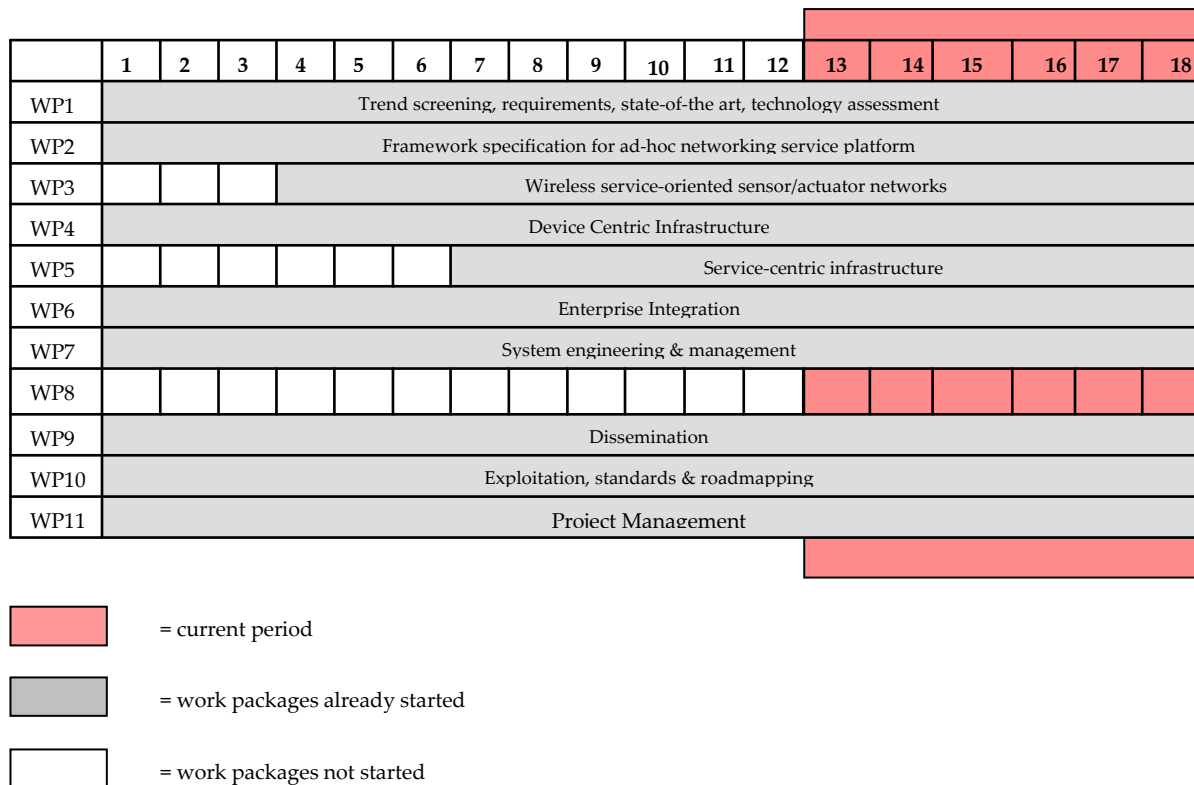
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**Dissemination Level:**

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 third 6-monthly reporting period (September 2007 until February 2008). It is based on the Guidelines for preparing project reports for FP6 (<http://cordis.europa.eu/fp6/find-doc-management.htm#reporting>).



**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 the Technical Workshops held in conjunction with PCC meetings, as well as the recommendations of the evaluators after the first 6-monthly and first year EC Review meetings, the following main objectives have been addressed in this period:

- SOCRADES General Framework specification (first project milestone) and Consolidation of the First Period (18 months) results and Exploitation Plan (second project milestone).
- Screening of the major RTD values addressed in SOCRADES, against the background of the current market and competition state, as documented in current public reports.
- First specifications and developments of the necessary steps for demonstrating the innovation aspects of the SOCRADES related technologies:
  - Improvement and modularization 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 formal (Petri Net-based) modeling 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.
- Dissemination of SOCRADES in international events concerning different Framework Programs like International IMS (Zürich, 2007), Manufuture'07 (Porto, 2007)
- First external demonstration of project developments/results. Participation of SOCRADES in the ITEA2 Fair (Berlin, 2007).
- Finalization and delivery of a consortium internal and external roadmap and exploitation plan.
- Initiating the first actions for conducting standardization activities.
- Completion and delivery of the SOCRADES Annex 1 (2<sup>nd</sup> 18 months-period)

From the management point of view, the project consortium's situation, i.e., legal and financial aspects, was stabilized.

### ***1.2. Short evaluation of the status achieved & lessons learned***

The project's first yearly milestone (SOCRADES Framework Specification) has been reached and positively evaluated by external experts.

The project's second milestone has also been reached with the present report, which confirms the positive evaluation results of the 1<sup>st</sup> year EC review meeting. This status is particularly showing the commitment of the individual partners but also the high degree of integration of work reached within the consortium.

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, situation that is confirmed by a big amount of invitations to participate in International Events that the partners started to receiving during the last months, mainly events oriented to define RTD-programs for the next 10-15 years (in the EU, USA, Japan, Korea, etc).

"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 during the first year. The deadline to conclude the first version of the Roadmap was extended to the end of the 1<sup>st</sup> 18-months-period and the result is now being submitted as (D10.4a). As a matter of fact, it was impossible to define a roadmap for the adoption of a paradigm, as long as the necessary technology roadmap does not exist. At this moment, the technology roadmap has been finished and the consortium is starting activities in order to get an improvement of the roadmap by getting inputs from SOCRADES external experts/institutions.

Although the partner FlexLink Oy was replaced by FlexLink Components AB, action that required additional and not planned before management activities, i.e., amendment of SOCRADES Consortium Agreement, amendment of the EU contract, the consortium reached a stable structure and a fruitful cooperative atmosphere.

This change of partners is also showing a very dynamic consortium structure and of course it shows that a 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 mainly being performed in a collaborative manner by the major players/ stakeholders of the automation value chain.

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### **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.

Although the project was running its 1<sup>st</sup> year, the strong commitment of the partners allowed the development of a first set of early SOCRADES prototypes and demonstrators. This set of 1<sup>st</sup> demonstrators was shown in the 1<sup>st</sup> year EC review meeting and one of them was presented in the ITEA2 fair in Berlin (October 2007). The generation of the demos has been very useful to address the integrative aspects (technological and organizational) of the project, aspects that are very hard to manage in the kind of heterogeneous consortium and particularly due to the partnership between world-wide competitors.

One difficult matter that arose in the last 6-month period was the improvement of the SOCRADES Annex1 adapting the original version (1<sup>st</sup> 18 months-plan) to the 2<sup>nd</sup> 18 months-period. Two special days were scheduled for consortial meeting associated to two PCC meetings (Seligenstadt, September 2007, and Milano, December 2007). With 5 months delay according to the original plan, the consortium was able to deliver the final (agreed by all partners) version of the DoW-Annex I for the second period and it has been accepted by the EC.

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. SOCRADES partners have started speaking about a possible SOCRADES result called DPUA. The topic has been discussed during the last four 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 WP3, WP4 and 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. The success is world-wide recognized by an Award for a Best Paper at the IEEE Int. Conf. on Emerging Technologies and Factory Automation (ETFA'07) in Patras, Greece. 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 the Loughborough University and Schneider Electric that was carried out from the very beginning of the project. The success of the work performed till now is shown by an official invitation that Jaguar/Ford/SE got for demonstrating first results in the MACH'08 fair to be held by the end of April 2008 in the UK.

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

Due to (Flexlink) company internal strategy, Flexlink Automation Oy (Finland) withdrew its SOCRADES partnership and Flexlink Components AB (Sweden) joined the consortium assessing the SOCRADES CA and the SOCRADES EC Contract.

#### **Management matters:**

- 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 after the 1<sup>st</sup> 6-month EC review meeting (following the recommendations of the experts), 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.
- In the PCC, it was decided to incorporate into the deliverable "6-monthly project 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 coordination and the partners.
  - A special case has been the participation and the reporting of the partner ARM (UK). This partner is working with a high degree of commitment and its contributions to the different deliverables are completely in accordance with the plans. Nevertheless, the official reports about allocation of resources and funding-consuming is not showing the real scientific and technical involvement of this partner. This issue was identified and explicitly addressed by the EC and the external experts during the 1<sup>st</sup> year EC review meeting. Although the PC addressed the issue in synchronization with the partner, the situation is not completely solved yet.
- After receiving the EC evaluation of the 1<sup>st</sup>-year finance reports and audits, which did not address any special/particular issues, the coordinator got the 2<sup>nd</sup> part of the EC funding transferred into its SOCRADES bank account. The distribution of the money among partners has already started.

#### 1.4. Next Steps

##### Technical steps:

- Continuing major developments based on the framework specification addressed in Project Milestone 1.
- Implementation of the early prototypes.
- Demonstrators during the second year.
- Actualization of the exploitation plan.
- Actualization of the roadmap, but focusing explicitly on the SoA technology.

##### Management steps:

- Complete the transfer of the 2<sup>nd</sup> EC funding
- Preparing the 18-months EC review (already scheduled for June 17-18, 2008 in Lulea, Sweden)
- Start necessary legal actions to proceed replacing Flexlink Components AB with a new partner
- Start necessary legal actions to proceed replacing Jaguar Cars with another Ford-associated company.

#### 1.5. Analysis of the effort Consumption

##### Contents of the report after 1 year project:

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.

##### Report from the last 6 months

- The audits and the D11.3 were delivered to the EC. It did not address any special/particular issues.
  - There is still an unsolved issue detected and addressed by the coordinator during the 1<sup>st</sup> year EC review meeting, i.e., the extremely lower consumption of efforts reported by the partner ARM. Unfortunately, this report of efforts does not reflect (at all) the very good commitment and involvement of the partner in the scientific and technical works.
-

## 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;

The 12M EU Review meeting took place in M14 in Nuremberg, where the reached results and early prototypes for activities related to WP2, 5- 7 were demonstrated. With SAP a demonstrator has been prepared showing the integration of a mechatronic component and a wireless temperature sensor in an SAP xMII and Web application. A second demonstrator showed the approach of PN-based coordination with a graphical tool allowing for design, validation of structural and behavioural specifications and for simulation. Along with that a first glance was given to where decision support by intelligent systems is needed in the task around orchestration. A last demonstrator was only provided by video, showing the integration of real and virtual Web Services with DelmiaV5 simulation tool and a real FlexLink module.

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

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.

#### 2.1.1. Tasks progress

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

Work on Task 1.1 was finished at the beginning of this reporting period.

The work started within reporting period 1. The results of this work were documented within D1.1, which has been submitted in advance to the first iterim 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 and submitted to the Commission in advance to the first Review Meeting in October 2007. D1.1 became accepted by the reviewers.

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*

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

During this review, comments raised 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

was delivered for the first Review Meeting in October 2007. Further on work on clustering was done with the target to provide a complete list of SOCRADES requirements for the Milestone 2 deliverable. At the end of this reporting period this requirements list has been distributed to the PCC for final approval.

### ***Task 1.3: Trend screening and self-evaluation***

Work on Task 1.3 has been continued during the actual reporting period. This work is dedicated to the continuation of the work on state-of-the-art analysis as started within Task 1.1 throughout the overall project duration. Results of this work were documented within D1.3, which has been submitted to the Commission in January 2008.

D1.3 is structured into 8 sections, each of them dedicated to another technological field. Each section is related to a single section of D1.1 and its Annex.

Section 1 is aimed at providing an update of the state-of-the-art and trend description on middleware concepts and solutions followed by section 2 providing the latest trends on agent-based control. The deliverable proceeds with the trends in service oriented architectures (section 3) to update the common understanding of the subject to the entire project team. Whereas section 4 is dedicated to the trends in networked control (related to WP4), section 5 describes the progress discovered in wireless technologies and sensor networks. Section 6 describes what is going on related to device profiles. The last two sections of this deliverable describe the ongoing trends in engineering of distributed systems and business process integration.

The structure of each chapter is first introduced by an overview of the technical progress discovered related to the selected technology, followed by a description of the progress and its relation to the SOCRADES approach. Finally the relevant references are provided.

Deliverable D1.3 is a collection of contributions from the experts involved in the project distributed across the different work packages. It shows therefore an update of the state of the art at the current stage of the project. This deliverable is passed back to the technical WPs as well as to the project management to support supervision and evaluation of the projects progress.

### **2.1.2. Deviations of the project work program (if applicable)**

Work on WP1 is in line with the current planning. Updates of D1.1 and D1.2 have been submitted in line with the decisions made at the first iterim Review Meeting.

### **2.1.3. List of deliverables for the reporting period (if applicable)**

Del. no.	Deliverable name	WP no.	Lead partner	Del. type	Security	Due date	Actual date
D1.3	Trend screening report 1	1	ifak	Report	CONFIDENTIAL	M15	14.01.2008

### **2.1.4. List of milestones for the reporting period (if applicable)**

Not applicable

### **2.1.5. Meetings attended (if applicable)**

Meeting Title	Objectives/ Results Achieved	Date	Place
PCC and Workshop		25.-26-09.2007	Seligenstadt
Review Meeting		08.-09.10.2007	Nuremberg

ifak-SAP demonstration	Requirements on demonstration SOCRADES results on legacy device integration	29.11.2007	Karlsruhe
PCC and Workshop		11.- 12.12.2007	Milan
PCC and Workshop		10.- 11.03.2008	Aachen

### 2.1.6. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
D1.4: Trend screening report 2		M24	

## 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 was to provide a set of specifications that will define the service-oriented infrastructure that would be used to implement all interactions between SOCRADES components.

The tasks that were active during the reporting period, their respective main objectives and starting points, are:

- Task 2.2: specify a service orchestration framework which provides machine-readable description of the conversations that a service supports. By the end of the previous reporting period, a service orchestration framework highly modular and covering all potential scenarios has been introduced.
- Task 2.3: specification of a framework for implementing management functionality based on WS-Management – initiated in the end of the previous reporting period (M12).
- Task 2.4: specification of a framework for implementing a lightweight service-oriented agent system. By the end of the previous reporting period, there was introduced an approach to semantically describe 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.

In 28-29 January 2008 (Tampere, Finland) the partners hold a meeting dedicated to the technical and managing issues of the WP2. SE, Siemens, PoliMi, Lboro, SAP, LTU and TUT were presented at the meeting. There were discussed the approaches proposed in tasks 2.2, 2.3 and 2.4, partners came to common decisions and compromising solutions. Schedule for finalizing D2.1 was agreed.

By the end of the reporting period (M18) WP2 was concluded as it was planed in accordance to SOCRADES schedule. The deliverable 2.1 “Framework specification for the device level service platform” was completed and submitted at time - for internal review (contributors and PCC members) on February 19th 2008, the approved deliverable was sent to Project Coordinator 27 February 2008.

Although, the WP was concluded, the dissemination of its materials and results is coming in the next reporting period.

### 2.2.2. Tasks progress

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

The task was concluded M12 and was not active in the reporting period.

The task was summarized for final version of D2.1 with main contribution of SE.

### *Task 2.2 – Service orchestration framework*

Architecture for Service Orchestration was introduced (TUT, SE). The definition of the architecture was aimed to identify main components such as the Orchestrator tool chain, service oriented middleware and, Orchestration Engine which is also the part of middleware - their functions and also their scope was defined. Service composition and validation of the system using High-Level Petri Net (HLPN) models and an alternative method known as Timed Net Condition/Event Systems (TNCES) was proposed as the approach for Modelling and analyzing the services and their compositions. The service orchestration framework is responsible for the control and coordination of distributed services that is suitable and applicable to different application domains addressing requirements for flexibility and reconfigurability. TUT has initiated a basic demonstrator to show dynamic invocations and discovery of Web-services with a use of DPWS and direct communications at SOAP level, the work is related to WP5.

From Schneider perspective an approach has been investigated that uses formal representations for the structural and behavioural specifications of a production system allowing for composition of components to systems, validation and analysis of the system specifications. First prototypes of models have been implemented for flexible and reconfigurable manufacturing system, in which particularly problems of material flow specifications are dealt with. Schneider as a control vendor proposes to implement a device-level orchestration engine allowing for synchronized operation of the device's services.

Based on the Service orchestration framework proposed by TUT, APS has developed a first conceptual strategy how to transfer these ideas and concepts of service orchestration into application within the mechatronic trials planned in WP8. The work was related to T2.3. Baseline for the service deployment are functional and operational elements (called macros) which are derived from the work of robots and mechatronic devices in manufacturing automation environments. The orchestration of services is planned to be carried out in consideration of XML-based configuration and commissioning trees, by use of an icon-based work flow editor, and through interaction with a knowledge-base containing all macros as functional building blocks to execute the defined work order. The implementation of this orchestration concept is under development. It will be performed in line with those activities of WP5 which are directed to the implementation of orchestration engines.

Loughborough investigated the application of DPWS and BPEL in defining orchestration framework.

TUT has been preparing the articles to be submitted in INDIN-2008 (2 papers), ETFA-2008 and IEEE CASE 2008.

With main contributions of TUT and SE, the partners presented the results of the task in the internal task report 2.2. The report was summarized for D2.1, which was enriched with ideas, commented and revised by other partners involved.

### *Task 2.3 – Service management framework*

With main contribution of SE, task 2.3 (Service Management Framework) was concluded at the end of February 2008 by the publication of the corresponding task report, included in the D2.1 deliverable with comments of other partners.

The proposed approach is three-pronged:

- use WS-Management as the management protocol;
- use SML (Service Modeling Language) as the resource modelling language;
- establish the feasibility of implementing a subset of the OPC UA information model.

Management concepts and functionality are outlined, in particular as regards the modelling of managed resources and the protocols for exchanging management information between management systems and managed resources. On the basis of an evaluation of various existing and emerging management standards and technologies, the proposed approach for building a service management framework on top of the DPWS-based SOCRADES infrastructure is to use WS-Management as the management protocol and Service

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Modelling Language (SML) as the resource modelling language. In addition, given the emergence of the OC UA framework, it is proposed to establish the feasibility of implementing a subset of the OPC UA metamodel. Loughborough research team attended in training at Schneider to support the implementations of service management framework in SOCRADES.

A joint paper related to T2.5 (TUT's contribution) has been written with Loughborough and Tampere University on "creating automation life cycle" to be submitted to COMPSAC 2008 - 32nd Annual IEEE International Computer Software and Applications Conference – Finland Aug 08.

#### ***Task 2.4 – Service-enabled agent framework***

In the task 2.2 the necessity of a system that supports the orchestration framework has been justified that is further elaborated in this task. In close collaboration of SE and TUT the decision support system has been specified as a component in the SOCRADES architecture that is able to translate the decision requests to requests that can be processed by the underlying intelligent algorithms, e.g. implemented as a MAS, and that can then provide a decision to the orchestration framework.

Available agent frameworks were reviewed and a possible candidate for the SOCRADES was identified. The use of a multi-agent system is justified by the existence of scenarios such as service redundancy, service composition and scheduling, where the simple coordination of service execution is not enough and complex decisions must be taken at runtime. In order to be able to integrate the agent framework with an existing service-oriented architecture, this task identified extra elements required such as semantic time descriptors for Web Services, the control of concurrent service calls, handling of knowledge base representations, and the creation of a common language between the multi-agent system and the service-oriented architecture, as well as possible implementation mechanisms.

TUT has been preparing the articles to be submitted in INDIN-2008, ETFA-2008 and Journal of Engineering Applications of Artificial Intelligence.

The task was reported in the internal task report 2.4 (TUT, SE, Lboro), the results were summarized for D2.1, commented and revised by other partners.

#### ***Task 2.5 – Semantic Web Services framework***

With main contribution of TUT the task was concluded M12 and was not active in the reporting period.

The task was summarized for final version of D 2.1 and commented by other partners.

#### ***Task 2.6 – Service gateway framework***

The task was concluded M8 by publishing D2.2 and was not active in the reporting period.

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

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

Del. no.	Deliverable name	WP no.	Lead part.	Del. type	Security	Due date	Actual date
D2.1	Framework specification for the device level service platform	2	TUT	Deliverable	CO	29.02.2008	27.02.2008

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

Not applicable.

#### **2.2.6. Meetings attended (if applicable)**

Meeting Title	Objectives/ Results Achieved	Date	Place
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WP2-meeting	The objective was to discuss the technical and managing issues of the WP2. There were discussed the approaches proposed in tasks 2.2-2.4, partners came to common decisions and compromising solutions. Schedule for finalizing D2.1 was agreed.	28-29 January 2008	Tampere, Finland
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### 2.2.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
1. Presentation and publication at a conference	Dissemination of T2.4 results (topic: Service-enabled agent framework) at IEEE International Conference on Industrial Informatics (INDIN2008)	July 13-16 2008/ Submission 20 March	Daejeon, Korea
2. Presentation and publication at a conference	Dissemination of T2.4 results (topic: interfaces between Decision Support System and Web Services) at 13 <sup>th</sup> International Conference on Emerging Technologies and Factory Automation (EFTA2008) Special Session on Industrial Agents	September 15-18 2008/ Submission 31 March	Hamburg, Germany
3. Publication	Dissemination of T2.4 results (Specification of a Multi-Agent System-based Decision Support System) in Engineering Applications of Artificial Intelligence (Journal)	Submission time: July 2008 (tentative)	
4. Presentation and publication at a conference	Dissemination of T2.2 results (topic: BPEL tools) in IEEE International Conference on Industrial Informatics (INDIN2008)	July 13-16 2008/ Submission 20 March	Daejeon, Korea
5. Presentation and publication at a conference	Dissemination of T2.2 results at IEEE International Conference on Industrial Informatics (INDIN2008)	July 13-16 2008/ Submission 20 March	Daejeon, Korea
6. Presentation and publication at a conference	Dissemination of T2.2 results (topic: SOA, orchestration framework) at 13 <sup>th</sup> International Conference on Emerging Technologies and Factory Automation (EFTA2008) Special Session on Industrial Agents	September 15-18 2008/ Submission 31 March	Hamburg, Germany
7. Presentation and publication at a conference	Dissemination of T2.2 results (topic: structural reasoning) at 4 <sup>th</sup> IEEE Conference on Automation Science and Engineering (IEEE CASE 2008)	August 23- 26 2008/ Submission 20 March	Washington, USA

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

### 2.3.1. Work package objectives, starting point of work

For future automation solutions it might be imaginable to equip sensors and actuators with a freely programmable processor each. In such special wired / wireless networked HW/SW systems embedded in distributed smart physical objects, so called “sensor-/actuator networks”, all processors use the same communication medium and are able to communicate directly with each other according to the peer-to-peer-

principle – without any coordinating instance. All (or at least the most important of) these processors then could be equipped with corresponding software based on a service oriented architecture concept as e.g. DPWS. This would enable such sensor/actuator networks to provide necessary functionalities for the wished degree of interoperability with the ERP/MES level.

Almost inescapably in context with these sensor-/actuator networks wireless technologies have to be mentioned. Though these from a theoretical point of view are not imperative for sensor-/actuator networks, in practical considerations wired sensor-/actuator networks are not of any relevance as the wiring of a high amount of sensor and actuator nodes would be difficult and not economic.

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

- 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 (e.g. IEEE 802.15.4, 802.15.4a or ZigBee),
- Power supply for the network infrastructure as well as the sensor itself,
- New Services with Wireless Sensor Networks,
- Demonstrator setup.

As a starting point of work it can be stated that consortium members are active in a number of relevant working groups which deal with radio communication and industrial communication e.g. the Institute of Electrical and Electronics Engineers (IEEE), the International Electrotechnical Commission (IEC), the Zentralverband der Elektrotechnik und Elektronikindustrie (ZVEI), the German Commission for Electrical, Electronic & Information Technologies of DIN and VDE (DKE), the German VDI/VDE-Society. The continuous contact to these panels increases the acceptance of a later standardisation following in this area.

### **2.3.2. Tasks progress**

*Task 3.2 – Architecture and functional specification of wireless DPWS-oriented sensor/actuator networks and Task 3.3 – Implementation and validation*

After determining the status quo for Wireless Sensor/Actuator Networks and the corresponding starting point for this WP (cf. Task 3.1), during the period of observation of this project report the WP mainly dealt with two tasks:

- 1.) Design and description of architecture and functional specification for SOCRADES based Wireless Sensor Networks (Task 3.2);
- 2.) Implementation of a first demonstrator based on the above mentioned architecture and functional specification (Task 3.4);

The demonstrator mentioned above was successfully shown to the SOCRADES review team and the SOCRADES consortium itself during the project review in October 2007.

Furthermore, partners Schneider Electric, ABB, ifak, and Siemens started serious discussions about a possible merger between DPWS and OPC UA to be used in SOCRADES and beyond.

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

Two deviations occurred:

- 1.) For test and validation reasons task 3.4 was started earlier then intended;
  - 2.) Task 3.2 took a bit longer to be accomplished then intended.
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None of these deviations are anyhow critical for the WP's or even project's advancement.

#### 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
D.03.2	Architecture and Functional Specification of Wireless DPWS-oriented Sensor Networks	3	Siemens	document	confidential	12/2007	04/2008

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

MS No.	Milestone name	Lead partner	Due date	Actual date
MS3.2	Architecture and Functional Specification of Wireless DPWS-oriented Sensor Networks	Siemens	02/2008	04/2008

#### 2.3.6. Meetings attended (if applicable)

Meeting Title	Objectives/ Results Achieved	Date	Place
WP4 Meeting	Harmonization and coordination of WP3 and WP 4 activities	Sept. 14 <sup>th</sup> 2007	Stockholm Arlanda
PCC Meeting	Project Coordination	Sept. 24 <sup>th</sup> /25 <sup>th</sup> 2007	Seligenstadt
Review Meeting	1-year-project review	Oct. 8 <sup>th</sup> /9 <sup>th</sup> 2007	Nuremberg
WP10-Meeting	Discussion of Exploitation and Dissemination activities	Nov. 22 <sup>nd</sup> /23 <sup>rd</sup> 2007	Cernobbio
WP2-Meeting	Finalization of WP2 Work	Jan. 28 <sup>th</sup> /29 <sup>th</sup> 2008	Tampere
WP4-Meeting	Harmonization and coordination of WP3 and WP 4 activities	Feb. 22 <sup>nd</sup> 2008	Stockholm Arlanda

#### 2.3.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
DPWS/ OPC UA merging	See title	tbd	tbd
Compsac 2008 - "signature" event of IEEE and SAINT2008	Conference	tbd	Turku
Enhancement of the WP3 demonstrator	See title	Whole period	Nuremberg/ Munich

### 2.4. WP4 – Device Centric Infrastructure

#### 2.4.1. Work package objectives, starting point of work

Today, wireless solutions are developed to replace wired solutions under an IO-centric paradigm, meaning that the wireless link has to meet the same requirements as a wired counterpart. This scenario is very hard and costly to achieve and guarantee, and is unrealistic in practice. Instead we can do better if we consider and compensate for the shortcomings of the wireless link (possibly exploiting its special characteristics) and take a holistic approach to the design of the control system. It is natural to include the properties of the

communication link in the control design: limitations imposed by unreliable interconnections and bandwidth constraints suggest that new control methodologies need to be developed. One can imagine two approaches: either robust control laws, which compensate for the added uncertainties, or adaptive algorithms, which are able to follow and predict variations.

It is very important that application development does not become more complex, despite the fact that the implementation platform is of higher complexity. The control application should be developed according to well known principles (e.g., PID, feed-forward, cascaded control, and Kalman filters) or new innovative and intuitive application specific methods utilizing the services of a middleware; removing the complexity of the combined control and communication strategies. In that way the platform abstraction hides the details and helps the system developer to focus on the key issues in the design.

Here we have the special case of a control application combined with real or virtual sensor and actuator "applications", communicating over an unreliable wireless network. Target is to provide fault-tolerant interaction methods between these specific applications. The objective is to overcome the shortcomings of the network (jitter, varying bandwidth, lost packets, temporarily lost nodes, etc.) by considering both control *and* communication strategies.

#### 2.4.2. Tasks progress

In the reporting period tasks 4.2. and 4.3. are active. Initial developments materialized in visits at Boliden locations targeting plans for validation activities and deployment of final results. The specific radio environment has been recorded and analyzed, together with the map of necessary control activities.

Various communication techniques and scenarios are under analysis, with tool support. The purpose is to allow an as smooth as possible transition of solutions from design phase to the actual implementation phase.

As a result of the above, WP4 participants will be able to offer a laboratory demonstration of some of the Boliden plant control situations (June 2008).

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

None identified.

#### 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
MS4.2	Simulation of control under uncertain sensor and actuator communication	4	ABB	MS report	CO	Febr. 2008	11.04.2008
MS4.3	Simulation of wireless communication link for control purposes	4	ABB	MS report	CO	Febr. 2008	11.04.2008

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

MS4.2 and MS4.3

#### 2.4.6. Meetings attended (if applicable)

Meeting Title	Objectives/ Results Achieved	Date	Place
PCC meeting	Discussions on latest review process. Planning answers through WP activities.	11-12.12.08	Milan, IT
SOCRADES WP4 SE	Clarification on local (Swedish partner) activities for the continuation of the project.	17.01.08	Luleå, SE

SOCRADES WP5	Plan activities for the second phase of the project	06.02.08	Frankfurt, DE
SOCRADES WP4	Clarification on general WP activities for the continuation of the project. Tasks for each partner defined. Specification of the next review meeting jobs.	22.02.08	Stockholm, SE

#### 2.4.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
Preparation for the review meeting June08	Set up of the laboratory demonstration following the data collection and analysis at Boliden plant.	17-18.06.08	Luleå, SE
Activities within T4.2., T4.3.	Reaching the project goals of integration and analysis of various solutions that can be employed today or in the near future.	10.08	NA
Preparations for T4.4., T4.5	Study of available prototypes for wireless connectivity and their possible employment within a Boliden plant	10.08	NA
Dissemination	Increase the number of publications / presentations	continuous	NA

### 2.5. WP5 – Service-centric infrastructure

#### 2.5.1. Work package objectives, starting point of work

#### 2.5.2. Tasks progress

A WP5 meeting has been held in Feb 08 used as official kicked-off for the work package that officially starts in March 1st 2008.

During this meeting:

- The responsibilities were assigned;
- The schedule was approved;
- The detailed task content, compliant to the DoW2 document, was discussed and agreed;
- A detailed action plan for the next months was approved.

TUT initiated a basic demonstrator to show dynamic invocations and discovery of Web-services with a use of DPWS and direct communications at SOAP level. Simple use cases which do not require a hard coding of service “clients” are implemented to be further elaborated for a presentation at the next WP-meeting.

#### 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.

### 2.5.6. Meetings attended (if applicable)

Meeting Title	Objectives/ Results Achieved	Date	Place
WP5 Kick off	Kick off	6/02/2008	Frankfurt airport

### 2.5.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
First software delivery	Availability of software components required for the 2008 demonstrator	M24	

## 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 remaining tasks are:

- Task 6.2: Integration of aggregated services into business applications
- Task 6.3: Integration of non Web Service enabled devices into business processes

Task 6.2 and Task6.3 have continued in M13-M18.

### 2.6.2. Tasks progress

The main goal of WP6 was focusing on design as well as prototyping a variety of concepts. In more detail:

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

The integration architecture presented in D6.1/D6.2 was revised, while we have been examining in more detail its specifications. In parallel we have started prototyping our concepts, as well as develop some demos that show device integration in enterprise systems.

#### **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. The work already started in previous period has continued.

In both Task 6.2 and Task 6.3 we move in parallel towards a detailed specification as well as selective implementation of components that will be the major part of work up to M24.

### 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
D6.3	Early Prototyping of Integration	WP6	SAP	R, P	CO	28.02.2008	28.02.2008



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

MS6.1 associated to D6.3.

### 2.6.6. Meetings attended (if applicable)

Meeting Title	Objectives/ Results Achieved	Date	Place
PCC and Workshop		25.-26-09.2007	Seligenstadt, Germany
Review Meeting		08.-09.10.2007	Nuremberg, Germany
ifak-SAP demonstration	Requirements on demonstration SOCRADES results on legacy device integration	29.11.2007	Karlsruhe, Germany
PCC and Workshop		11.-12.12.2007	Milan, Italy
WP10-Meeting	Discussion of Exploitation and Dissemination activities	Nov. 22 <sup>nd</sup> /23 <sup>rd</sup> 2007	Cernobbio
WP2-Meeting	Finalization of WP2 Work	Jan. 28 <sup>th</sup> /29 <sup>th</sup> 2008	Tampere, Finland
WP4-Meeting	Harmonization and coordination of WP3 and WP 4 activities	Feb. 22 <sup>nd</sup> 2008	Stockholm Arlanda, Sweden

### 2.6.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
Detailed specification		-	-
Prototype implementation			

## 2.7. WP7 – System engineering & management

### 2.7.1. Work package objectives, starting point of work

Within work package 7 an engineering environment is being developed to provide application support for the engineering of distributed systems composed of embedded devices in service-oriented architecture. The main focus of this work package is to develop a set of prototype engineering tools with associated prototype demonstrators to enable the evaluation of the SOCRADES concepts on physical systems meeting realistic user application scenarios.

Three deliverables (D7.1, D7.2, and D7.3) have already been submitted and one more (D7.4) is being submitted. Following a number of meetings (both via audio and in person), the application description for the Loughborough-based manufacturing demonstrator has been specified in collaboration with Schneider, ifak and SAP based on requirements defined by Jaguar and Ford for reconfigurable engine assembly machinery.

A number of full-scale demonstrations are planned for the next 12 months, focusing on application of engineering tools in the areas of distributed control systems, Web Services, and high-level management integration. APS has, for example, started to develop a prototyping concept that is applicable for manufacturing automation and process control applications.

In addition, Loughborough in collaboration with SAP, Schneider, Jaguar and Ford is exhibiting the SOCRADES concept with a demonstration system at the MACH 2008 international manufacturing exhibition in the National Exhibition Centre, Birmingham (24-25 April 2008).

### **2.7.2. Tasks progress**

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

A comprehensive study was carried out to identify key enabling technologies and candidate tools for use within the application engineering environment. The result of this study has been previously documented in D7.2.

Following this study during the last six months, a number of selected tools and methods were further investigated for their suitability for integration within the application toolsets being developed by the partners in WP7. Work has, for example, focused on how best to provide suitable Web-Services-based interfaces to these tools, which include Delmia Automation, Loughborough's Process Definition Environment and xMII from SAP.

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

This task is aimed at defining and developing functionality necessary for the application engineering required for the build and configuration of automation systems in the manufacturing domain.

The main focus of this task is to provide an appropriate applications engineering approach to support the description and build of prototype demonstrators exploiting SOCRADES. Work is in progress to specify, design, implement and test in a phased manner: a) support for Web-Services-based distributed control elements with state behaviour, b) a simple orchestrator, c) configuration of device choreography from the application design tools, with the option for high level orchestration, d) application element/component creation and visualisation, e) evaluation of this functionality in the context of industrial applications, e.g., engine assembly scenarios at Jaguar and similar case studies for the electronic assembly domain.

A number of demonstrations are being prepared to support and present the above mentioned capabilities within the application engineering environment involving all work package partners. In the MACH 2008 exhibition in April 2008, simple orchestration, system component creation, and control of basic elements' state behaviour through web-services will be demonstrated. This demonstration, based on an application scenario from Jaguar, will be implemented on Schneider Electric's FTB (ARM9-based embedded controllers utilising Schneider's DPWS stack) with applications engineering from Loughborough and SAP providing business integration via xMII. Another demonstration of this system is being prepared for the second EU review meeting. In this demonstration, the functionality will be enhanced by the provision of VRML-based 3D visualisations and support from a high level orchestration/choreography definition and configuration tool. Future provision for demonstration of device support and maintenance is also planned utilising software being developed at ifak. APS is working to develop a prototyping concept for manufacturing automation and process control applications with loosely coupled distributed components and heterogeneous mechatronic devices for use during the Mechatronic Trials in WP8 to support systems engineering activities including, configuration, commissioning, orchestration, and management.

#### ***Task 7.4 - Simulation and verification***

Based on the development of application description and configuration tools in Task 7.3, the definition of compatible simulation and verification capabilities within the engineering tools is the main focus of this activity.

Within Task 7.4, a 3D visualisation capability is being prototyped to enable connectivity between real and virtual control elements via Web-Services. This capability is being embedded into the engineering toolset to facilitate verification and support of manufacturing automation systems throughout their lifecycle. Delmia Automation is being utilised for this purpose by Schneider Electric and a visualisation approach (i.e. VRML

based 3D visualisation) has been developed by Loughborough University capable of supporting system visualisation, simulation, and early verification.

During the last reporting period, Schneider has been investigating and partly implementing the use of Delmia Automation as an engineering platform to support several lifecycle aspects of service-enabled flexible and reconfigurable production systems. A simple full-scale FlexLink assembly cell is being used as a case study in the electronic assembly domain, and this has been reproduced in Delmia Automation as a 3D model. Based on the developments for the review in Nuremberg which demonstrated the principle interaction of real and virtual services of FlexLink components, the scenario is about to be extended to the complete system, offering the entire system as a set of services. This task is still in progress, and a first prototype will be demonstrated in review June 2008, showing a virtual production system that is running in Delmia Automation, coordinated by an external orchestration engine (see D7.4).

The foundation of the proposed approach is to build reconfigurable systems out of modular and simple automation components, each of them providing a set of services that represent their production capabilities. The real automation components are mechanical devices that are equipped with computing capabilities and control software for logical control, with electrical interfaces to I/O and with a service interface exposing the internal functions as services.

Main efforts during the last reporting period were spent on implementing the necessary virtual FlexLink components according to the required automation component structure:

- Creation of 3D models
- Simulation of kinematics and behaviour through logics inside Delmia
- Implementation of the automation functions through control logics inside Delmia
- Implementation of Web-Services and interfacing to the automation functions
- Dynamic loading of service plug-ins
- Instantiation and configuration of virtual components in Delmia

Use case scenarios were further elaborated that require specific interfaces for virtual components:

- Design and simulation in a virtual environment – the system is modelled in 2D/3D in the engineering environment, the workflow models are generated and deployed to one/many external or internal service coordination engines. The virtual components are exposed internally and also to other nodes in the network as services, which allows control and coordination of the virtual production system.
- Simulation with hardware-in-the-loop (HIL) – this scenario extends the previous one by allowing now to add real services to the system or to replace virtual by real services.
- Monitoring of the real production system – in this case the engineering tool is used to "monitor" on event-based mechanisms in order to synchronize the virtual production system with the real production system at runtime, showing actions that are performed with the real components also at their corresponding virtual components.

An approach is under investigation to export layout configurations created during the design of the production system.

Loughborough, SAP and Schneider have begun work to define potential interoperability between different tools and embedded devices with a technical meeting on this topic planned for April 2008. This interoperability is likely to include the definition of real-to-virtual connectivity along with levels and types of error reporting.

The initial results of application description and supporting methodologies defined in tasks 7.3 and 7.4 are reported in deliverable 7.4, submitted in March 2008.

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

The work in WP7 has progressed as planned and no deviation is expected.

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#### 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
D7.4	Early prototyping of application description and support methodology	7	Lboro	Report	CONFIDENTIAL	M18	March 31 <sup>st</sup>

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

MS7.1 associated to D7.4.

#### 2.7.6. Meetings attended (if applicable)

Meeting Title	Objectives/ Results Achieved	Date	Place
PCC Meeting / Tech Discussions	Progress review and WP planning	25-26 Sept 2007	Seligenstadt, Germany
Review Meeting	Presentation of approach and review of results D7.2 and D7.3	8-9 October 2007	Nuremberg, Germany
PCC Meeting / Tech Discussions	Progress review and WP planning	11-12 Dec 2007	Milan, Italy
Application requirements review meeting	Ford and Jaguar engineering verify application requirements of engine assembly	7 Feb 2008	Loughborough, UK
PCC Meeting / Tech Discussions	Progress review and WP planning	10-11 March 2008	Aachen, Germany

#### 2.7.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
MACH 2008 Exhibition	Demonstration of SOCRADES concept	24-25 April 2008	NEC Birmingham
Engineering Framework Review	Meetings and discussions to scope the engineering activity for the project's 2 <sup>nd</sup> phase.	April – May 2008	Frankfurt & Loughborough
Demonstration	Project domain meeting (end of Year 2)	Aug 2008	Germany
Demonstration	2 <sup>nd</sup> EU Review meeting	Sept/Oct 2008	

### 2.8. WP8 – Application pilots, demonstrators

#### 2.8.1. Work package objectives, starting point of work

The main objectives of WP 8 are:

- To select application scenarios and trials in the fields of process control and manufacturing automation
- To specify and set-up application pilots and trials
- To run trials and test the application of the SOCRADES framework at real world situations like automatic set-up and system start; device or system failure; plug & play situations; control failure; control at 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.

- To compare the SOCRADES achievements with the performance of traditional process automation and control technology
- To evaluate and assess the results achieved

Starting point is scheduled for month 21.

### 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 continued with the preparatory work to create the technical and technological platform for the integration activities and 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 continued to implement DPWS technology into existing mechatronic devices particularly into robots, sensors, and control equipment selected for the trials. Priority has been given to install WebService-based communication and interaction mainly on device-level but also on the business level.

Wireless networking capabilities have been evaluated through extensive experimental work on different technologies like WLAN, ZigBee and nanoNet. Based on the evaluation results meanwhile wireless communication and interaction between simple sensors and a gantry robot system is available. In view of the cross-layer capabilities of the SOCRADES integration concept basic WS functionality has been implemented to communicate, and to monitor status and position data from a robot system across the device and application layer up to the business level and further to external places outside the trial site. At the moment this functionality enables to access robots from the business level and from outside, to control any robot movement remotely, to support visual information, and to monitor TCP data from the gantry robot system.

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.

### 2.8.6. Meetings attended (if applicable)

Meeting Title	Objectives/ Results Achieved	Date	Place
Review Meeting	Presentation of WP 8 scheme	Oct 8-9, 2007	Nuremberg
Work meeting	Specification of WP 8 trials with SE and SAP	Nov 27-28, 2007	Aachen
PCC Meeting	Presentation of WP 8 work program	Dec 11-12, 2007	Milan

### 2.8.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
Start of WP 8	Implementation of WP 8; final selection of prototypes, demonstrators and trials, technical specification and set-up	May 2008	
Specification of Service Deployment and Orchestration strategies in WP 8 and WP5	Work meeting	April 23, 2008	Frankfurt

## 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 conferences. 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

For a complete comprehensive list of Dissemination activities, see also D9.2 Dissemination Report.

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

Dissemination, promotion and assessment activities are including the following:

- 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 are 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.



### **2.9.3. List of deliverables for the reporting period**

D9.1c Dissemination Plan successfully completed at M18. This is a plan of the dissemination activities to be carried out in the next 18 months of the project

D9.2 Dissemination Report successfully completed at M18. This is a report of the dissemination activities carried out in the past 18 months of the project

### **2.9.4. List of milestones for the reporting period**

M9.2 Dissemination and promotion of key technologies, methods, scenarios and approaches. Milestone achieved, as testified by the D9.2

### **2.9.5. Key activities planned for the next period**

Please refer to D9.1c Dissemination Plan.

## **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 10.3 (Roadmapping). 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. Based on the actions defined in the previous project phase the preparation of stronger exploitation is improved. In particular, synchronized with dissemination activities, the demonstrators and trials are key elements to deploy the SOCRADES technologies. All partners are involved in the definition and implementation of these demonstrations. They are aligned to the major technology areas and the Roadmap. The individual partner activities were updated and documented in the deliverable D10.1b.

According to the initial Exploitation Plan common features of SOCRADES are defined and base for the promotion of customer benefits. To promote these the creation of an expert network has been initiated via the actions around task 10.3 for roadmapping.

##### ***Task 10.2: Specifications for Standards***

Task leader has performed several actions to define the standardization path in particular towards DPWS and OPC-UA. An approach called DPUA has been proposed to partners. Since some IP related questions and concerns have to be clarified between some industrial partners to finalize this approach to be introduced in the international standardization bodies.

A white paper was issued comparing DPWS and OPC-UA (see also task 2.3). Based on this white paper, and on the agreement between Schneider, Siemens and ABB to find a common interoperable solution (also supported by SAP), Schneider got in touch with the OPC Foundation in order to explore the feasibility of this common solution.

Schneider looked at possible standardization paths through IEC65E, and concluded that it will be possible to push such a solution through this committee when a detailed specification will be available. Schneider is in charge of writing this specification, and to discuss it and validate it with SOCRADES partners.

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

All actions to recover the preparation of the first roadmap (D10.3a) are done. There will be other 2 releases (PM24 and PM36) with further upgrades of the roadmap, using a couple of other information sources: Delphi (a first initial study has been initiated and will be continued) and external workshops. In several meetings and discussions 44 Expected Feature of the Technology Area (EFTA) have been identified in total for the 4 SOCRADES technology areas and shared among partners.

In particular workshops with international experts are planned to coincide with conferences or other events use the roadmap. Therefore an official communication will be done to the SOCRADES EC PO requesting the official support of the commission for organizing an international event with the participation of experts of Europe and also from outside Europe, in order to give the SOCRADES Roadmap an optimum broad spectrum under an international character.

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

**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
D10.1b	Exploitation Plan	10	SE	R	PU	30.3.2008	7.4.2008
D10.4a	(Technology) Roadmap of the SOCRADES paradigm	10	PoliMi	R	PU	28.02.2008	31.3.2008

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

MS No.	Milestone name	Lead partner	Due date	Actual date
10.2	2 <sup>nd</sup> release of Exploitation Plan and Roadmap	SE	M18	M18

**2.10.5. Meetings attended (if applicable)**

Meeting Title	Objectives/ Results Achieved	Date	Place
SOCRADES Technical Roadmap Workshop	Develop and share EFTAs for common technology areas Preparation of Delphi study	22.-23.11.07	Como, Italy
SOCRADES PCC	Share current status for Exploitation , Standardization and Roadmapping	10.-11.12.07	Milano, Italy
WP5 Meeting	Share and synchronize demonstrator activities	06.02.2008	Frankfurt, Germany
SOCRADES PCC	Share deliverables and next actions	10.-11.3.208	Aachen, Germany

**2.10.6. Key activities planned for the next period)**

Activity / Result / Publication	Contents / Objectives	Date	Place
Exploitation Plan update	Preparation of next demonstrator "story boards" to promote customer benefits  Preparation and execution of 2 <sup>nd</sup> survey for	M24	

	exploitation  Continuous update		
Standardization	Clarification of IP topics Introduction to standardization bodies	M24	
Roadmap	Workshop with external stakeholders ( <ul style="list-style-type: none"> <li>- European industries</li> <li>- Relevant platforms (ARTEMIS, ENIAC)</li> <li>- Other Integrated Projects</li> <li>- CSA together with roadmap and standardization</li> </ul> Delphi study  Internal workshop  Continuous monitoring and review (within and outside SOCRADES)	May-June 08       Nov 2008	

### 3. Consortium management (WP11 – Project management)

#### 3.1.1. Work package objectives, starting point of work

Note: This section remains unchanged in comparison to the latest 6M-project progress report (D11.2b).

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

Note: This section remains unchanged in comparison to the latest 6M-project progress report (D11.2b).

##### **Task 11.1: Planning and scheduling (M0-M3)**

This task was already finished in November 2006.

##### **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.

- 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 is being 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:

- Groove Communication Platform
- Project Webpage ([www.socrades.eu](http://www.socrades.eu))
- Project e-mailing lists (partners, PCC, WPLeaders)

**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
X	SOCRADES DoW (Annex I) 2 <sup>nd</sup> Phase	11	1	Report	CO	M12	M17
D11.2c	6-Month Project Progress Report	11	1	Report	CO	M18	April 15 <sup>th</sup> , 2008

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

Mil. no.	Deliverable name	WP no.	Lead partner	Del. type*	Security	Due date	Actual date
M2	“Consolidation of the First Period (18 months) results and Exploitation Plan”	11	1	Report	CO	M12	M17

### 3.1.6. Meetings attended (if applicable)

Meeting Title	Objectives/ Results Achieved	Date	Place
PCC-Meeting	Management Activities Control and Monitoring	September 2007	Seligenstadt, GE
SOCRADES Technical Workshop	Framework Specification – Review/Actualization	September 2007	Seligenstadt, GE
EC SOCRADES 1 <sup>st</sup> Year Review Meeting	Official Assessment and Evaluation of SOCRADES	October 2007	Nuremberg, GE
PCC-Meeting	Management Activities Control and Monitoring. DoW 2 <sup>nd</sup> Phase	December 2007	Milano, IT
SOCRADES Technical Workshop	DoW 2 <sup>nd</sup> Phase	December 2007	Milano, IT
IMS International	Synchronization of SOCRADES with the International Program	November 2007	Zurich, Switzerland
FP7 Control and Monitoring in Continuous Processes	Synchronization of SOCRADES with the European Program	December 2007	Brussels, BE
FP7 Manufacture '07	Synchronization of SOCRADES with the European Program	December 2007	Porto, PO
FP7 Conference	Synchronization of SOCRADES with the European Program	January 2008	Cardiff, Wales

### 3.1.7. Key activities planned for the next period

Activity / Result / Publication	Contents / Objectives	Date	Place
3 <sup>rd</sup> EC SOCRADES Review Meeting	Assessment of the project results	June 17-18, 2008	Lulea, Sweden
SOCRADES & ARTEMISIA	Possible follow-up activities of SOCRADES	May 2008	Athen, Greece

## 4. Dissemination report

Note: Please, refer to D9.1c and D9.2 (Month 18).

### 4.1. Training activities for the last 6-month period

Planned/ Actual dates	Description	Type of audience	Countries addressed	Size of audience	Partner/Responsible involved
14-16.01.2008	DPWS <u>C stack</u> training session	SOCRADES partners	Europe	~ 11	SE, SAP, Flexlink, Lboro, TUT, APS
16-18.01.2008	DPWS <u>Java stack</u> training session	SOCRADES partners	Europe	~ 10	SE, SAP, Lboro, TUT, APS

Note: Other training activities were performed during the 1<sup>st</sup> year and were reported before (see D11.2a (month 6) and D11.2b (Month 12)).

### 4.2. Planned activities for the next period

Note: For a complete dissemination plan, please see D9.1c (Month18).

## 5. Standardization and IPR report

Note: For a complete overview of Standardization and IPR-related activities and plans, please refer to D10.3 (Month18).

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

Note: For a complete overview of Exploitation/Dissemination-related activities, please refer to D10.1b (Month18).

## 7. 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.

### 7.1. 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
A new change of partner in the "Electronics Assembly Area".	Another signature process for an "Amendment to the Consortium Agreement" needs to be conducted	M	Not applicable	11	Not applicable
A change of the legal owner of the partner in the "Manufacturing Area". Jaguar -> Ford	Another signature process for an "Amendment to the Consortium Agreement" needs to be conducted	M	Not applicable	11	Not applicable
Necessity for more efforts allocated to Management activities	The current plan of efforts allocated to WP11 would need to be increased and the threshold of 7% of budget indicated by the EC rules exceeded	H	To negotiate with the EC	11	Not applicable

### 7.2. 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, D1.4, D1.5) is intended to care about trend screening. (request is covered by Task 1.3, not a	1	



			subject of Task 1.1)		
D1.2 (reviewers request to cluster and prioritize requirements in a common document)	Medium	L	Work in progress, results to be submitted at the beginning of the next reporting period	1	
Major Standard for WSN arising "somewhere else"	Main value of WP3 gone	M	Influencing of relevant standardization bodies	3	Standardization efforts regarding WSN in Profibus User Organisation (PNO)
DPWS not usable for WSN due to technical and IPR reasons	No usage of DPWS in WP3	M	Discussion of the topic with relevant partners	3	Ongoing Talks with SE, ABB, ifak
Development of wireless enablers for field devices is delayed by providers	Hinders the validation of the approach at plant location	M	The existent prototypes may provide a good solution. The effect may be a lesser functionality. Alternatively "self-made" wireless connectors can be built.	4	NA
Interlayer communication solutions not accepted by all partners	Will affect the "unity" of the approach and the coherence on vertical and horizontal communication / interaction layers.	H	Fast solution of rendering protocol compatibility through wrapper techniques.	4	NA
The new SE FTB devices to be used in the demonstrators have not been tested extensively with WS software at Lboro.	Could affect the performance and reliability of the prototype systems and related demonstrators.	M	If problems occur the hardware /software within the devices would need to be revised by SE, Lboro and other partners.	7	On-going testing of FTB system performance in various application scenarios.
Insufficient Dissemination	Failure to achieve a widespread diffusion of the project results	L	Provide a valid Dissemination Plan and follow it	9	Adoption of "Push" technique to "force" partners to make dissemination

**Table 1 Risks analysis**

## 8. 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.







### 8.1. Quality Assurance for Deliverables finished during the current period

#### 8.1.1. 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.

#### 8.1.2. Summary of the deliverables of the reporting period


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 	Approval Project Coord. (date)
D1.3	Trend screening report 1	1	Ifak	R	CO	M15	14.01.2008		14.01.2008
D2.1	Framework specification for device-level service platform	2	TUT	R	CO	M18	27.02.2008		March 2008
D3.2	Architecture and Functional Specification of Wireless DPWS-oriented Sensor Networks	3	Siemens	Doc.	CO	12/2007	March 2008		April 2008
D6.3	Early Prototyping of Integration	6	SAP	R,P	CO	M18	28.02.2008		March 2008
D7.4	Early Prototyping of Application Description and Support Methodology	7	Lboro	R,P	CO	M18	01.04.2008		April 2008
D9.1c	Dissemination plan M18	9	Polimi	R	CO	M18	March 2008		April 2008
D9.2	Dissemination progress report	9	Polimi	R	CO	M18	March 2008		April 2008
D10.1b	SOCRADES Exploitation Plan (2nd Release)	10	Schneider	R	CO	M18	April 2008		April 2008
D10.3	Standardization report	10	Schneider	R	PU	M18	13.03.2008		April 2008
D10.4	(Technology) Roadmap of the SOCRADES paradigm	10	Polimi	R	CO	M18	31.03.2008		April 2008
D11.2c	Project Report	11	Schneider	R	CO	M18	10.04.2008		April 2008










## 8.2. Quality Assurance of Work Packages

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

### 8.2.1. Work Package Quality Status Overview

WP No.	WP stage	Milestone number (if milestone)	Due date	Actual date	Status 	Corrections actions (in case if the status is yellow or red)	Approval Project Coord. (date)
	OPEN MS CLOSE <sup>6</sup>				7		

- <sup>5</sup>
-  = Deliverable assessed
  -  = Deliverable in pending assessment
  -  = Deliverable not ready
- <sup>6</sup>
- OPEN = See Project Handbook
  - MS = See Project Handbook
  - CLOSE = See Project Handbook

WP1	Open		M34			
WP2	Close		M18	M18		
WP3	Close	MS3.2	12/2007	03/2008		April 2008
WP4	Close	MS4.2	02/2008	08.04.2008		April 2008
WP4	Close	MS4.3	02/2008	01.04.2008		April 2008
WP6	Close	MS6.1	02/2008	28.02.2008		April 2008
WP7	Close	MS7.1	02/2008	01.04.2008		April 2008
WP9	Close	MS 9.2	M 18	M18		April 2008
WP10		MS10.2	M18			April 2008
Project MS	Close	M2 (Month 18) - Consolidation of the First Period (18 months), results & detailed exploitation plan	M18	04/2008		April 2008

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

The consortium has already started preparing the reaction to the Comments & Recommendations Made by the Reviewers after the 1<sup>st</sup> year EC review meeting. There is a document compiling the reactions discussed and defined by the work package leaders concerning their WPs and also the reactions of the consortium as a whole to the "General Recommendations". This document is a living document that will be concluded with an official project consortium statement to be presented during the next EC review meeting planned for June 17-18, 2008 in Lulea, Sweden. Remark: The addressed document can be shown if required.

## 10. Contractual Matters (Project Coordinator's level)

- Amendment of the SOCRADES EC Contract due to the replacement of FlexLink Automation Oy (Finland) with FlexLink Components AB (Sweden)
- Forthcoming amendment of the SOCRADES EC Contract due to the already official communicated withdraw of FlexLink Components AB (Sweden) and the replacement for a new partner.
- Forthcoming amendment of the SOCRADES EC Contract due to the already official communicated change of legal situation of Jaguar Cars Ltd. (UK).

7



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

- **Annex 1: Report on Costs and Allocation of Efforts (M13-M18)**
- **Annex 2: CD-ROM with deliverables produced during the reporting period (Project Coordinator's Level)**