PROJECT PERIODIC REPORT

JU Grant Agreement number: ***100204***

Project acronym: ***PSHIELD***

Project title: ***pilot embedded Systems arcHItecturE for multi-Layer Dependable solutions***

Date of latest version of Annex I against which the assessment will be made:

Periodic report: **1st** ☐ **2nd** ☐ **3rd** ☐ **4th** ☐

Period covered: **from 1.06.2010 to 31.12.2010**

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[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the grant agreement

[2] The home page of the website should contain the generic European Emblem and the Joint Undertaking's logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm ; logo of the Joint Undertaking: http://www.artemis-ju.eu. The area of activity of the project should also be mentioned.

Declaration by the scientific representative of the project coordinator[1]

I, as scientific representative of the coordinator[1] of this project and in line with the obligations as stated in Article II.2.3 of the JU Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate):

  ☐ has fully achieved its objectives and technical goals for the period;

  ☐ has achieved most of its objectives and technical goals for the period with relatively minor deviations[3];

  ☐ has failed to achieve critical objectives and/or is not at all on schedule[4].

- The public website is up to date, if applicable.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 5 (Project Management) in accordance with Article III.2.f and IV.1.f of the JU Grant Agreement.

Name of administrative representative of the Coordinator[1]: Dr. Spase Drakul

Date: 15/04/2011

Signature of administrative representative of the Coordinator[1]:.....

Name of scientific representative of the Technical Coordinator: Ing. Antonio Di Marzo (SESM)

Date: 15/04/2011

Signature of scientific representative of the Technical Coordinator:.....

[3] If either of these boxes is ticked, the report should reflect these and any remedial actions taken.

[4] If either of these boxes is ticked, the report should reflect these and any remedial actions taken.

Project no: 100204

p-SHIELD

pilot embedded Systems architecture for multi-Layer Dependable solutions

Instrument type: Capability Project

Priority name: Embedded Systems (including RAILWAYS)

M0.6: Mid-Term Management Report

Due date of deliverable: 15th April 2011
Actual submission date: 15th April 2011

Start date of project: 1st June 2010 Duration: 12 months

Project co-funded by the European Commission within the Seventh Framework Programme (2007-2012)		
Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission	
RE	Restricted to a group specified by the consortium (including the Commission	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Draft A	11/04/2011	First issue for comments
Draft B	13/04/2011	Second issue for comments
Draft C	15/04/2011	Third issue for comments

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Acronyms

ESs	Embedded Systems
SPD	Security Privacy Dependability
ESNs	Embedded System Networks
ESD	Embedded System device
KETs	Key Enabling Technologies
WP	Work Package
PPR	Project Periodic Report
HW	Hardware
SW	Software
SotA	State of the Art
CR	Cognitive Radio
SDR	Software Defined Radio

1 Publishable summary

1.1 Summary

pSHIELD is a pilot project co-funded by the ARTEMIS JOINT UNDERTAKING (Sub-programme SP6) focused on the research of SPD (Security, Privacy, Dependability) within the context of Embedded Systems.

The SHIELD consortium proposes a pilot project (pSHIELD) which is a reduced R&D project addressing the core concepts of SHIELD, participated by the core/key partners and extended to a new group of partners coming from Norway and Portugal.

The pilot is foreseen to be an initial investigation to be enhanced with R&D activities that will be proposed in the future ARTEMIS Calls.

pSHIELD wants to investigate and validate a reduced but still consistent and coherent set of innovative concepts behind the SHIELD project, in a restricted scenario, with a rearranged consortium tailored on the pilot's scope.

The pSHIELD project aims at addressing Security, Privacy and Dependability (SPD) in the context of Embedded Systems (ESs) as "built in" rather than as "add-on" functionalities, proposing and perceiving with this strategy the first step toward SPD certification for future ES.

The leading concept is to **demonstrate composability** of SPD technologies. Starting from current SPD solutions in ESs, the project will develop **new technologies** and consolidate the available ones within a solid base that will become the reference milestone for a new generation of "SPD-ready" ESs. pSHIELD will approach SPD at 4 different levels: node, network, middleware and overlay. For each level, the state of the art within SPD of single technologies and solutions will be improved and integrated (hardware and communication technologies, cryptography, middleware, smart SPD applications, etc.). The SPD technologies will be enhanced with composable functionality, in order to fit in with the pSHIELD architectural framework.

The composability of the pSHIELD architectural framework will have great impact on the system design costs and time to market of new SPD solutions in ESs. At the same time, the integrated use of SPD metrics within the pSHIELD framework will have impact on the development cycles of SPD in ESs because the qualification, (re-)certification and (re-)validation process of a pSHIELD framework instance will be faster, easier and more widely accepted.

The use of an overlay approach to SPD and the introduction of semantic technologies address the complexity associated with the design, development and deployment of built-in SPD in ESs. Using semantics, the available technologies can be automatically composed to match the needed application specific SPD levels, resulting also in an effort reduction during the design, operational and maintenance phases. The pSHIELD approach is based on **modularity and expandability**, and

can be adopted to bring built-in SPD solutions into the whole of the strategic sector of ARTEMIS, such as transportation, communication, health, energy and manufacturing.

To achieve these challenging goals the project aims to create an **innovative, modular, composable, expandable and high-dependable architectural framework**, concrete tools and common SPD **metrics** capable of improving the overall SPD level in any specific application domain, with minimum engineering effort. The whole ESs lifecycle will be supported to provide the highest cross-layer and cross-domain levels of SPD, guaranteeing their maintenance and evolution in time.

In order to verify these important achievements, the project will **validate the pSHIELD integrated system by means of an application scenario**: monitoring of freight trains transporting hazardous material.

The project will have a great impact on the SPD market of the ESs. By addressing the reusability of previous designed solutions, the interoperability of advanced SPD technologies and the standardised SPD certificability, it is possible to estimate an overall 30% cost reduction for a full pSHIELD oriented design methodology.

To fulfil these challenging goals a European consortium has been set-up accounting major industries in the field of SPD in ESs. The high involvement of specialized SMEs, skilled universities and research centres makes the research team complete in order to make SHIELD a successful project.

The pSHIELD project will be focused on:

1. **Demonstrate composability**: The main novelty is the composability of SPD functionality at different layers among different technologies. The mechanism behind the composability could be investigated as well in this pilot project, at least limited to the design level.
2. **New technologies:** A sub-set of the previous SHIELD technologies will be used to be the very first significant example of SPD composability.
3. **Modularity and expandability:** As well as SHIELD, pSHIELD will maintain the same features, by preserving the work breakdown structure proposed in SHIELD.
4. **Innovative, modular, composable, expandable and high-dependable architectural framework:** the pilot project will be in charge of designing the core of this architectural framework, thus leaving to a future project its refinement and development
5. **Metrics:** metrics are the other novelty in the SHIELD project. They can be investigated in the pSHIELD project and used to validate the first basic functionalities of the framework.
6. **Validate the SHIELD integrated system in one application scenario:** the pilot project will validate the architectural framework by means of a specific application scenario.

1.1 Main results achieved

For the first reporting period of pSHIELD project (01.06.2010-31.12.2010) some intermediate objectives for the project were planned. A delay was reported to the Project Officer before the end of the reporting period and an official request of seven months of extension has been sent to the Project Officer in April 2011.

pSHIELD is structured in work packages and main results are related to them.

The objectives for the **WP2 Scenarios, requirements and system design** are:

1. The definition of the SPD requirements and specifications of each layer, as well as of the overall system on the basis of the application scenario;
2. The definition of proper SPD metrics to assess the achieved SPD level of each layer, as well as of the overall system;
3. The definition of SHIELD system architecture. Identification of the SPD layers functionalities, their intra and inter layer interfaces and relationships.

The results of the first objective have been reported in D2.1.1. Results of the other two objectives are in progress and will be reported in D2.2.1 and D2.3.1 (in progress).

Clearly significant and tangible results are:

- Top-level requirements specification for the application scenario
- High-level pSHIELD system requirements specification
- High-level SPD requirements specification for Node, Network, Middleware and Overlay Functional Layer
- High-level requirements specification for the SPD metrics
- High-level pSHIELD reference system architecture requirements specification
- High-level SPD Node, Network, Middleware and Overlay architecture requirements specification

The objectives for the **WP3 SPD Node** are:

1. Select a representative set of SPD technologies at Node level;
2. Develop appropriate composability mechanisms at such level;
3. Deliver a SPD node prototype.

The results of these objectives were not planned within the period of this report. The activities performed are on-going and preliminary results will bring to **D3.1 SPD Node technologies prototype** (in progress).

Clearly significant and tangible results are:

- A final first version D3.1 is developed.
- Embedded System security based on the whole design pyramid is investigated (protocol, algorithm, architecture, micro-architecture and circuit level)
- Potential architecture for SPD core module that include both TPM and MTM features

- Secure firmware, secure boot and bootstrapping with key management is investigated
- An architectural solution of nano node analysed for 3D integration technology is considered as first choice that can be also modelled by conceptual models.
- An architectural solution for micro/personal node is analysed as a possible upgrade of Contiki and Hydra OS solutions
- SPD conceptual models are proposed for sensor node based on the IEEE 802.11, IEEE 802.15.4 standards
- SotA solutions in the field of secondary power supply source to guarantee the correct system operation
- Studies of SotA node hardware and software available on market.
- Identification and description of hardware and software power nodes platforms.
- Development of hardware and software demonstrating selected pSHIELD node capabilities described by node architecture in D2.3.1.
- Design of a mobile and rugged high performance embedded node, the Power Node, with SPD intrinsic functionalities.
- Power Node board design.
- Power Node rugged enclosure design.
- Power node thermal studies.
- Design and implementation of board firmware.
- Operating system identification.
- Preliminary analysis of Power Node SDK.
- Results: Power Node PCB Layout design terminated. Operating system selection oriented in favour of Red Hat, CentOs or Scientific Linux.
- Research of the SotA within the means of providing security in lightweight and networked embedded devices through an adequate cryptographic scheme.
- Evaluation of asymmetric cryptography algorithms and their suitability to pSHIELD.
- Evaluation of symmetric cryptography algorithms and their suitability to pSHIELD.
- Evaluation of message authentication codes algorithms and their suitability to pSHIELD.
- Results: The results of Task 3.3 activities are formalised within Deliverable 3.4 “SPD self-x and cryptographic technologies”, available at pSHIELD BSCW Server.
- Due to AES Rijndael being the cipher selected to be integrated into the nodes, some studies, about the original definition of the protocol, have been made to propose several code optimisations that let improve the efficient of the system.

The objectives for the **WP4 SPD Network** are:

1. Improve SPD technologies at Network level;
2. Develop potential prototype to be integrated in the demonstrator

The results of these objectives were not planned within the period of this report. The activities performed are on-going and preliminary results will bring to **D4.1 SPD Network technologies prototype** (in progress).

Clearly significant and tangible results are:

- Study and motivation of the main features needed for making the pSHIELD SPD-Based Radio System working
- Identification and study of the reconfigurable radio components with waveform parameters (frequency, bandwidth, …) allowing SPD transmissions
- Identification and study of the sensing mechanism to acquire awareness about the context and the available/used resources
- Study and implementation of SPD-based transmission techniques capable of guaranteeing a low probability of interception

According to T4.1 objectives, new technologies have been proposed, enabling smart SPD driven transmissions. In particular, the cognitive radio (CR) paradigm, which is usually based on Software Defined Radio (SDR), has been proposed to deal with such transmissions. CR is composable and expandable and modular by definition. In fact, it has been designed to accommodate these features.

Moreover, the modules of a cognitive radio which enable the required smart SPD driven transmissions and trusted and dependable connectivity have been analysed. In particular, the security threats related to these modules in reaching the goals have been discussed and some solutions to overcome such limitations have been identified.

The objectives for the **WP5 Middleware & Overlay** are:

1. Define a common semantic to describe the SPD interfaces and functionalities;
2. Introduce the Overlay concepts and functionalities;
3. Develop a prototype to be integrated in the demonstrators.

The results of these objectives were not planned within the period of this report. The activities performed are on-going and preliminary results will bring to **D5.1 pSHIELD Semantic model** and **D5.2 SPD middleware and overlay functionalities prototype** (in progress).

Clearly significant and tangible results are:

- Preliminary identification of pSHIELD semantic technologies candidates;
- semantic models to enable the pSHIELD seamless approach definition of main services at middleware layer;
- a draft prototype of OWL ontology to model the pSHIELD system;
- analysis of the OSGI Knoplerfish platform as technological candidate for pSHIELD Middleware demonstrator;
- Service Oriented technology selection to address the seamless approach and interoperability requirements;
- High level design of the pSHIELD Middleware Architecture;
- High level design of a secure service discovery for pSHIELD Middleware;
- Analysis of the SoA in Policy-based management architectures and protocols;
- Preliminary modelling of an Embedded System with Hybrid Automata.
- design of the closed-loop control algorithms to enable the Composability functionality;
- Formalisation of two procedures (static and plug&play) to model the composability of Embedded Systems by means of Hybrid Automata.

- preliminary Matlab-Simulink overlay models and simulations.

The WP5 work has been organised affording at the beginning three main tasks identified: semantic model, core services and overlay.

The semantic model has been analysed among the other involved partners and a good collaboration brought at the end of the period to a first proposal for the pSHIELD ontology.

The issue of middleware and overlay has been analysed from an architectural point of view and some alternative proposal have been studied and discussed between partners.

A Service Oriented approach has been investigated and selected as the one that would satisfy the seamless requirements of pSHIELD innovative features. This kind of approach is moreover suitable to develop all main functionalities, decoupling the technological details of the infrastructural layers (node and network) from the middleware and overlay layers.

The middleware has been identified as the broker between the high level functionalities exposed by core services and the overlay, and the node and network functional components. In this matter it will be important to exchange information between the other technical WPs (3,4) to detail the appropriate interfacing between the functional layers.

The Core Services realised by the middleware has been analysed and identified as the main functionality needed by the control system (implemented by the Overlay layer) in order to demonstrate the composability features of pSHIELD.

Research activities has been brought to a first modelling of the Overlay layer from a control perspective and some models have been proposed and verified through simulations.

The objectives for **WP7 Knowledge exchange and industrial validation** is:

1. Industrial Dissemination

Industrial dissemination activities play an essential role, from an ARTEMIS perspective, in the validation of research results in the industrial sector. Therefore, such activities are considered as integral part of the project both in terms of industrial research and experimental development. Several partners have been involved in dissemination activities and results are reported in §1 of this report.

Clearly significant and tangible results are listed below:

pSHIELD established three dedicated Web spaces for users, internal and external to pSHIELD. These are as follows:

- *pSHIELD Web site* for pubic information, news and promotion of pSHIELD project. SESM is currently maintaining this site.
- *BSCW Server* for clean document exchange within the project internal users. THYIA is currently providing this facility.
- *pSHIELD semantic media wiki* platform for internal collaboration, visualization and day-to-day work support. CWIN is maintaining the wiki.

Following are the dissemination activities performed within this period. SESM, CS, ED, CWIN and MAS were involved in these dissemination activities.

- Targeted industrial meeting – 1
- Participation to workshops & exhibitions – 3
- Industrial publication – 1
- Scientific publication/presentation – 3

1.2.1. Overall project impact

pSHIELD has been conceived as first phase (pilot) in the development of the overall SHIELD project. In this respect, when all the foreseen SHIELD functionalities will be deployed and exploited, impact on the market and its innovation will be the same highlighted in the SHIELD proposal.

The **current technological situation** for the ES solutions within the area of security, privacy and dependability are ad-hoc designed, implemented and deployed for each specific system pursuing sub-optimised performances and incompatibility at higher costs while the growing number and quality of treats are emphasising new challenges towards secure, dependable ES that will be operative in the augmented complexity scenarios of the future.

Lack in well defined SPD metrics constitutes, furthermore, big obstacles for a fast-validation and certification of the ES for many industrial applications where security, privacy, and dependability are with high priorities.

To resolve this situation, **the ES market** urgently **needs** an holistic built-in approach for a fast, flexible and standardised development of SPD solutions taking advantages from reusing previously validated results, adopting reference parameters to evaluate the product and deploying after standard and easier certification procedures.

During dissemination events mentioned below it was noted that the European industry in the ES is gaining a large momentum in terms of investments, stringent collaboration between academy and industry, governmental support, and development of significant competitive advantages with SPD type technologies. By proposing to realise embedded SPD via standardised design methods mainly based on *frameworks of composable technologies* to be settled within a specific industrial solution, a *set of on new SPD metrics* which allow fast, standard validations and certification as well as *methods and mechanism to easily design and keep SPD level compliance the whole of the system's lifetime*, the SHIELD project aims to **drastically improve SPD quality of ES** addressing the above mentioned industrial requirements.

1.2 Dissemination

PSHIELD project has been promoted through:

- Workshops and Exhibitions participation

- Industrial publications
- Scientific dissemination
- Public website.

1.3.1 Workshops and Exhibitions

- "pSHIELD and security in embedded systems", Critical Software, Coimbra, Portugal, 08 October 2010. **Internal Seminar**.

- Przemyslaw Osocha (SESM), Yen Pham (CWIN), "Demonstrating Security, Privacy and Dependability for Sensors to Systems", ARTEMIS IA Co-summit 2010 Project Exhibition, 26-27 October 2010, Ghent, Belgium. **Poster presentation.**

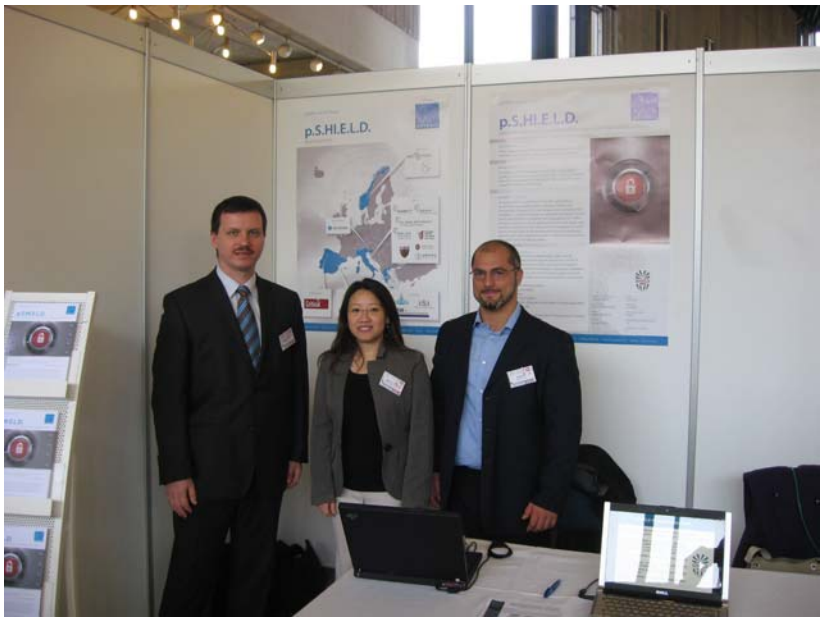

Figure 1 - ARTEMIS IA Co-summit 2010 Project Exhibition

- Przemyslaw Osocha (SESM), Yen Pham (CWIN), "p.S.HI.E.L.D.-pilot embedded Systems arcHItecturE for multi-Layer Dependable solutions", ARTEMIS Spring Event at Embedded World 2011, 1-3 March 2011, Nuremberg, Germany. **Poster presentation.**

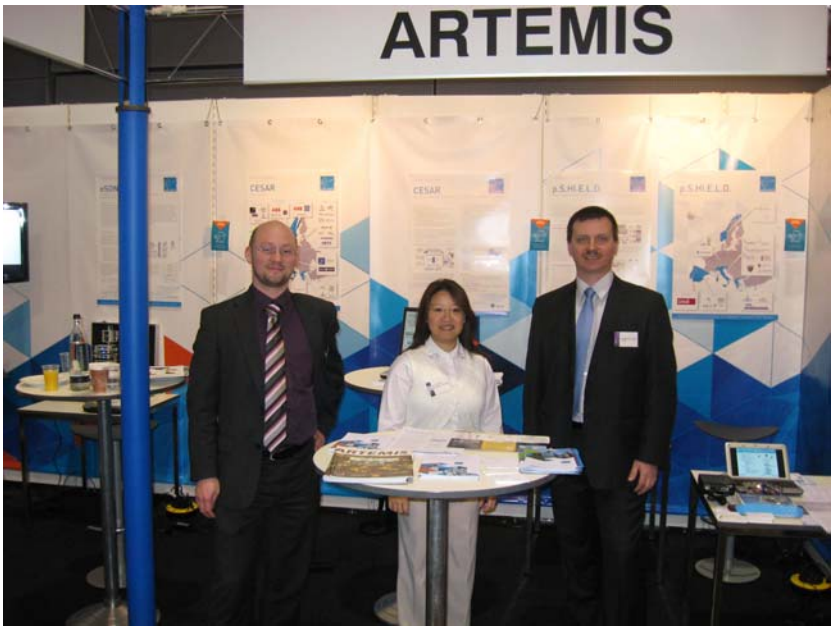

Figure 2 - ARTEMIS Spring Event at Embedded World 2011

1.3.2 Industrial publications

- Giuseppe Martufi, Fabrizio de Seta, "pSHIELD for Embedded System Security", EDlink 37 (Elsag Datamat Company Magazine), Rome, 2010.

1.3.3 Scientific dissemination

- Sarfraz Alam, Mohammad M. R. Chowdhury, Josef Noll, "An Event-driven Sensor Virtualization Approach for Internet of Things", VERDIKT conference, Oslo, 1.-2. November 2010. **Poster presentation.**

- Yen N. T. Pham, "Sensor Integration into Heterogeneous Service Platform and Domain Adaptation", University of Oslo, December 20, 2010. **Master Thesis.**

- Mohammad M. R. Chowdhury, Josef Noll, "Securing Critical Infrastructure: A Semantically Enhanced Sensor Based Approach", 2nd International Conference on Wireless Communications, Vehicular Technology, Information Theory and Aerospace & Electronic System Technology, WiRELESS ViTAE 2011, Chennai, India, Feb. 28-Mar. 03. **Scientific paper presentation**.

1.3.4 Public website

The pSHIELD public website is accessible at http://www.pshield.eu/.

2 Project objectives for the period

Within the first reporting period of the pSHIELD project (01.06.2010-31.12.2010) some intermediate objectives for the project were planned as described within the previous section. In August 2010 the Coordinator SESM reported the causes for three month delay (agreed by the Project Assembly). A final delay was reported by THYIA (as Coordinator from December 2011) to the Project Officer by e-emails before the end of the reporting period and an official request of seven months of extension has been sent to JU Artemis on the 29 of March 2011.

The objectives for the **WP2 Scenarios, requirements and system design** are:

1. The definition of the SPD requirements and specifications of each layer, as well as of the overall system on the basis of the application scenario;
2. The definition of proper SPD metrics to assess the achieved SPD level of each layer, as well as of the overall system;
3. The definition of SHIELD system architecture. Identification of the SPD layers functionalities, their intra and inter layer interfaces and relationships.

The results of the first objective have been reported in D2.1.1. Results of the other two objectives are in progress and will be reported in D2.2.1 and D2.3.1 (in progress).

The objectives for the **WP3 SPD Node** are:

1. Select a representative set of SPD technologies at Node level;
2. Develop appropriate composability mechanisms at such level;
3. Deliver a SPD node prototype.

The results of these objectives were not planned to be ready within the period of this report. The activities performed are on-going and preliminary results will be presented within **D3.1 SPD Node technologies prototype** (in progress).

The objectives for the **WP4 SPD Network** are:

1. Improve SPD technologies at Network level;
2. Develop potential prototype to be integrated in the demonstrator

The results of these objectives were not planned to be ready within the period of this report.. The activities performed are on-going and preliminary results will be presented within **D4.1SPD Network technologies prototype** (in progress).

The objectives for the **WP5 Middleware & Overlay** are:

1. Define a common semantic to describe the SPD interfaces and functionalities;
2. Introduce the Overlay concepts and functionalities;
3. Develop a prototype to be integrated in the demonstrators.

The results of these objectives were not planned to be ready within the period of this report.. The activities performed are on-going and preliminary results will be presented within **D5.1 pSHIELD Semantic model** and **D5.2 SPD middleware and overlay functionalities prototype** (in progress).

The objectives for **WP7 Knowledge exchange and industrial validation** is:

1. Industrial Dissemination

Industrial dissemination activities play an essential role, from an ARTEMIS perspective, in the validation of research results in the industrial sector. Therefore, such activities are considered as integral part of the project both in terms of industrial research and experimental development. Several partners have been involved in dissemination activities and results are reported in §1 of this report.

3 Work progress and achievements during the period

For Work Package

3.1 WP2 SPD Metrics Requirements and System Design

3.1.1 Progress towards objectives

WP2 (THYIA Leader) R&D activities are partitioned in three tasks, i.e., Task 2.1 (ASTS Leader), Task 2.2 (ESI Leader), and Task 2.3 (HAI Leader).

From these tasks the outcome in the Period 1 are three deliverables D2.1.1 (M3), D2.2.1 (M6), and D2.3.1(M6). Since a delayed was reported it was not expected a completion of D2.2.1 and D2.3.1 for the first period.

The partners contributing in WP2 are: SESM (9PMs), ASTS (14PMs), ATHENA (3PMs), CS (3PMs), CWIN (4PMs), ED (8PMs), ESI (2PMs), ETH (12PMs), HAI (9PMs), SCOM (1PM) and THYIA (11PMs).

Their main contributions were related to the following key objectives in pSHIELD: SESM (T2.1 & T2.3, SPD nodes), ASTS (T2.1, T2.2, Application scenario), ATHENA (T2.2, T2.3, network), CS(T2.1, T2.2, T2.3) CWIN (T2.1, T2.2, T2.3), ED(T2.1, T2.2, T2.3, middleware), ESI(T2.2, SPD metrics), ETH(T2.1, T2.2, T2.3, SPD nodes), HAI (T2.3, SPD layers, system, and network), SCOM (2.3, reviewer), THYIA (T2.1, T2.2, T2.3, involved almost in all targeted objectives).

Overall summary for WP2:

- Targeted objectives for D2.1.1 are reached. Refinement will be done with respect to the new plane for M15.
- Targeted objectives for D2.2.1 are reached up to 70%. Refinement will be done with respect to the new plane for M15
  - Study of metrics for SPD multilayer approach and analysis of methodologies for metrics gathering;
  - Analysis and study in depth of Common Criteria standard;
  - Analysys of SoA of existing composability approach;
  - Analysis and proposal of Quantitative Measurement of Metrics;

- Targeted objectives for D2.3.1 are reached up to 80%. Refinement will be done with respect to the new plane for M13.
  - As major achievements in this task:
    - ✓ High-level pSHIELD reference system architecture requirements specification
    - ✓ High-level SPD Node, Network, Middleware and Overlay architecture requirements specification

D2.2.1 and D2.3.1 requirements specifications will be refined and aligned to D2.1.1 for the next review in September 2011.

3.1.2 Significant and tangible results

Clearly significant and tangible results are:

- Top-level requirements specification for the application scenario
- High-level pSHIELD system requirements specification
- High-level SPD requirements specification for Node, Network, Middleware and Overlay Functional Layer
- High-level requirements specification for the SPD metrics
- High-level pSHIELD reference system architecture requirements specification
- High-level SPD Node, Network, Middleware and Overlay architecture requirements specification

Based on these tangible results the consortium implemented these requirements specification in two additional documents for mid-term review: "Formalised Conceptual Models for the Key pSHIELD Concepts" and "Aggregation of SPD metrics during composition" in which appropriate conceptual models are developed to support development of detailed requirements and specifications for WP3, WP4, WP5 and WP6.

Related project taken in considerations are: **CESAR** (pSHIELD participants: ASTS, CS, ED, HAI, and ATHENA), **EMMON** (pSHIELD participants: CS and SESM), **IMSK** (pSHIELD participants: SCOM, THYIA), **SMART** (pSHIELD participants: HAI), **ECRYPT II.**

Liaison with the related projects in which we have 8 participants are contributing for dissemination of the R&D activities and results especially on the security, privacy and dependability issues for the future embedded systems. The exploitation prospective are huge if we take in consideration overlap with the business segments covered in CESAR, EMMON, SMART and IMSK project. With respect to the extension of this project, i.e. nSHIELD where we have an additional three scenarios, the range of possible market place is growing rapidly. Overall the exploitation of the pSHIELD project results has a solid foundation within the selected application scenario since the European rail transportation will go through a significant technology breakthrough where the new generation Embedded Systems for safety critical applications will play the key role.

3.2 WP 3 SPD Node

3.3.1 Progress towards objectives

Work Package 3 according to initial Technical Annex starts from month 1 till month 11 of the project. Due to reported delay mentioned in the beginning of this section the work started with a delay of 3-6 months with respect to the partners' contributions.

WP3 SPD Node (Leader: SESM based on the PA decision taken in October 2010) is divided into 3 tasks: T3.1, T3.2, and T3.3. In all of them are conducted studies, analysis and R&D activities based of the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications.

3.3.2 Significant and tangible results

Task 3.1 Nano, Micro/Personal node (Task Leader: THYIA)

- A first draft version D3.2 is developed.
- Embedded System security based on the whole design pyramid is investigated (protocol, algorithm, architecture, micro-architecture and circuit level)
- Potential architecture for SPD core module that include TPM and MTM features
- Secure firmware, secure boot and bootstrapping with key management is investigated
- An architectural solution of nano node analysed for 3D integration technology is considered as first choice that can be also modelled by conceptual models.
- An architectural solution for micro/personal node is analysed as a possible upgrade of Contiki and Hydra OS solutions
- SPD conceptual models are proposed for sensor node based on the IEEE 802.11, IEEE 802.15.4 standards
- SotA solutions in the field of secondary power supply source to guarantee the correct system operation

Task 3.2 Power node (Task Leader: ETH)

- Studies of SotA node hardware and software available on market.
- Identification and description of hardware and software power nodes platforms.
- Development of hardware and software demonstrating selected pSHIELD node capabilities described by node architecture in D2.3.1.
- Design of a mobile and rugged high performance embedded node, the Power Node, with SPD intrinsic functionalities.
- Power Node board design.
- Power Node rugged enclosure design.
- Power node thermal studies.
- Design and implementation of board firmware.
- Operating system identification.

- Preliminary analysis of Power Node SDK.
- Results: Power Node PCB Layout design terminated. Operating system selection oriented in favour of Red Hat, CentOs or Scientific Linux.

Task 3.3 Dependable self-x and cryptographic technologies (Task Leader: AS)

- Research of the SotA within the means of providing security in lightweight and networked embedded devices through an adequate cryptographic scheme.
- Evaluation of asymmetric cryptography algorithms and their suitability to pSHIELD.
- Evaluation of symmetric cryptography algorithms and their suitability to pSHIELD.
- Evaluation of message authentication codes algorithms and their suitability to pSHIELD.
- Results: The results of Task 3.3 activities are formalised within Deliverable 3.4 "SPD self-x and cryptographic technologies", available at pSHIELD BSCW Server.
- Due to AES Rijndael is the cipher selected to be integrated in the nodes, some studies, about the original definition of the protocol, have been made to propose several code optimisations that let improve the efficient of the system.

Status of the deliverables:

- D3.1 SPD node technologies prototypes (internal M8) – The contribution from CWIN and MAS is 80% ready. THYIA first draft version D3.2 is ready.

- D3.2 SPD nano, micro/personal node technologies prototype report (public M11) – draft document in the ToC state is available at bscw server.

- D3.3 SPD power node technologies prototype report (M11) – Task partners are developing report, 10% ready.

- D3.4 SPD self-x and cryptographic technologies prototype report (M11) – draft deliverable is available at bscw server, it is 30% ready with main task partner CS contribution included. THYIA contribution on cryptographic technologies (ECC types).

3.3 WP4 SPD Network

3.3.1. Progress towards objectives

WP4 SPD Network (Leader: SCOM) is divided into 2 tasks. In all of them are conducted studies, analysis and R&D activities based of the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications.

3.3.2. Significant and tangible results

- Study and motivation of the main features needed for making the pSHIELD SPD-Based Radio System working
- Identification and study of the reconfigurable radio components with waveform parameters (frequency, bandwidth, …) allowing SPD transmissions
- Identification and study of the sensing mechanism to acquire awareness about the context and the available/used resources
- Study and implementation of SPD-based transmission techniques capable of guaranteeing a low probability of interception

According to T4.1 objectives, new technologies have been proposed, enabling smart SPD driven transmissions. In particular, the cognitive radio (CR) paradigm, which is usually based on Software Defined Radio (SDR), has been proposed to deal with such transmissions. CR is composable and expandable and modular by definition. In fact, it has been designed to accommodate these features.

Moreover, the modules of a cognitive radio which enable the required smart SPD driven transmissions and trusted and dependable connectivity have been analyzed. In particular, the security threats related to these modules in reaching the goals have been discussed and some solutions to overcome such limitations have been identified. The study of the effectiveness of the identified solutions to address the open issues, through simulation models of the proposed algorithms, is the next step and will conclude the WP4.

The activities performed are still on-going and preliminary results will bring to D4.1 SDP Network technologies prototype of this pilot phase (pShield) of the Shield project.

3.4 WP5 SPD Middleware & Overlay

3.4.1. Progress towards objectives

WP5 (ELSAGDATAMAT Leader) R&D activities are partitioned in four tasks, i.e., Task 5.1 *SPD driven Semantics* (TRS Leader), Task 5.2 *Core SPD services* (THYIA Leader), Task 5.3 *Policy-based management* (ESI ED Leader), and Task 5.4 *Overlay monitoring and reacting system by security agents* (ED Leader). From these tasks there aren't planned deliverables in the Period 1.

Here below the list of the deliverables for WP5:

Deliverables

- *Public*
  - D5.3 pSHIELD semantic models report (M11)
  - D5.4 SPD middleware and overlay functionalities report (M11)
- *Internal*
  - D5.1 pSHIELD semantic models (M8)
  - D5.2 SPD middleware and overlay functionalities prototype (M8)

The partners contributing in WP5 are: ED (37PMs), UNIROMA1 (22PMs), CS (20PMs), ATHENA (4PMs), CWIN (7PMs), TECNALIA (1PMs), TRS (14PMs), and THYIA (11PMs).

Overall summary for WP5:

- Targeted objectives for D5.1 are reached up to 45%.
- Targeted objectives for D5.2 are reached up to 40%.
- D5.3 will be targeted after the D5.1 completion
- D5.4 will be targeted after the D5.2 completion.

3.4.2. Significant and tangible results

- Preliminary identification of pSHIELD semantic technologies candidates;
- semantic models to enable the pSHIELD seamless approach definition of main services at middleware layer;
- a draft prototype of OWL ontology to model the pSHIELD system;
- analysis of the OSGI Knoplerfish platform as technological candidate for pSHIELD Middleware demonstrator;
- Service Oriented technology selection to address the seamless approach and interoperability requirements;
- High level design of the pSHIELD Middleware Architecture;
- High level design of a secure service discovery for pSHIELD Middleware;
- Analysis of the SoA in Policy-based management architectures and protocols;
- Preliminary modelling of an Embedded System with Hybrid Automata.
- design of the closed-loop control algorithms to enable the Composability functionality;

- Formalisation of two procedures (static and plug&play) to model the composability of Embedded Systems by means of Hybrid Automata.
- preliminary Matlab-Simulink overlay models and simulations.

The WP5 work has been organised affording at the beginning three main tasks identified: semantic model, core services and overlay.

The semantic model has been analysed among the other involved partners and a good collaboration brought at the end of the period to a first proposal for the pSHIELD ontology.

The issue on middleware and overlay has been analysed from an architectural point of view and some alternative proposal have been studied and discussed between partners.

A Service Oriented approach has been investigated and selected as the one that would satisfy the seamless requirements of pSHIELD innovative features. This kind of approach is moreover suitable to develop all main functionalities decoupling the technological details of the infrastructural layers (node and network) from the middleware and overlay layers.

The middleware has been identified as the broker between the high level functionalities exposed by core services and the overlay, and the node and network functional components. In this matter will be important to exchange information between the other technical WPs (3,4) to detail the appropriate interfacing between the functional layers.

The Core Services realised by the middleware have been analysed and identified as the main functionality needed by the control system (implemented by the Overlay layer) in order to demonstrate the composability features of pSHIELD.

Research activities have been brought to a first modelling of the Overlay layer from a control perspective and some models has been proposed and verified through simulations.

3.5 WP6 Platform integration, validation & demonstration

3.5.1. Progress towards objectives

Work Package 6 according to initial Technical Annex start from month 7 till month 11 of the project. Due to reported delay mentioned in the beginning of this section the work started with a delay of 3-6 months with respect to the partners' contributions. According to the agreed delay for 7 months the start for this WP is accordingly shifted for 7 months.

Anyway, CWIN and Movation have reported manpower in WP6, even though WP6 is not formally started in pSHIELD. The reason for the soft start in WP6 is the requirements from the pSHIELD associate partners Norwegian Rail Authorities (Jernbaneverket, JBV) and Telenor Objects. These partners have requirements to demonstrate interoperability in March/April 2011, showing the import of JBV data in the Telenor Objects "Shepherd" platform.

While CWIN concentrated on the integration of on-the-shelf nodes, Movation concentrates on the conceptual work, the link to standardisation and the interoperability with the systems in JBV and Shepherd. The specific implementation is based on nano-nodes such as a GPS receiver providing positioning, micro-nodes such as SunSPOTs providing temperature and personal nodes such as an embedded Linux platform being used for collection of data and access to the gateway. The embedded linux platform was established, and early data exchange was provided in the reporting period. The results will be documented in D3.1 and the deliverables of WP6. Extensions are foreseen to include certain semantic SPD functionalities. Besides demonstrating the interworking on security, the work further identifies required extensions for the ETSI TS102.690 M2M platform.

3.5.2. Significant and tangible results

N/A.

3.6 WP7 Knowledge exchange & industrial validation

3.6.1. Progress towards objectives

The progress of work at WP7 is satisfactory till M0.6 to meet the objectives of this work package. The works at WP7 are formally divided into two tasks: T7.1 – Dissemination and T7.2 – Exploitation.

3.6.2. Significant and tangible results

The performed and on-going activities at each task are summarized as follows mentioning *measurable indicators*, and *significant* and *tangible results*:

T7.1 – Dissemination (Leader: SESM)

pSHIELD established three dedicated Web spaces for users, internal and external to pSHIELD. These are as follows:

- pSHIELD Web site for pubic information, news and promotion of pSHIELD project. SESM is currently maintaining this site.
- BSCW Server for clean document exchange within the project internal users. THYIA is currently providing this facility.
- pSHIELD semantic media wiki platform for internal collaboration, visualization and day-to-day work support. CWIN is maintaining the wiki platforms.

Following are the summary of the dissemination activities performed during this period. SESM, CS, ED, CWIN and MAS were involved in these dissemination activities.

- Targeted industrial meeting – 1
- Participation to workshops & exhibitions – 3
- Industrial publication – 1
- Scientific publication/presentation – 3

During the participation at ARTEMIS Spring Event 2011 and ARTEMIS IA Co-Summit 2010, pSHIELD demonstrated early version of prototype and exchanged views with other ARTEMIS-JU funded projects. As a part of scientific dissemination pSHIELD participated workshops such as VERDIKT Conference 2010 by the Norwegian Research Council and hold talks with other relevant national funded projects. Based on the focus of pSHIELD, a Master thesis has been completed at University of Oslo.

The major scientific outcomes of the project are expected in the second half period and this task already identified several key conferences and Journals for contribution.

T7.2 – Exploitation (Leader: CWIN)

Norwegian members (CWIN & MAS) of pSHIELD carried out a preliminary meeting with supporting industrial members JBV (the Norwegian Railway Administration) and Telenor Objects to plan on how to exploit the upcoming results of pSHIELD. In this regard, CWIN & MAS

maintains regular contact with JBV and Telenor Object. As an outcome of such cooperation, CWIN & MAS planned two more dissemination and exploitation events in April 2011. One of them is discussion with the National Hospital in Norway (Rikshospitaltet) on how to apply pSHIELD expected results in eHealth arena. Thus pSHIELD identified one potential application area outside of its core focus. This is the result of maintaining informal communication with potential industries where the results of pSHIELD can also be applied. THYIA has intensive talk with national authorities (Ministry of Higher Education, Science and Technology and Ministry of the Economy) as well as with industry in the field of interests: Rail Transport (pSHIELD), and Telecom Operators for Social Mobility Networks (nSHIELD). The interest shown and discussed perspectives are encouraging for a potential outcome in the next three years.

Status of the deliverables:

- D7.1.1 Web site – The project Web site was up online according to schedule on month 2 and thus WP7 achieved the milestone M1. The deliverable D7.1.1 was accepted during the mid-term review meeting (22. March 2011).
- D7.1.2 Dissemination report – The preliminary table of contents has been already been proposed and we are on course to achieve the deadline
- D7.2.1 Exploitation plan – The preliminary table of contents & responsible partners have been proposed.

For Partner (grouped by Country)

The following tables resume the work progress and achievements during the reporting period.

3.7 Italy

3.7.1. SESM

Beneficiary[5]:	SESM
Work Package(s)	WP1[6] – Project management (total 36PM) WP2 – SPD metric, requirements and system design (total 9PM) WP3 – SPD node (total 29PM) WP6 – Platform integration, validation & demonstration (total 9PM) WP7 – Knowledge exchange and industrial validation (total 6PM)
Task(s)	Task 1.1 Project management Task 1.2 Liaisons Task 2.1 Multi-technology requirements & specification Task 2.3 Multi-technology architectural design Task 3.2 Power node Task 6.2 Multi-Technology Validation & Verification Task 6.3 Lifecycle SPD Support Task 7.1 Dissemination
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project management – 12PM Task 1.2 Liaisons – 6PM Task 2.1 Multi-technology requirements & specification – 4,5PM Task 2.3 Multi-technology architectural design – 4,5PM Task 3.2 Power node – 14PM Task 6.2 Multi-Technology Validation & Verification – 0PM Task 6.3 Lifecycle SPD Support – 0PM Task 7.1 Dissemination – 3PM
Effort actual or spent in this period:	Task 1.1 Project management – 1PM Task 1.2 Liaisons – 1PM Task 2.1 Multi-technology requirements & specification – 2PM Task 2.3 Multi-technology architectural design – 2PM Task 3.2 Power node – 2PM Task 6.2 Multi-Technology Validation & Verification – 0PM Task 6.3 Lifecycle SPD Support – 0PM

[5] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)
[6] x is 1, 2, 3, 4, 5, 6, and 7

	Task 7.1 Dissemination – 1PM
% of work completed at the end of the period (indicative):	Task 1.1 Project management – 8%[7] Task 1.2 Liaisons – 17% Task 2.1 Multi-technology requirements & specification – 44% Task 2.3 Multi-technology architectural design – 44% Task 3.2 Power node – 14% Task 6.2 Multi-Technology Validation & Verification – 100% Task 6.3 Lifecycle SPD Support – 100% Task 7.1 Dissemination – 33%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 1.1 Project management
  - Role of Project Coordinator from 1st of June 2010 till change approved by PO in December 2010.
  - Role of TCM after change of project coordinator.
  - SESM acts as a WP3 Leader, after withdraw of previous leader and acceptance of project consortium in October 2010.
- Task 1.2 Liaisons
  - Studies on projects concerning topics related to pSHIELD.
- Task 2.1 Multi-technology requirements & specification
  - Extensive analysis of TA (Annex I) described goals in node layer area.
  - Analysis of relevance to Sub-Programme 6 Priority, Industry Priorities and Artemis Targets.
  - Definition of Nodes requirements following above goals.
  - Results: Rich set of Node requirements contributed to deliverable D2.1.1 chapter 8 "Node Requirements and Specifications" with subchapters containing detailed references to Annex I.
- Task 2.3 Multi-technology architectural design
  - Studies of SotA technologies available on market.
  - Development of pSHIELD generic node architecture on the base of previously prepared for D2.1.1 node requirements and specifications.
  - Results: Design of generic conceptual model of a pSHIELD node for all node types, which can be implemented in different architectures, providing different functionalities, different SPD compliance levels and different services, depending on the type of node and application field. Three node types represent very different devices but they share the same conceptual model, enabling a seamless composability. Contributed to D2.3.1 (Node section).
- Task 3.2 Power node
  - Studies of SotA node hardware and software available on market.
  - Selection and description of hardware and software power nodes platforms.
  - Development of hardware and software demonstrating selected pSHIELD node capabilities described by node architecture in D2.3.1.
  - Result:
    - Selected several Common Of The Shelf (COTS) development board (DB);
    - Analysed in details the features of each selected DB;

[7] Z% = PMs spent/PMs planned x 100. This must correspond to Table 3.1

- Decided to use Altera StratixII FPGA based board (ADB) and Xilinx Virtex5 FPGA based board (XDB).
- Selected two softcores necessary for synthesizing an FPGA based System on Chip (SoC): Leon3, NiosII;
- Designed the SoC Leon3 based for ADB;
- Synthesized SoC Leon3 based for ADB;
- Programmed ADB with SoC Leon3 based and made able to be alive at boot;
- Built boot loader for ADB with SoC Leon3 based (without network connectivity);
- Built operating system (OS) for ADB with SoC Leon3 based, (without network connectivity);
- Designed the SoC NiosII based for ADB;
- Synthesized SoC NiosII based for ADB;
- Programmed ADB with SoC NiosII based and made able to be alive at boot;
- Formalized the procedure to make ADB alive at boot with SoC Leon3 based and running the OS automatically;
- Built boot loader for ADB with SoC NiosII based; some trouble encountered with flash memory;
- Built operating system (OS) for ADB with SoC NiosII based; system working without flash memory support;
- Designed and tested the HSM (Health Status Monitoring) module (see D2.3.1);
- Designed the SoC Leon3 based for XDB;
- Synthesized SoC Leon3 based for XDB;
- Programmed XDB with SoC Leon3 based and made able to be alive at boot;

- Task 6.2 Multi-Technology Validation & Verification
  - Task not started yet
- Task 6.3 Lifecycle SPD Support
  - Task not started yet
- Task 7.1 Dissemination
  - Exchange of informative materials on the project subject.
  - Preparation and presentation of pSHIELD project at Co-summit 2010 in Ghent (with CWIN).
  - Preparation and presentation of pSHIELD project at Embedded World 2011 exhibition in Nuremberg (with MAS).
  - Results: Presentation of project at two exhibitions, making it recognized by governments and industry representatives.

A summary progress towards objectives.

During the first period of the project, SESM was involved in actions on several different management levels.

- From the project beginning on 1st of June 2010 SESM took the role of Project Coordinator. Due to lack of national agreement project consortium decided in October 2010 to move coordinator role to another partner. The change entered in force in December 2010. From that moment SESM took technical coordinator role of TCM.
- SESM acts as a WP3 leader, after decision of previous leader to withdraw, and acceptance of project consortium in October 2010.
- SESM also takes part in 8 tasks as a partner or leader.

During described period in SESM we took necessary steps to realise our project aims. After analysis of Annex I and relevance to Sub-Programme 6 Priority, Industry Priorities and Artemis Targets, we defined Nodes requirements following above goals. They are contributed to deliverable D2.1.1 chapter 8 "Node Requirements and Specifications".

Based on that we developed and proposed in D2.3.1 a pSHIELD generic node architecture. Proposed generic conceptual model of a pSHIELD node for all node types, can be implemented in different architectures, providing different functionalities, different SPD compliance levels and different services, depending on the type of node and application field. Three node types represent very different devices but they share the same conceptual model, enabling a seamless composability.

The first necessary step is to identify a development platform. Waiting for a definitive one, we set two possible candidates: Altera StratixII FPGA based board (ADB) and Xilinx Virtex5 FPGA based board (XDB).
The second necessary step is to identify a useful operating environment. In particular a very important decision is related to the issue of using an Operating System (OS) based approach or an OS-less approach.
We definitively decided for a OS based approach in order to ensure all the functionalities required with a reasonable result / work effort ratio.
We focused on the following three necessary and sequential steps:

- Detailed knowledge of the selected platform;
- Implementation of boot loader;
- Customisation of a general purpose OS for the selected platform;

Only after accomplished the previous three steps, the specific SPD compliance is implementable at application level.

Clearly significant and tangible results

- Development of extensive set of Node requirements that exactly follow goals of Annex I. Results contributed to deliverable D2.1.1 chapter 8 "Node Requirements and Specifications" with subchapters containing detailed references to Annex I.
- Design of generic conceptual model of a pSHIELD node for all node types, which can be implemented in different architectures, providing different functionalities, different SPD compliance levels and different services, depending on the type of node and application field. Three node types represent very different devices but they share the same conceptual model, enabling a seamless composability. Contributed to D2.3.1 (Node section).
- The actual result of the work is the availability of some real development systems and a scalable / configurable development environment for FPGA based Power Nodes, that are ready to host the target application.

Use of resources

The delay in the project had as a consequence that the deploy of resources has been shifted to 2011.

Dissemination activities and exploitation perspectives

- SESM (together with CWIN) prepared informative materials on pSHIELD project, i.e.: poster and leaflets, and presented them at Co-summit 2010 exhibition in Ghent.

➢ SESM (together with MAS) prepared informative materials on pSHIELD project and presented them at Embedded World 2011 exhibition in Nuremberg.
Corrective actions A project extension is necessary to achieve the objectives defined in pSHIELD project, due to the initial delay.

3.7.2. Ansaldo ASTS

Beneficiary[8]:	ASTS
Work Package(s)	WP1 - Project Management WP2 - Scenarios, user requirements and architecture design
Task(s)	Task 1.1 Project management Task 2.1 Multi-technology scenarios & requirements Task 2.2 Multi-technology specification & metrics
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project management: 1,7 Task 2.1 Multi-technology scenarios & requirements: 12 Task 2.2 Multi-technology specification & metrics: 11
Effort actual or spent in this period:	Task 1.1 Project management: 1 Task 2.1 Multi-technology scenarios & requirements: 12 Task 2.2 Multi-technology specification & metrics: 4
% of work completed at the end of the period (indicative):	Task 1.1 Project management: 40% Task 2.1 Multi-technology scenarios & requirements: 100% Task 2.2 Multi-technology specification & metrics: 60%
Description of the activities carried out during the period to reach specific objectives within the task/WP: • Task 1.1 ➢ Coordination activities with the Technical Management Committee (TMC); • Task 2.1 ➢ Analysis of the state of the art, definitions and taxonomy on the key concepts regarding Security, Privacy and Dependability, and their attributes; ➢ Preliminary identification of high level requirements for scenario; ➢ Collection of all requirements coming from partners; ➢ Drafting of the D2.1.1 document "*System Requirements and Specification*";	

[8] This report is per Beneficiary, and has to be provided for each WP in which it is involved each Beneficiary

• Task 2.2 ➢ Revision and checking of D2.2.1 document;
Description of criticalities met during the period: ➢ Met some difficulties in finding a common and shared table of content for D2.1.1 document; ➢ Missing a preliminary or draft version of deliverable from Task 2.2. This has introduced a delay in contributing to Task 2.2 itself.
Dissemination activities and exploitation perspectives: ➢ Dissemination activities regarding the proposal of an advanced monitoring and surveillance system to protect freight trains transporting hazardous material are planned. In particular, the results of project will be disseminated through the production of scientific publications and participation in international conferences on these topics.

3.7.3. Elsag Datamat

Beneficiary[9]:	ELSAGDATAMAT
Work Package(s)	WP1 - Project Management WP2 - SPD Metric, requirements and system design WP5 - SPD Middleware & Overlay WP6 - Platform integration, validation & demonstration WP7 - Knowledge exchange and industrial validation
Task(s)	Task 1.1 - Project Management Task 2.1 - Multi-technology requirements & specification Task 2.2 - Multi-technology SPD metrics Task 2.3 - Multi-technology architectural design Task 5.1 - SPD driven Semantics Task 5.2 - Core SPD services Task 5.3 - Policy-based management Task 5.4 - Overlay monitoring and reacting system by security agents Task 6.2 - Multi-technology Validation & Verification Task 7.2 – Exploitation
Period:	1st June 2010 – 31st December 2010
Effort planned for the period:	**WP1 – 1,8 PM** Task 1.1 – 1,8 PM **WP2 – 8 PM** Task 2.1 – 2,0 PM Task 2.2 – 2,0 PM Task 2.3 – 4,0 PM **WP5 – 26,5 PM** Task 5.1 – 7,0 PM

[9] This report is per Beneficiary, and has to be provided for each WP in which it is involved each Beneficiary

	Task 5.2 – 6,5 PM Task 5.3 – 6,5 PM Task 5.4 – 6,5 PM **WP6 – 4 PM** Task 6.2 – 4,0 PM **WP7 – 1 PM** Task 7.2 – 1,0 PM
Effort actual or spent in this period:	**WP1 – 1,17 PM** Task 1.1 – 1,17 PM **WP2 – 5,96 PM** Task 2.1 – 2,0 PM Task 2.2 – 1,26 PM Task 2.3 – 2,7 PM **WP5 – 17,38 PM** Task 5.1 – 5,2 PM Task 5.2 – 3,88 PM Task 5.3 – 3,30 PM Task 5.4 – 5,0 PM **WP6 – 0,0 PM** Task 6.2 – 0,0 PM **WP7 – 0,0 PM** Task 7.2 – 0,0 PM
% of work completed at the end of the period (indicative):	**WP1 – 65,0%** Task 1.1 – 65,0% **WP2 – 74,5%** Task 2.1 – 100,00% Task 2.2 – 63,00% Task 2.3 – 67,50% **WP5 – 65,58%** Task 5.1 – 74,29% Task 5.2 – 59,69% Task 5.3 – 50,77% Task 5.4 – 76,92% **WP6 – 0,0% PM** Task 6.2 – 0,00% PM **WP7 – 0,0% PM** Task 7.2 – 0.00% PM

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- **Task 1.1**
  - Technical management activities and support to the coordinator;
  - Project scheduling and achievements control;
  - Progress reports about involved resources and other expenditure;
  - Coordination of the leaded WPs and tasks technical activities;
  - Participation to physical meetings and phone conferences;
  - Organization of physical meetings and phone conferences.

Objectives: manage the project

- **Task 2.1**
  - Analysis of SPD requirements on Middleware and Overlay layers;
  - Analysis of standard methodologies on SPD requirements definition;
  - Contribution to the D2.1.1 "System Requirements and Specification" defining the requirements of Middleware and Overlay functionalities;
  - Contribution to the internal review of D2.1.1.

Objectives: defining the requirement of the pSHIELD framework driven by the use case
Results: inputs to the D2.1.1 deliverables and proposition of a standard methodology

- **Task 2.2**
  - Study of metrics for SPD multilayer approach and analysis of methodologies for metrics gathering;
  - Analysis of the state of the art of the existing metrics on SPD;
  - Analysis and study in depth of Common Criteria standard;
  - Analysys of SoA of existing composability approach;
  - Analysis and proposal of Quantitative Measurement of Metrics;
  - Contribution to the D2.2.1 "Preliminary SPD Metrics Specification".

Objectives: defining the SPD metrics of the pSHIELD framework
Results: inputs to the D2.2.1 deliverables and proposition of a conceptual model approach on metrics

- **Task 2.3**
  - Analysis of the SoA of Middleware architecture;
  - Proposition of a Service Oriented architecture to address the seamless approach and interoperability requirements;
  - Contribution to the D2.3.1 "Preliminary System Architecture Design".

Objectives: defining the pSHIELD framework architecture
Results: inputs to the D2.3.1 deliverables on overall high level and middleware/overlay architecture

- **Task 5.1**
  - Analysis of the SoA of semantic technologies;
  - First identification of semantic technologies candidates suitable for use in pSHIELD;
  - Formal methodology definition for the building of pSHIELD ontology;
  - Evaluation of SoA languages for model implementation (OWL, OWL-DL, ...)

Objectives: semantic models addressing the pSHIELD seamless approach
Results: definition of ToC and inputs to deliverable D5.1 and OWL prototypes

- **Task 5.2**
  - Analysis of the SoA in the Core SPD services at Middleware Level;
  - Preliminary definition of a Service Oriented Middleware architecture;
  - Identification of interfaces between the functional layers;
  - Preliminary definition of main Core SPD services (service discovery, filtering, ranking, aggregation and

composition)

Objectives: definition of main services at middleware layer
Results: definition of ToC and inputs to deliverable D5.2

- **Task 5.3**
  - Analysis of the SoA in Policy-based management (PBM);
  - Evaluation of PBM architectures and protocols;

Objectives: addressing a PBM SoA analysis as starting point to be continued and implemented in the full nSHIELD project
Results: definition of ToC and inputs to deliverable D5.2

- **Task 5.4**
  - Definition of the overlay functional architecture;
  - Definition of how overlay interfaces all other layered architecture components;

Objectives: definition of the overlay functional architecture
Results: definition of ToC and inputs to deliverable D5.2

A summary progress towards objectives

Although the activities has been focused in the first months on contributions to the WP2 deliverables, the WP5 tasks has been started almost at the same time.

The contributions to the WP2 on middleware and overlay matter has been kept aligned with the progress of WP5 work.

The WP2 contribution on the D2.1.1 requirements deliverables has been always shared between the WP5 partners in order to keep them aligned with the WP5 tasks.

An approach of standardization methods has been analysed and proposed with Common Criteria.

A risk based approach has been proposed for SPD Metrics definitions.

The WP5 work has been organised affording at the beginning three main tasks identified: semantic model, core services and overlay.

The semantic model has been analysed among the other involved partners and a good collaboration brought at the end of the period to a first proposal for the pSHIELD ontology.

The issue on middleware and overlay has been analysed from an architectural point of view and some alternative proposal have been studied and discussed between partners.

A Service Oriented approach has been investigated and selected as the one that would satisfy the seamless requirements of pSHIELD innovative features. This kind of approach is moreover suitable to develop all main functionalities decoupling the technological details of the infrastructural layers (node and network) from the middleware and overlay layers.

The middleware has been identified as the broker between the high level functionalities exposed by core

services and the overlay, and the node and network functional components. In this matter will be important to exchange information between the other technical WPs (3,4) to detail the appropriate interfacing between the functional layers.

The Core Services realised by the middleware has been analysed and identified as the main functionality needed by the control system (implemented by the Overlay layer) in order to demonstrate the composability features of pSHIELD.

Research activities has been brought to a first modelling of the Overlay layer from a control perspective and some models has been proposed and verified through simulations.

Clearly significant and tangible results

Main results and objectives achieved on WP5 activities and on WP2 contributions:

- Adoption of a standard methodology as Common Criteria to afford the Formalisation of objectives;
- Definition of a methodical approach on Metrics;
- Definition of an architecture of middleware and overlay layers;
- Service Oriented technology selection to address the seamless approach and interoperability requirements;
- Prototypes of ontologies;

Some results have been produced as contributions to the WP2 deliverables and some others will be included in the WP5 deliverables.

Although delay on WP2 activities impacted with almost all WP5 tasks due to missing inputs as requirements, the WP5 tasks are almost in line considering the overall project delay. The collaboration between the participants has been fine.

Use of resources

There are some issues to address on reduction of effort on the WP5 asked by Critical Software.

The weakness of coordination had produced difficult in communications between partners. In WP5 a better local coordination and cooperation and some specific independent characteristics, allowed to advance the related activities reducing the impact of the general delay.

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning

The delay and the lack of coherence of WP2 have been due mainly to lack of agreement on the document structure.

The staff has been well planned to afford the required activities but the inefficient overall management has actually slowed the activity progress with a related lesser effort expenditure in the reported period.

Dissemination activities and exploitation perspectives

The project has been presented inside the Finmeccanica Group and an article on pSHIELD project's overview has been written for the company magazine.
Some perspectives of exploitation are foreseen in the field of secure and dependable service middleware aimed to security information management systems.

Corrective actions It's needed a better coordination and communication between partners. The collaborative tools should be used exploiting at best its knowledge sharing capabilities. The activities should be tightly defined in order to satisfy the limited use case scenario due to the "pilot" nature of the project.

3.7.4. Eurotech

Beneficiary[10]:	ETH
Work Package(s)	WP1 - SPD metric, requirements and system design WP3 – SPD node
Task(s)	Task 1.1 Project management Task 2.1 Multi-technology requirements & specification Task 2.2 Multi-technology SPD metrics Task 2.3 Multi-technology architectural design Task 3.2 Power node Task 6.4 Multi-Technology Demonstration
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project management: 1MM Task 2.1 Multi-technology requirements & specification: 4MM Task 2.2 Multi-technology SPD metrics: 1MM Task 2.3 Multi-technology architectural design: 6MM Task 3.2 Power node: 21MM Task 6.4 Multi-Technology Demonstration: 0MM
Effort actual or spent in this period:	Task 1.1 Project management: 1MM Task 2.1 Multi-technology requirements & specification: 4MM Task 2.2 Multi-technology SPD metrics: 1MM Task 2.3 Multi-technology architectural design: 6MM Task 3.2 Power node: 9MM Task 6.4 Multi-Technology Demonstration: 0MM
% of work completed at the end of the period (indicative):	Task 1.1 Project management: 50% Task 2.1 Multi-technology requirements & specification: 100% Task 2.2 Multi-technology SPD metrics: 50% Task 2.3 Multi-technology architectural design: 100% Task 3.2 Power node: 22% Task 6.4 Multi-Technology Demonstration: 0%

[10] This report is per Beneficiary, and has to be provided for each WP in which it is involved each Beneficiary

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 1.1
  - Management activities required by the project: financial and technical planning, research activities control, reporting activities, review meeting preparation.
- Task 2.1
  - Identification of pSHIELD system requirements and specifications
  - Results: contribution to D2.1.1 with the identification of Power Node requirements and specifications.
- Task 2.2
  - Examination of the SPD metrics that can be used to evaluate the prototype.
  - Results: SPD metrics examination.
- Task 2.3
  - pSHIELD system architecture definition and design.
  - Power Node architecture definition and design.
  - Results: contribution to D2.1.3, related to Power Node architecture.
- Task 3.2
  - Design of a mobile and rugged high performance embedded node with SPD intrinsic functionalities.
  - Power Node board design.
  - Power Node rugged enclosure design.
  - Power node thermal studies.
  - Design and implementation of board firmware.
  - Operating system identification.
  - Preliminary analysis of Power Node SDK.
  - Results: Power Node PCB Layout design terminated. Operating system selection oriented in favour of Red Hat, CentOs or Scientific Linux.
- Task 6.4
  - No activities performed, as planned.

A summary progress towards objectives

The Power Node represents an important element of pSHIELD hardware infrastructure. The hardware infrastructure is the basement on which every other layer will rely. The infrastructure will be partially developed in pSHIELD project and partially in nSHIELD project. The Power Node provides to pSHIELD system an element with high computing power, and offers the possibility to customize its SPD functionalities with a high performance FPGA. This will increase the smartness of the node in terms of SPD. The Power Node design and development will be performed with the following steps: identification of requirements and specifications, definition of the node architecture, design and development of the node, development of software components for OS support and SDK identification. The first two steps have been completed. The design and development of the node board is in progress, such as the development of the cooling system and of the rugged enclosure. The software related activities have been started and have been concentrated on the OS selection.

Clearly significant and tangible results

The most important results achieved in the first reporting period are:

- The PCB layout design of the Power Node. It has been performed following these principles:
  - CPU positioning to maximize performance and parallelism;
  - Memory/CPU close coupling;

- Connector positioning to ensure easy composability;
- Distribution of components to optimise heat dissipation;
- PCB power aware design.

- First analysis of ruggedised enclosure.
- First analysis of the cooling concept in combination with a cold-plate based cooling system.
- Identification of the preferred OSs that will be used: Red Hat, CentOs or Scientific Linux.

Preliminary study of the requirements of the power node SDK.

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning

The overall project has been subjected to a delay that influenced the other activities. Work package 3 has been only partially influenced by this delay because the activities in this Work package are fully aligned with the company internal research plan and have been performed anyway.

Use of resources

Resources have been used according to the activities plan, with some deviations in Task 3.2 due to the delay accumulated in Work package 2.

Dissemination activities and exploitation perspectives

No dissemination activities have been performed yet.

Corrective actions

No corrective actions are needed. The activities will proceed with a rescheduling and will progress according to the technical annex.

3.7.5. Selex Communications

Beneficiary[11]: SCOM	
Work Package(s)	WP1 – Project Management (4MM) WP2 – Metrics, Requirements & System Design (1MM) WP4 – SPD Network (18MM) WP6 – Platform integration, validation & demonstration (1MM) WP7 – Knowledge exchange & industrial validation (1MM)
Task(s)	Task 1.1 Project Management Task 1.2 Liaisons Task 2.3 Multi Technology Architectural Design **Task 4.1 Smart SPD driven transmission** Task 6.1 Multi Technology System Integration Task 7.2 Exploitation

[11] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)

Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project Management - 1.5MM Task 1.2 Liaisons - 0.5MM Task 2.3 Multi Technology Architectural Design - 1MM Task 4.1 Smart SPD driven transmission – 9MM Task 6.1 Multi Technology System Integration – 0MM Task 7.2 Exploitation – 0MM
Effort actual or spent in this period:	Task 1.1 Project Management – 1.5MM Task 1.2 Liaisons – 0.5MM Task 2.3 Multi Technology Architectural Design – 0.7MM Task 4.1 Smart SPD driven transmission – 6MM Task 6.1 Multi Technology System Integration – 0MM Task 7.2 Exploitation – 0MM
% of work completed at the end of the period (indicative):	Task 1.1 Project Management - 38% Task 1.2 Liaisons - 12 % Task 2.3 Multi Technology Architectural Design - 70 % Task4.1 Smart SPD driven transmission [12] - 33% Task 6.1 Multi Technology System Integration – 0% Task 7.2 Exploitation – 0%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 2.3
  - Study of the metrics for the SPD classification related to the architectural design
- Task 4.1
  - Study and motivation of the main features needed for making the pSHIELD SPD-Based Radio System working
  - Identification and study of the reconfigurable radio components with waveform parameters (frequency, bandwidth, …) allowing SPD transmissions
  - Identification and study of the sensing mechanism to acquire awareness about the context and the available/used resources
  - Study and implementation of SPD-based transmission techniques capable of guaranteeing a low probability of interception

Additional Information:

The above mentioned activities have been partially completed according to the lack of input form the other WPs (in particular WP2). The work which has been performed represents a strong basis for future activities.

[12] Z% = (PMs planned-PMs spent)/PMs planned x 100. This must correspond to Table 3.1

A summary progress towards objectives

According to T4.1 objectives SCOM has proposed new technologies enabling smart SPD driven transmissions. In particular, the cognitive radio (CR) paradigm, which is usually based on Software Defined Radio (SDR), has been proposed to deal with such transmissions. CR is composable and expandable and modular by definition. In fact, it has been designed to accommodate these features.

Moreover, the modules of a cognitive radio which enable the required smart SPD driven transmissions and trusted and dependable connectivity have been analysed. In particular, the security threats related to these modules in reaching the goals have been discussed and some solutions to overcome such limitations have been identified. SCOM will use the remaining PMs to study the effectiveness of the identified solutions to address the open issues, through simulation models of the proposed algorithms.

Clearly significant and tangible results

In the next months, SCOM will provide some results on the benefits which can be obtained by introducing the considered new technologies for smart SPD transmissions and trustable and dependable connectivity. At the moment SCOM has spent almost half of the effort and it is planning to spend the rest of the PMs to achieve the objectives according to the pSHIELD technical annex.

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning

No deviations have occurred with respect to the project but the delay in the progress of other WP activities has directly affected SCOM contribution. According to this, some additional effort has been considered in the first reporting period to cope with a more deep analysis of technical aspects required to be in line with WP4 schedule (internal release of deliverable 4.1).

Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning

SCOM contribution is reasonably in line with respect to the project schedule taking into account the delay of other WPs. The research group has been empowered to be able to set-up and perform activities even if a delay is actually unavoidable.

Corrective actions

No corrective actions are needed. The activities have started and will progress according to the technical annex while the contribution of other critical WPs will be properly released.

3.7.6. Tecnologie delle Reti e dei Sistemi

Beneficiary[13]:	TRS
Work Package(s)	WP1 - Project Management WP5 - SPD Middleware & Overlay
Task(s)	Task 1.1 - Project Management Task 5.1 - SPD driven Semantics
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 - Project Management – 0,5 PM Task 5.1 - SPD driven Semantics - 6.5 PM
Effort actual or spent in this period:	Task 1.1 - Project Management – 0,5 PM Task 5.1 - SPD driven Semantics - 6.5 PM
% of work completed at the end of the period (indicative):	Task 1.1 - Project Management – 50% Task 5.1 - SPD driven Semantics – 50 %

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 1.1
  - Controlling project scheduling and achievements
  - Reporting of progress and resource expenditure
  - Coordination of technical activities inside the task

- Task 5.1
  - Survey of the state of the art in the field of semantic technologies
  - Analysis of relevant applications of semantic technologies to pSHIELD framework
  - Analysis of a formal methodology to build ontologies
  - Additional contribution and review, in the scope of WP2, concerning the D2.x deliverables, with respect to the sections that have direct impact on WP5.
  - Prototyping of ontology models

Additional Information:

In spite of the delay the project has undergone as a whole, the work that has been performed in Task 5.1 provides a sound groundwork for activities coming forth.

[13] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)

A summary progress towards objectives

The activities carried out during the period have achieved a meaningful number of valuable results.

First of all, effort has been put to analyse the applicability of a formal methodology to build, verify and maintain an ontology.

As a matter of fact, in order to make available large-scale, high quality domain ontologies, effective and usable methodologies are needed to facilitate the process of ontology building. Even though automatic ontology learning methods (such as text mining) significantly support ontology engineers, speeding up their task, there is still the need of a significant manual effort, in the integration and validation of the automatically generated ontology. Existing ontology building methods only partly are built capitalizing the large experience that can be drawn from widely used standards in other areas, like software engineering and knowledge representation. In pSHIELD, we fit and develop to a greater extent a methodology for ontology building derived from a well-established and widely used software engineering process, the Unified Software Development Process .

This is a novel approach to large-scale ontology building that takes advantage of the Unified Process (UP) and the Unified Modelling Language (UML). This choice makes ontology building an easier task for modellers familiar with these techniques: each phase of the method fits in the UP, providing a number of consolidated steps that guide the process of ontology development. UML has been already shown to be suitable to this end, confirming its nature of rich and extensible language. What distinguishes the UP and the ontology building methodology from the other methodologies, respectively for software and ontology engineering, is their use-case driven, iterative and incremental nature.

Moreover, an analysis has been carried out to discover original exploitations of semantic technologies in order to effectively and efficiently manage interoperability issues regarding SPD technologies in the pSHIELD framework. This analysis brings us to take advantage of semantic technologies at several levels of the pSHIELD framework:

- Reconciliation of heterogeneous formats of parameters exchanged between different layers, supporting independency from implementation.
- Semantic characterization of the behavioural aspect of components, supporting discovery.
- Semantic characterization of the composition of functionalities and of the relations among them, supporting composition and reconfigurations of the system at run-time.

Clearly significant and tangible results

Tangible outcomes, provided as inputs to deliverable D5.1, include:

- A formal process for ontologies building
- An architecture for run-time semantic reconciliation (i.e. semantic mismatches removal)
- Prototypes of ontologies

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning

Missing inputs, mainly from WP2, brought about a delay in the modelling of some key concepts, notably those regarding SPD metrics and requirements concerning SPD metrics driven composability.

Moreover, the lack of timely contributions in terms of application lexicon (the SPD dictionary) has slowed

the process of glossary definition. Delays in task 5.1 have an impact on all other tasks in WP 5.
Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning TRS's contribution is reasonably in line with respect to the project schedule taking into account the delay of other WPs. Thanks to the close collaboration with the WP 5 partners, the task has achieved valuable conceptual results, and further development shall be sped up, provided that all the consortium catches up with the enabling deliverables.
Use of resources A meaningful deviation from planned effort is reported. Two senior system engineers and a research manager have been allocated to better deal with unplanned overhead and issues deriving from inefficient overall management. Actually, the scheduling of next activities must consider an effective distribution of residual budget to fit the extension needed by the overall project.
Dissemination activities and exploitation perspectives Advancements in semantic technologies expected in pSHIELD project have already been introduced during the "Workshop on Semantic Technologies applied to Requirements Management" held in SELEX SI in July 2010. Application and further development of such technologies are planned in a number of oncoming research projects in TRS.
Corrective actions A closer collaboration among partners is suggested, as well as the pervasive use of the cooperative work platform for an effective sharing of knowledge and a better coordination.

3.7.7. Università degli Studi di Genova

Beneficiary[14]:	UNIGE
Work Package(s)	WP4 – SPD Network
Task(s)	Task 4.1 Smart SPD driven transmission Task 4.2 Trusted and dependable Connectivity

[14] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)

Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 4.1 Smart SPD driven transmission – PM 6 (Effectively needed 9) Task 4.2 Trusted and dependable Connectivity – PM 3 (Effectively needed 4)
Effort actual or spent in this period:	Task 4.1 Smart SPD driven transmission – PM 7.6 Task 4.2 Trusted and dependable Connectivity – PM 1
% of work completed at the end of the period (indicative):	Task4.1 Smart SPD driven transmission [15] - 65% Task 4.2 Trusted and dependable Connectivity – 25%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 4.1
  - Analysis of the vulnerability of distributed spectrum sensing to attacks and countermeasures
  - Study and motivation of distributed spectrum sensing role to achieve the goals of the WP
  - Study and implementation of SPD-based transmission techniques capable of guaranteeing a low probability of interception (UWB and OFDM signals)
- Task 4.2
  - Transmission parameters smart adaptation according to radio resources observation towards trusted and dependable connectivity implementation

Additional Information:

The above mentioned activities have been partially completed according to the lack of input form the other WPs (in particular WP2). The work which has been performed represents a strong basis for future activities. The number of PM has been increased has explained in the following section.

A summary progress towards objectives

According to T4.1 and T4.2 objectives UNIGE has proposed new technologies enabling smart SPD driven transmissions. In particular, the cognitive radio (CR) paradigm, which is usually based on Software Defined Radio (SDR), has been proposed to deal with such transmissions. CR is composable and expandable and modular by definition. In fact, it has been designed to accommodate these features.

Moreover, the modules of a cognitive radio which enable the required smart SPD driven transmissions and trusted and dependable connectivity have been analysed. In particular, the security threats related to these modules in reaching the goals have been discussed and some solutions to overcome such limitations have been proposed. At the moment the solutions have been proposed and analysed and UNIGE is planning to spend the remaining PMs to shows the effectiveness of the proposed solutions to address the open issues, through the software implementation of the proposed algorithms and carrying out a set of numerical simulations.

[15] Z% = (PMs planned-PMs spent)/PMs planned x 100. This must correspond to Table 3.1

Clearly significant and tangible results In the next few months UNIGE will provide some numerical tangible results on the benefits which can be obtained by introducing the considered new technologies for smart SPD transmissions and trustable and dependable connectivity. One can note that at the moment UNIGE has spent half of the effort and it is planning to spend the rest of the PMs to achieve the objectives according to the WP4 leader.
Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning No deviations have occurred with respect to the project but the delay in the progress of other WP activities has directly affected UNIGE contribution. According to this, some additional effort has been considered in the first reporting period to cope with a more deep analysis of technical aspects required to be in line with WP4 schedule (internal release of deliverable 4.1).
Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning UNIGE contribution is reasonably in line with respect to the project schedule taking into account the delay of other WPs. The research group has been empowered to be able to set-up and perform activities even if a delay is actually unavoidable.
Use of resources With respect to the proposed PM breakdown a little deviation is occurred. Actually we have spent 8.6 PM. A few PM belonging to personnel not initially considered for participating in the project have been allocated to better manage and perform project activities. However we have kept the total declared costs at the same amount involving more staff with a lower income and avoiding the contribution of staff with an higher income according to the need of more effort to better address project needs and to cope with issues deriving from delays in the overall project development. We plan a total of 16 PM instead of 12 for the overall project duration.
Dissemination activities and exploitation perspectives Dissemination of the preliminary steps performed during project-related activities is started and the research unit has already participated or is going to participate in international conferences and forums where part of the work performed in pSHIELD has been discussed.
Corrective actions No corrective actions are needed. The activities have started and will progress according to the technical annex while the contribution of other critical WPs will be properly released.

3.7.8. Università degli Studi di Roma "La Sapienza"

Beneficiary[16]:	UNIROMA1
Work Package(s)	WP5 - SPD Middleware & Overlay
Task(s)	Task 5.1 - SPD driven Semantics Task 5.2 - Core SPD services Task 5.4 - Overlay monitoring and reacting system by security agents
Period:	1st June 2010 – 31st December 2010
Effort planned for the project:	**WP5 – 13,2 PM** Task 5.1 – 3,0 PM Task 5.2 – 5,4 PM Task 5.4 – 4,8 PM
Effort actual or spent in this period:	**WP5 – 10,7 PM** Task 5.1 – 3,6 PM Task 5.2 – 2,2 PM Task 5.4 – 4,9 PM
% of work completed at the end of the period (indicative):	**WP5 – 81,0%** Task 5.1 – 120,0% Task 5.2 – 40,7% Task 5.4 – 102,0%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- **T5.1 - SPD driven Semantics**
  - Analysis of the state of the art in the field of semantic technologies. In particular investigations have been performed on:
    - procedures for semantic model formulation (like IASI-LEAK ones);
    - languages for model implementation (like RDF, OWL, OWL2, ...);
    - tools to perform reasoning (inferential engines like Jena or Pellet,...);
    - performances and implementation issues regarding all the above mentioned technologies.
  - Preliminary identification of pSHIELD semantic technologies candidates. The choice will be frozen once the WP2 deliverable will be frozen.
  - Definition of an innovative formal methodology to build up the pSHIELD ontology. This methodology is going to address the problem of modelling SPD issues in Embedded Systems environment, thus going behind the state of the art. Relevant extensive research activities.
  - A draft prototype of OWL ontology to model the pSHIELD system, as well as SPD functionalities has been developed with the Protégé tool.
  - Additional work has been performed in the scope of WP2 to contribute and review the D2.x deliverables with respect to the sections that have direct impact on WP5.

Objectives: provide semantic models to enable the pSHIELD seamless approach
Tangible Results: some inputs to deliverable 5.1 (including preliminary OWL prototypes)

[16] This report is per Beneficiary, and has to be provided for each WP in which it is involved each Beneficiary

- **T5.2 - Core SPD services**
  - Analysis of the state of the art in the Core SPD services at Middleware Level. In particular investigations have been performed on:
    - Middleware architectures (like the consolidates SoA based on web-services);
    - Middleware solutions for Embedded Systems (like Hydra);
    - Service discovery, filtering, ranking, aggregation and composition.
  - High level design of the pSHIELD Middleware Architecture.
  - High level design of a secure service discovery for pSHIELD Middleware.
  - Analysis of the OSGI Knoplerfish platform as technological candidate for pSHIELD Middleware demonstrator.
  - Additional work has been performed in the scope of WP2 to contribute and review the D2.x deliverables with respect to the sections that have direct impact on WP5

Objectives: define the basic services at middleware layer in the multilayered approach; provide the Overlay with the (secure) discovery functionality
Tangible Results: some inputs to deliverable 5.2

- **T5.4 - Overlay monitoring and reacting system by security agents**
  - Functional architecture and definition of the overlay.
  - Formalisation of the pSHIELD architecture as a closed-loop control problem, where the technological layer are the process to be controlled and the Overlay is the controller to be designed. Related extensive research activities.
  - Analysis of the state of the arte in the theoretical foundations of how to describe, in a control perspective, the pSHIELD system. In particular investigations have been performed on:
    - Computer Science/Mathematical methods to model interconnected dynamic systems (like Petri Nets, Markov Chains, State Space representation, Hybrid Systems, Switching Systems, Automata, ...);
    - I/O representation of interconnected dynamic systems represented with the above mentioned models;
    - Control strategies compatible with the above mentioned models.
  - Identification of pSHIELD theoretical candidate to model the Overlay (Hybrid Automata). Related extensive research activities.
  - Preliminary modelling of an Embedded System with Hybrid Automata. Related extensive research activities.
  - Formalisation of two procedures (static and plug&play) to model the composability of Embedded Systems by means of Hybrid Automata.
  - Simulation of the Overlay behaviour in a very simple scenario by means of Matlab-Simulink tool, in order to demonstrate the composability.
  - Additional work has been performed in the scope of WP2 to contribute and review the D2.x deliverables with respect to the sections that have direct impact on WP5

Objectives: design and develop the Overlay; design the closed-loop control algorithms to enable the Composability functionality
Tangible Results: some inputs to deliverable 5.2 (including preliminary Matlab-Simulink models and simulations)

Description of criticalities met during the period: ➢ The initial delay in the project and in the finalization of WP2 deliverables, in particular requirements and architecture affected the Formalisation of some key concepts in tasks 5.1, 5.2 and 5.4, especially the choice of technologies. This delay did not impact the first half of the project regarding the extensive studies and researches carried out (up to month 6), but it will impact the second half, when the pSHIELD solutions have to be designed and developed. For that reason additional time is necessary, once the WP2 outputs are ready, to tailor the solutions of WP5 and to describe them in the specific documents (D5.1 and D5.2).
Corrective actions: ➢ A project extension seems necessary to provide enough time to analyse and use the output of WP2
Meetings performed during the period: ➢ 8th June, Ansaldo STS: Kick-off Meeting ➢ 18th June, ElsagDatamat: phone call WP5 – Core Team ➢ 6th July, ElsagDatamat: phone call WP5 – ALL ➢ 5-6th October CWIN: Consortium Meeting ➢ 9th December UNIROMA1: meeting with TRS and ED ➢ 17th December ElsagDatamat: meeting SPD Core services and overlay
Deviations between actual and planned person-months: ➢ none
Dissemination activities and exploitation perspectives: ➢ The pSHIELD concepts have been subject of Master Thesis, as well as of Master and Ph.D courses

3.8 Spain

3.8.1 Acorde Seguridad

Beneficiary[17]:	AS
Work Package(s)	WP1 - Project Management
Task(s)	Task 1.1 Project management

[17] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)

Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project management 0.5 PM
Effort actual or spent in this period:	Task 1.1 Project management 0.5 PM
% of work completed at the end of the period (indicative):	Task 1.1 Project management 0.5 PM 100%[18]
Description of the activities carried out during the period to reach specific objectives within the task/WP: • Task 1.1 ➢ General administrative project issues ➢ Coordination of Spanish team	

Beneficiary[19]:	AS
Work Package(s)	WP3 - SPD Node
Task(s)	Task 3.1 Nano, Micro/Personal node Task 3.2 Power Node Task 3.3 Dependable self-x and cryptographic technologies
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 3.1 Nano, Micro/Personal node 2.5 PM Task 3.2 Power Node 2.5 PM Task 3.3 Dependable self-x and cryptographic technologies 1 PM
Effort actual or spent in this period:	Task 3.1 Nano, Micro/Personal node 2.5 PM Task 3.2 Power Node 2.5 PM Task 3.3 Dependable self-x and cryptographic technologies 1 PM
% of work completed at the end of the period (indicative):	Task 3.1 Nano, Micro/Personal node 100%[20] Task 3.2 Power Node 100% Task 3.3 Dependable self-x and cryptographic technologies 100%

[18] Z% = (PMs planned-PMs spent)/PMs planned x 100. This must correspond to Table 3.1
[19] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)
[20] Z% = (PMs planned-PMs spent)/PMs planned x 100. This must correspond to Table 3.1

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 3.1 and Task 3.2
  - Nano, micro/personal and power nodes need a secondary solution to guarantee the correct system operation even when main source fails or it is removed. Some technologies have been studied in order to identify the best ones available in the market.
  - The ideal solution should be a tiny source which could keep the system running during a period of time long enough to solve the problem with the main power supply. The design will depends directly on power consumption, so it will be necessary to know the power needs when the system works both in idle and full mode.
- Task 3.3
  - Due to AES Rijndael is the cipher selected to be integrated in the nodes, some studies, about the original definition of the protocol, have been made to propose several code optimisations that let improve the efficient of the system.

A summary progress towards objectives

During the first period of the project, the objectives to be reached by ACORDE, were focused on the study of the different technologies already available in the market.

The compiled information will be selected, during the second part of the project, in order to choose the best technologies to be integrated in an embedded solution. The final design will be clearly constrained by power consumption as well as by other features related to the HW design.

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning

The delay in the project affected the schedule planned in WP3; in particular WP2 outputs are necessary to develop the tasks defined in WP3.

Dissemination activities and exploitation perspectives

Many of today's ES, such as wireless and portable devices rely heavily on the limited power supply. ACORDE, as company specialized in the development of RF equipment, satellite communications systems, monitoring and control integrated systems, and location & positioning systems, is really interested in increasing its knowledge in power supply design, due to is the base to design autonomous wireless systems which can compete in market.

Corrective actions

A project extension is necessary to achieve the objectives defined in pSHIELD project, due to the initial delay in WP2 has affected all WPs

3.8.2 European Software Institute/Tecnalia

Beneficiary[21]:	TECNALIA
Work Package(s)	WP1[22] - Project Management WP2 - SPD Scenarios, user requirements and architecture design WP4 – SPD Network WP5- SPD middleware & Overlay WP6 – Platform Integration , validation and demonstration
Task(s)	Task 1.1 Project management Task 2.2 Multi-Technology specification and Metrics Task 4.2 Trusted and dependable connectivity Task 5.3 Policy-Based Management Task 6.3 Lifecycle SPD Support Task 7.1 Dissemination
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project management. PM - 1 Task 2.2 Multi-Technology specification and Metrics PM – 2 Task 4.2 Trusted and dependable Connectivity - PM: 1 Task 5.3 Policy-Based Management. PM - 1
Effort actual or spent in this period:	Task 1.1 Project management. PM - 1 Task 2.2 Multi-Technology specification and Metrics PM – 3 Task 4.2 Trusted and dependable Connectivity - PM: 0 Task 5.3 Policy-Based Management. PM - 1
% of work completed at the end of the period (indicative):	Task 1.1 Project management. 50% Task 2.2 Multi-Technology specification and Metrics 80% Task 4.2 Trusted and dependable Connectivity – 0% Task 5.3 Policy-Based Management. 50%

Description of the activities carried out during the period to reach specific objectives within the task/WP:
• Task 1.1
  ➢ Project management: Reporting of progress and resource expenditure, production of deliverables.
• Task 2.2
  ➢ Study of metrics for SPD multilayer approach
  ➢ Analysis of the methodology for metrics gathering
  ➢ Quantitative Measurement of Metrics
• Task 5.3
  ➢ Study of the policy-based mechanisms	

Additional Information:	

[21] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)
[22] x is 1, 2, 3, 4, 5, 6, and 7

Results and progress in WP2 have been delayed due to the different of point of view when structuring the document.

A summary progress towards objectives There is a need to commit security, privacy and dependability concepts to Embedded Systems Engineering. SPD functionalities have to be exposed and embedded in each engineering phase. Tecnalia will analyse this concept by studying the requirements. Taking into account the requirements Tecnalia will lead SPD Metrics deliverable. This is the first step for defining a lifecycle SPD for pSHIELD. Defining correctly the metrics for each layer is essential. Tecnalia is planning to spend the remaining PMs in the system architecture (aggregation of metrics) and the definition of SPD Lifecycle.
Clearly significant and tangible results Contributions to deliverable 2.2 (due in month 8) have already been provided. In the next few months Tecnalia will provide a specific prototype for metrics gathering
Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning Due to the general delay of the project, deliverables in the WP were Tecnalia is involved will accordingly be delayed too.
Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning Tecnalia's contribution is reasonably in line with respect to the project schedule and the already mentioned delay.
Use of resources Tecnalia has consumed 5 PM of which 3 were dedicated to task 2.2 and the rest to policy and project management. Even if there is no major deviation, additional efforts are foreseen to complete the tasks in WP2 due to the late inputs from other WPs.
Dissemination activities and exploitation perspectives No external dissemination of the preliminary steps performed during project-related activities has been carried out.

3.8.3 Mondragon Goi Eskola Politecnikoa

Beneficiary[23]:	MGEP
Work Package(s)	WP1[24] - Project Management WP4 - SPD Network WP7 - Knowledge exchange and industrial validation
Task(s)	Task 1.1 Project management Task 4.2 Trusted and dependable Connectivity Task 7.1 Dissemination
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project management - PM: 0,25 Task 4.2 Trusted and dependable Connectivity - PM: 4 Task 7.1 Dissemination - PM: 0
Effort actual or spent in this period:	Task 1.1 Project management - PM: 0,25 Task 4.2 Trusted and dependable Connectivity - PM: 4 Task 7.1 Dissemination - PM: 0
% of work completed at the end of the period (indicative):	Task 1.1 Project management - 30%[25] Task 4.2 Trusted and dependable Connectivity - 40% Task 7.1 Dissemination - 0 %

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 1.1
  - Project management: Reporting of progress and resource expenditure, production of deliverables.
- Task 4.2
  - Study of requirements for Wireless Sensor Network security
  - Study of intrusion detection systems suitable for Wireless Sensor Network
  - Results:
  - ✓ Requirements for intrusion detection in a WSN have been defined.
- Task 7.1
  - No dissemination activities have been carried out yet.

Additional Information:

Results and progress in WP4 have been delayed due to the lack of inputs from other WPs, especially WP2. From now on, the information provided in this document will only refer to Task 4.2 as Task 7.1 has no results yet and Task 1.1 is a management task.

[23] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)
[24] x is 1, 2, 3, 4, 5, 6, and 7
[25] Z% = PMs spent/PMs planned x 100. This must correspond to Table 3.1

A summary progress towards objectives

In the world of communication a trusted connection is an essential requirement for the final user and system administrators of a system. Due to this designing prerequisite a trusted connectivity in a system is vital to obtain a high quality service. MGEP has studied the requirements for lightweight link-layer secure communication in wireless sensor network scenarios. For that purpose specific intrusion detection systems have been analysed. How data reliability mechanisms (including confidentiality, integrity, and authenticity) can be shared between different wireless network technologies were also investigated.

One of the goals of pSHIELD is to reach a generic level in the implementation of intrusion detection systems in wireless sensor networks. This reason is the key to understand that, in this project, there would be no point in specifying an ideal communication protocol or network structure, the intrusion detection system itself should be adapted to the network and protocol where is deployed. Anyway, the type of intrusion detection system preferred to be developed is an anomaly detection system. In this way, the system would base its knowledge on previous network activities that are considered as the common behaviour of the network. A misuse detection system can also be considered, but this supposes to know every single attack or intrusion, something very difficult or almost impossible to specify in a generic system oriented to any kind of wireless sensor networks.

MGEP is planning to spend the remaining PMs in the system architecture and implementation design phase to shows the effectiveness of the proposed solutions.

Clearly significant and tangible results

Contributions to deliverable 4.1 (due in month 8) have already been provided. In the next few months MGEP will provide a specific prototype for intrusion detection for Wireless Sensor Networks. MGEP is planning to spend the remaining PMs in the system architecture and implementation design phase to show the effectiveness of the proposed solutions.

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning

The delay in the progress of other WP activities has directly affected MGEP contribution in task 4.2. This may require additional effort to make sure that our results are in line with the inputs from those WPs.

Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning

MGEP contribution is reasonably in line with respect to the project schedule and the already mentioned delay. Due to the general delay of the project, deliverables in the WP were MGEP is involved will accordingly be delayed too.

Use of resources

MGEP has consumed 4.25PM of which 4 were dedicated to task 4.2 and the rest to management. Even if there is no major deviation, additional efforts are foreseen to complete the tasks in WP4 due to the late inputs from other WPs.

Dissemination activities and exploitation perspectives

No external dissemination of the preliminary steps performed during project-related activities has been carried out. Contributions to deliverable 4.1 (due in month 8) have already been provided to the consortium members.

3.9 Greece

3.9.1 ATHENA

Beneficiary[26]:	ATHENA
Work Package(s)	WP2 - SPD metrics, requirements and system design WP3 - SPD Node WP4 - SPD Network
Task(s)	Task 2.1 - Multi-technology requirements & specification Task 2.3 – Multi-technology architectural design Task 3.3 - Dependable self-x and cryptographic technologies Task 4.2 - Trusted and dependable connectivity
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 2.1 - Multi-technology requirements & specification – 1 PM Task 2.3 – Multi-technology architectural design - 2 PM Task 3.3 - Dependable self-x & cryptographic techn. – 2 PM Task 4.2 - Trusted and dependable connectivity – 0,5 PM
Effort actual or spent in this period:	Task 2.1 - Multi-technology requirements & specification – 1 PM Task 2.3 – Multi-technology architectural design - 2 PM Task 3.3 - Dependable self-x & cryptographic techn. – 2 PM Task 4.2 - Trusted and dependable connectivity – 0,5 PM
% of work completed at the end of the period (indicative):	Task 2.1 - Multi-technology requirements & specification – 100% Task 2.3 –Multi-technology architectural design - 100% Task 3.3 - Dependable self-x & cryptographic techn. – 30% Task 4.2 - Trusted and dependable connectivity – 20%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 2.1
  - Identification of the requirements of the application scenarios
  - Description of the specifications of the overall system
- Task 2.3
  - Analysis of the fundamental concepts of Security, Privacy
  - Analysis of the fundamental concepts of Dependability
  - Analysis of security aspects in embedded systems
- Task 3.3
  - Working on novel cryptographic key exchange algorithm (Controlled Randomness)
    - Less frequent key exchanges

[26] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)

- Lower control channel utilization
- Higher security vs. Cryptanalysis
- Multiple valid keys per time frame
- Low (to zero) processing overhead

- Task 4.2
  - Assessment of a number of defence mechanisms against DDoS attacks
    - Ingress/Egress filtering, Packet Marking/Logging, Self reconfiguration and sustainability, Deep packet inspection
    - Integration of the mechanisms inside the SPD network architecture
    - Evaluation and redesign of the mechanisms with regard to the node classes defined in wp3

Additional Information:-

Summary[27] of progress by ATHENA no. 4

A summary progress towards objectives

- WP2
  - Analysis of the fundamental concepts of Security, Privacy:
    - Principles : Confidentiality, Integrity, Availability
    - Mechanisms : Authentication, Authorisation, Intrusion detection/prevention, Policies
    - Domains : System, Network, Operations, Physical
  - Analysis of the fundamental concepts of Dependability:
    - Threats : Faults, Errors, Failures
    - Attributes : Availability, Reliability, Safety, Confidentiality, Integrity, Maintainability
    - Means : Fault Prevention, Tolerance, Removal
  - Analysis of security aspects in embedded systems
    - System Design
    - Application design and implementation
    - Physical Security and side channel attacks

- WP3
  - Adoption of proven methodologies against distributed denial of service attacks and their applicability on a resource limited environment such as the one of SPD embedded systems. Deployment, adaptation and measurement of the performance of packet marking and deep packet inspection methodologies that enable a node to mitigate an ongoing DDoS attack through reconfiguration of the node operation characteristics as well as the network ones. This subtask will be implemented in close cooperation with WP4 (Network layer) since most of these methodologies affect the node as well as its connectivity with the backbone network or the neighbouring nodes, depending on the deployment strategy.
  - Deploying and measuring the efficiency both in terms of performance and security of different cryptographic frameworks that offer PKI capabilities as well as symmetric cryptographic

[27] Summary means all actual beneficiary's WP s (the first table above) summarised together with the beneficiary explanations, remarks, conclusions, etc).

operations. Implementation and deployment of a new cryptographic key exchange algorithm called "Controlled Randomness" that limits the need of frequent key exchange between the communicating parties, thus boosting the robustness of the underlying cryptographic operations against cryptanalysis, while keeping the performance cost in acceptable, and in some cases favourable, levels.

3.9.2 Hellenic Aerospace Industry

Beneficiary[28]:	HAI
Work Package(s)	WP2 - SPD Metrics, Requirements and System Design
Task(s)	Task 2.3 - Multi-Technology Architectural Design
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 2.3 - Multi-Technology Architectural Design, 6 PM
Effort actual or spent in this period:	Task 2.3 - Multi-Technology Architectural Design, 5 PM
% of work completed at the end of the period (indicative):	Task 2.3 - Multi-Technology Architectural Design, 56% PM[2] (5/9)

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 2.3
  - The objective of describing a multi-technology Architecture encompasses the following activities:
    - ✓ Key definitions and approaches, including the concepts of Cross Layer, the layered pSHIELD structure and SPD values and functionalities
    - ✓ Consideration of SPD requirements under the view of a pSHIELD Reference System Architecture (pSRSA)
    - ✓ Description of SW and HW modules comprising each one of the 4 pSHIELD Layers
    - ✓ Definition of pSRSA

[28] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)

[2] This percentage of completed work is estimated with respect to the total person months declared for HAI for T2.3 (9).

- ✓ Description of Inter- and Intra- Layer Interfaces
- ✓ Gradual formation of an Overall System Architecture

➢ Results:

- ✓ Important pSHIELD concepts have been defined
- ✓ The link with the other WP2 activities and outcomes is being processed (Requirements and Metrics)
- ✓ A reference Architecture is close to finalization
- ✓ Architectural Components have been described by partners, according to their technical competences and involvement in the project

Additional Information:

The above activities have a different extent of completeness, as this is represented in the intermediate Deliverable D2.3.1 (which was handed over during mid-term review) and as work in T2.3 is in progress.

Two phone conferences between all T2.3 participants, one physical meeting between THYIA and HAI and very frequent communication and document (D2.3 drafts) exchanges have taken place during the reference period.

A summary progress towards objectives

The progress towards the main task objective (System Architecture design) comprises of the methodology to achieve synthesis of all necessary components, functions and concepts that constitute pSHIELD idea. Efforts are concentrating in the attempt to present an Overall Architecture that will integrate functionally the following:

- SW and HW modules representing the structure and function of 4 pSHIELD layers
- SPD services and functionalities in Embedded Systems
- Applications, Use cases and Scenarios
- pSHIELD focused issues: composability, technical novelty, modularity, composability, metrics, demonstration
- Formation of Security Agents

Especially HAI, apart from coordinating task activities and synthesizing partners' contributions, based on its technical capabilities and background, has focused on describing Network Layer Architecture, Reference Architecture (pSRSA) and the Overall System Architecture, in cooperation with correspondingly responsible partners.

Important steps for accomplishing D2.3 objectives are: the definition of a pSRSA, the integration of components to a functional platform and the description of an overall system architecture, with the first milestone being closer to finalization.

Clearly significant and tangible results

The detailed description of the three types of nodes, that will be the core system of the intelligent embedded system platform, is the tangible outcome of the conducted work. Nano, Micro/Personal and Power Node formulate not only pSHIELD Node layer, but also, provide the grounds for the rest of the layers' definition, through the tracking of their hardware requirements and running software.

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning Task 2.3 has followed the general timeline deviation that occurred for the project as a whole. Moreover, as a Task of System Architecture definition, its importance and the bilateral interactive relation with many other Tasks throughout the project are evident. The task has impact on technical development Work Packages 3-4-5, but mainly on the Work Package 6 related to demonstration.
Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning The critical objective of Task 2.3 can be mirrored in project milestones M3 and M5. The first milestone (Preliminary System Architecture Design) is behind in time. However the consortium plans to catch up on M5, which reflects the final design of a conceptual System Architecture. Failure in meeting M3 consists, only, in time deviations, which in turn can be ascribed (among others) to inefficient communication and financial problems (e.g. delayed national agreement) between members of the consortium.
Use of resources HAI participated in kick-off meeting, held in Rome. Regarding the person month effort, HAI consumed 5 pm instead of the 6 planned (where the total is 9 months) the majority (but not the whole) of the planned effort for the first part of T2.3 and in 7 (instead of 6) months of project life (reference period). This deviation is caused by the slower progress of T2.3 for reasons already explained.
Dissemination activities and exploitation perspectives No dissemination activities were performed, as the results are expected to be more concrete in the second part of project.
Corrective actions The work in T2.3.1 may be delayed, however is on track and there should be no impact in the on-time delivery of D2.3.2. Furthermore, T2.3 is in close interaction with many other Tasks, notably with WP6 (Integration, Validation and Demonstration). A close collaboration between activities and partners in the aforementioned Tasks and WPs is proposed, in the perspective of the design of a functional System Architecture in accordance with demonstration capabilities and a strong field of applications. The work plan, through which T2.3 will assist and, in turn, be complemented by activities in other WPs is illustrated in "pSHIELD focus" technical document.

3.9.3 Integrated Systems Development

ISD is withdrawing from the project. It was announced by them during Project Assembly phone conference on 15 February 2011. No report of activities and costs will be delivered.

3.10 Norway

3.10.1 Centre for Wireless Innovation

Beneficiary:	CWIN
Work Package(s)	WP2 - SPD metric, requirements and system design WP3 – SPD node WP5 – SPD middleware and overlay WP6 – Platform integration, validation & demonstration WP7 – Knowledge exchange and industrial validation
Task(s)	Task 2.1 Multi-technology requirements & specification Task 2.2 Multi-technology SPD metrics Task 2.3 Multi-technology architectural design Task 3.1 Nano, Micro/Personal node Task 3.2 Power node Task 5.1 SPD driven semantics Task 5.3 Policy-based management Task 6.1 Multi-technology system integration Task 6.4 Multi-technology demonstration Task 7.1 Dissemination Task 7.2 Exploitation
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 2.1 Multi-technology requirements & specification 1PM Task 2.2 Multi-technology SPD metrics 1PM Task 3.1 Nano, Micro/Personal node 4PM Task 5.1 SPD driven semantics 2PM Task 5.3 Policy-based management 1PM Task 6.1 Multi-technology system integration 2PM Task 6.4 Multi-technology demonstration 1PM Task 7.1 Dissemination 0.5PM
Effort actual or spent in this period:	Task 2.1 Multi-technology requirements & specification 1PM Task 2.2 Multi-technology SPD metrics 0.5PM Task 3.1 Nano, Micro/Personal node 4PM Task 5.1 SPD driven semantics 1PM Task 5.3 Policy-based management 1PM Task 6.1 Multi-technology system integration 2PM Task 6.4 Multi-technology demonstration 0.5PM Task 7.1 Dissemination 0.5PM

% of work completed at the end of the period (indicative):	Task 2.1 Multi-technology requirements & specification 100% Task 2.2 Multi-technology SPD metrics 50% Task 2.3 Multi-technology architectural design 40% Task 3.1 Nano, Micro/Personal node 70% Task 3.2 Power node 30% Task 5.1 SPD driven semantics 30% Task 5.3 Policy-based management 30% Task 6.1 Multi-technology system integration 45% Task 6.4 Multi-technology demonstration 25% Task 7.1 Dissemination 40% Task 7.2 Exploitation 20%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 2.1
  - Identification of pSHIELD system requirements
  - Results: Contribution to D2.1.1 by identifying requirements for pSHIELD application, middleware layer and overlay layer.
- Task 2.2
  - Examination of basis SPD technologies, to be useable for the prototype
  - Follow discussions and establish understanding related to prototype
  - Results: core technologies identified
- Task 3.1
  - identification of potential micro nodes
  - Analysis of potential micro nodes
  - Results: A preliminary report on analysis
- Task 3.2
  - identification of potential micro nodes
  - Analysis of potential micro nodes
  - Results: A preliminary report on analysis
- Task 5.1
  - Evaluation of ontology languages and inference mechanism with respect to expressivity, complexity, easiness of implementation, performance etc.
  - Establish Semantic MediaWiki for knowledge presentation, import and export
  - Results:
    - Identification of ontology language to be used
    - A preliminary evaluation criteria
    - A preliminary evaluation report
    - Semantic MediaWiki platform: http://pshield.unik.no
- Task 5.3
  - Identify definitions of policy and policy-based management
  - State of the art analysis
  - Performance evaluation of policy-based decisions
  - Results:
    - Early state of the art analysis
    - A preliminary evaluation report
- Task 6.1
  - Identification and analysis of demonstration platforms together with Telenor Object and the Norwegian Railway administration
  - Identification of components for pSHIELD system prototype
  - Results: Integration of nodes with the middleware platform
- Task 6.4:
  - Perform technical tasks relevant to demonstrating early version of prototype
  - Results: Early demonstration of node (micro & power node) integration to Telenor Object platform

Summary progress towards objectives.

pSHIELD objective stated:

The project main objective is to conceive and design a preliminary, innovative, modular, composable, expandable and high-dependable architectural framework (see Figure 2.2) which allows to achieve the desired SPD level in the context of integrated and interoperating heterogeneous services, applications, systems and devices; and to develop concrete solutions capable of achieving this objective in specific application scenarios with minimum engineering effort.

For the pilot one of the previous four scenarios, but reduced in scope, has been carefully selected in industrial exploitation perspective, in order to cover a minimum significant view of the foreseen industrial needs, the monitoring of a railway.

From the Norwegian point of view, pSHIELD concentrates on the secure interworking between heterogeneous systems. This interworking is achieved by inviting relevant partners such as the Norwegian Rail Administration (JBV) and Telenor Objects as associated partners to pSHIELD.

The work has provided the following aspects towards the objectives

- innovative, modular, expandable architecture framework – the basis of such an architecture is the interoperable ETSI TS102.690 M2M platform. The aspects of modular and expandable are part of the TS102.690. Innovative aspects are the semantic description for secure interworking. However, this platform needs to be extended in order to satisfy the needs for dependability and security. The foreseen extensions will be identified during the remaining part of pSHIELD
- integrated and interoperating heterogeneous services, applications, systems and devices – Semantic technologies have been identified as tools for interworking and interoperability. The main achievements are the description of components through ontologies, e.g. a sensor ontology describing the SPD sensors. A Semantic MediaWiki has been implemented in our associate partner JBV as well as CWIN in order to allow interoperability between applications and services. We established .rdf export and import for exchange of these service related aspects. Integration from sensors into this application framework have been achieved through an integration into the Telenor Objects platform, and from there further towards the applications platforms at CWIN and JBV. The path for Integration is established, and the integration of sensor to Telenor Objects platform as well as the application platforms are established. Further work will concentrate on interoperability of security.
- Develop concrete solutions in specific applications scenarios – A liaison between the pSHIELD partners and Telenor Objects, JBV, the Norwegian Computer Society, the Norwegian Mobile Association and Wireless Future has been created. During this liaison we identified promising IoT platforms satisfying the needs of privacy, security and dependability. The Telenor Objects platform Shepherd is on of these pilot platforms, wand will be made available for other pilot applications. Thus pSHIELD opened for a much wider entry into the Nordic and European Market, ensuring an industry-ready design of the framework. The specific application scenario was created together with the Norwegian Rail Administration, and has already now envisaged 4-6 new application scenarios, covering goods tracking, quality-of-transport control, maintenance of rolling equipment and track reporting. Together with the liaison partners new scenarios such as e-Health (Rikshospitalet) and Socialtainment (*"mobility in the post-oil age"*) have been identified.

Significant and tangible results

During the first reporting period, CWIN and MAS have provided/performed

- sensor analysis for prototypical implementation (result: JVM enabled suns spot sensor platform, VIA embedded Board as power node)
- identification of platforms for interworking, i.e. ETSI TS102.690 and Semantic MediaWiki
- implementation of a semantic platform pshield.unik.no, support for JBV
- coordinating meeting with Telenor Object to enable data exchange with their Shepherd Platform, which is an instance of the ETSI TS102.690
- establish and demonstrated a prototype technology integration for interworking

Use of resources

Resources are almost used according to plan, but with deviations as compared to the original assignment in certain tasks. Due to the requirements of our Lead Partner Movation and the Norwegian Associate Partners JBV and Telenor Objects focus has been on the prototypical implementation of interoperability. This focus forced us to concentrate on hardware work rather than deliverables.

Dissemination activities and exploitation perspectives

- Przemyslaw Osocha (SESM), Yen Pham (CWIN), "p.S.HI.E.L.D.-pilot embedded Systems arcHItecturE for multi-Layer Dependable solutions" ARTEMIS Spring Event at Embedded World 2011, 1-3 March 2011, Nuremberg, Germany
- Przemyslaw Osocha (SESM), Yen Pham (CWIN), "Demonstrating Security, Privacy and Dependability for Sensors to Systems", ARTEMIS IA Co-summit 2010 Project Exhibition, 26-27 October 2010, Ghent, Belgium
- Mohammad M. R. Chowdhury, Josef Noll, "Securing Critical Infrastructure: A Semantically Enhanced Sensor Based Approach", 2nd International Conference on Wireless Communications, Vehicular Technology, Information Theory and Aerospace & Electronic System Technology, WiRELESS ViTAE 2011, Chennai, India, Feb. 28-Mar. 03.
- Yen N. T. Pham, "Sensor Integration into Heterogeneous Service Platform and Domain Adaptation", **Master Thesis**, University of Oslo, December 20, 2010.
- Sarfraz Alam, Mohammad M. R. Chowdhury, Josef Noll, "An Event-driven Sensor Virtualization Approach for Internet of Things", *poster*, VERDIKT conference, Oslo, 1.-2. November 2010

3.10.2 Movation AS

Beneficiary:	Movation AS (MAS)
Work Package(s)	WP1 - Project management WP2 - SPD metric, requirements and system design WP3 – SPD node WP6 – Platform integration, validation & demonstration WP7 – Knowledge exchange and industrial validation
Task(s)	Task 1.2 Liaisons Task 2.1 Multi-technology requirements & specification Task 3.1 Nano, Micro/Personal node Task 6.1 Multi-technology system integration Task 6.4 Multi-technology demonstration Task 7.1 Dissemination
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.2 Liaisons - 0PM Task 2.1 Multi-technology requirements & specification - 0,5PM Task 3.1 Nano, Micro/Personal node - 2,5PM Task 6.1 Multi-technology system integration - 1,5PM Task 6.4 Multi-technology demonstration - 2PM Task 7.1 Dissemination - 0,5PM
Effort actual or spent in this period:	Task 1.2 Liaisons - 0,5PM Task 2.1 Multi-technology requirements & specification - 0,5PM Task 3.1 Nano, Micro/Personal node - 1PM Task 6.1 Multi-technology system integration - 1PM Task 6.4 Multi-technology demonstration - 0,5PM Task 7.1 Dissemination - 1PM
% of work completed at the end of the period (indicative):	Task 1.2 Liaisons - 50% Task 2.1 Multi-technology requirements & specification - 100% Task 3.1 Nano, Micro/Personal node - 80% Task 6.1 Multi-technology system integration - 65% Task 6.4 Multi-technology demonstration - 30% Task 7.1 Dissemination - 50%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 1.2
  - Building liaison with actors on the national plan
  - Identify industrial partners for joint standardisation
  - Results: Initiation of pilot platforms for IoT in Norway performed through Network "Wireless Future" (250 member organisations). Aware-rising towards Norwegian Mobile Association (NMA) and Norwegian Computer Society (DnD). Agreement established with Telenor Objects on access of the platform.
- Task 2.1
  - Discussion on requirements
  - Results: Input for contribution to D2.1.1 (contribution performed by CWIN)
- Task 3.1
  - Concept development for sensor integration, identification of nodes
  - Results: Definition of SPD-prototype eco-system
- Task 6.1
  - Identification and analysis of demonstration platforms together with Telenor Object and the Norwegian Railway administration
  - Identification of components for pSHIELD system prototype
  - Results: Integration of nodes with the middleware platform
- Task 6.4:
  - Coordination with market players towards demonstration
  - Results: Early demonstration of embedded platform with nodes, preparation for demonstrations at Norwegian Rail Administration (JBV) and Telenor Object
- Task 7.1:
  - Targeted industrial dissemination: JBV, Telenor Objects, relevant members of wireless future through work meetings (typical number of companies involved in meetings: 10-20)
  - Results: Early demonstration to Telenor Object; Identification of other use-cases: eHealth, Defence Industry.

Summary progress towards objectives.

pSHIELD objective stated:

The project main objective is to conceive and design a preliminary, innovative, modular, composable, expandable and high-dependable architectural framework (see Figure 2.2) which allows to achieve the desired SPD level in the context of integrated and interoperating heterogeneous services, applications, systems and devices; and to develop concrete solutions capable of achieving this objective in specific application scenarios with minimum engineering effort.

For the pilot one of the previous four scenarios, but reduced in scope, has been carefully selected in industrial exploitation perspective, in order to cover a minimum significant view of the foreseen industrial needs, the monitoring of a railway.

From the Norwegian point of view, pSHIELD concentrates on the secure interworking between heterogeneous systems. This interworking is achieved by inviting relevant partners such as the Norwegian Rail Administration (JBV) and Telenor Objects as associated partners to pSHIELD.

The work has provided the following aspects towards the objectives

- innovative, modular, expandable architecture framework – the basis of such an architecture is the interoperable ETSI TS102.690 M2M platform. The aspects of modular and expandable are part of the TS102.690. Innovative aspects are the semantic description for secure interworking. However, this platform needs to be extended in order to satisfy the needs for dependability and security. The foreseen extensions will be identified during the remaining part of pSHIELD
- integrated and interoperating heterogeneous services, applications, systems and devices – Semantic technologies have been identified as tools for interworking and interoperability. The main achievements are the description of components through ontologies, e.g. a sensor ontology describing the SPD sensors. A Semantic MediaWiki has been implemented in our associate partner JBV as well as CWIN in order to allow interoperability between applications and services. We established .rdf export and import for exchange of these service related aspects. Integration from sensors into this application framework have been achieved through an integration into the Telenor Objects platform, and from there further towards the applications platforms at CWIN and JBV. The path for Integration is established, and the integration of sensor to Telenor Objects platform as well as the application platforms are established. Further work will concentrate on interoperability of security.
- Develop concrete solutions in specific applications scenarios – A liaison between the pSHIELD partners and Telenor Objects, JBV, the Norwegian Computer Society, the Norwegian Mobile Association and Wireless Future has been created. During this liaison we identified promising IoT platforms satisfying the needs of privacy, security and dependability. The Telenor Objects platform Shepherd is on of these pilot platforms, wand will be made available for other pilot applications. Thus pSHIELD opened for a much wider entry into the Nordic and European Market, ensuring an industry-ready design of the framework. The specific application scenario was created together with the Norwegian Rail Administration, and has already now envisaged 4-6 new application scenarios, covering goods tracking, quality-of-transport control, maintenance of rolling equipment and track reporting. Together with the liaison partners new scenarios such as e-Health (Rikshospitalet) and Socialtainment (*"mobility in the post-oil age"*) have been identified.

Significant and tangible results

During the first reporting period, CWIN and MAS have provided/performed

- sensor analysis for prototypical implementation (result: JVM enabled suns spot sensor platform, VIA embedded Board as power node)
- identification of platforms for interworking, i.e. ETSI TS102.690 and Semantic MediaWiki
- implementation of a semantic platform pshield.unik.no, support for JBV
- coordinating meeting with Telenor Object to enable data exchange with their Shepherd Platform, which is an instance of the ETSI TS102.690
- establish and demonstrated a prototype technology integration for interworking

Use of resources

Resources are almost used according to plan, but with deviations as compared to the original assignment in certain tasks. Due to the requirements of our Lead Partner Movation and the Norwegian Associate Partners JBV and Telenor Objects focus has been on the prototypical implementation of interoperability. This focus forced us to concentrate on hardware work rather than deliverables.

Dissemination activities and exploitation perspectives

- Przemyslaw Osocha (SESM), Yen Pham (CWIN), "p.S.HI.E.L.D.-pilot embedded Systems arcHItecturE for multi-Layer Dependable solutions" ARTEMIS Spring Event at Embedded World 2011, 1-3 March 2011, Nuremberg, Germany
- Przemyslaw Osocha (SESM), Yen Pham (CWIN), "Demonstrating Security, Privacy and Dependability for Sensors to Systems", ARTEMIS IA Co-summit 2010 Project Exhibition, 26-27 October 2010, Ghent, Belgium
- Mohammad M. R. Chowdhury, Josef Noll, "Securing Critical Infrastructure: A Semantically Enhanced Sensor Based Approach", 2nd International Conference on Wireless Communications, Vehicular Technology, Information Theory and Aerospace & Electronic System Technology, WiRELESS ViTAE 2011, Chennai, India, Feb. 28-Mar. 03.
- Yen N. T. Pham, "Sensor Integration into Heterogeneous Service Platform and Domain Adaptation", **Master Thesis**, University of Oslo, December 20, 2010.
- Sarfraz Alam, Mohammad M. R. Chowdhury, Josef Noll, "An Event-driven Sensor Virtualization Approach for Internet of Things", *poster*, VERDIKT conference, Oslo, 1.-2. November 2010

3.11 Slovenia

3.11.1 THYIA Tehonlogije (Coordinator)

Beneficiary[29]:	**THYIA**
Work Package(s)	WP1[30] – Project management (total 2PM for WP2 management) WP2 – SPD metric, requirements and system design (total 11 PM) WP3 – SPD node (total 21 PM) WP4 – SPD Network (total 8 PM) WP5 – SPD Middleware and Overlay (total 11 PM) WP6 – Platform integration, validation & demonstration (total 25 PM) WP7 – Knowledge exchange and industrial validation (total 6PM)
Task(s)	Task 1.1 Project management Task 2.1 Multi-technology requirements & specification Task 2.3 Multi-technology SPD metrics Task 2.3 Multi-technology architectural design Task 3.1 Nano, micro/personal node Task 3.3 Dependable self-x and cryptographic technologies Task 4.1 Smart SPD driven transmission Task 4.2 Trusted and dependable Connectivity Task 5.1 SPD driven Semantics Task 5.2 Core SPD services Task 5.4 Overlay monitoring and reacting system by security agents Task 7.1 Dissemination
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 Project management – 1.5 PM Task 2.1 Multi-technology requirements & specification – 3 PM Task 2.2 Multi-technology SPD metrics – 3 PM Task 2.3 Multi-technology architectural design – 4 PM Task 3.1 Nano, micro/personal node -5 PM Task 3.3 Dependable self-x and cryptographic technologies- 2 PM Task 4.1 Smart SPD driven transmission - 0.25 PM Task 4.2 Trusted and dependable Connectivity - 0.25 PM Task 5.1 SPD driven Semantics - 0.3 PM Task 5.2 Core SPD services 0.5 PM Task 5.4 Overlay monitoring and reacting system by security

[29] This report is per Beneficiary, and it provides as many as WPs in which it is involved each Beneficiary (see as PPR - Project Periodic Report, section 1.2.7.)
[30] x is 1, 2, 3, 4, 5, 6, and 7

	agents – 0.5 PM Task 7.1 Dissemination 0.2 PM
Effort actual or spent in this period:	Task 1.1 Project management – 1.5 PM Task 2.1 Multi-technology requirements & specification – 3 PM Task 2.2 Multi-technology SPD metrics – 3 PM Task 2.3 Multi-technology architectural design – 4 PM Task 3.1 Nano, micro/personal node -5 PM Task 3.3 Dependable self-x and cryptographic technologies- 2 PM Task 4.1 Smart SPD driven transmission - 0.25 PM Task 4.2 Trusted and dependable Connectivity - 0.25 PM Task 5.1 SPD driven Semantics - 0.3 PM Task 5.2 Core SPD services 0.5 PM Task 5.4 Overlay monitoring and reacting system by security agents – 0.5 PM Task 7.1 Dissemination 0.2 PM
% of work completed at the end of the period (indicative):	Task 1.1 Project management – 100% Task 2.1 Multi-technology requirements & specification – 100% Task 2.2 Multi-technology SPD metrics – 100% Task 2.3 Multi-technology architectural design – 111% Task 3.1 Nano, micro/personal node - 104% PM Task 3.3 Dependable self-x and cryptographic technologies- 100% Task 4.1 Smart SPD driven transmission – 100% Task 4.2 Trusted and dependable Connectivity - 100% Task 5.1 SPD driven Semantics - 100% Task 5.2 Core SPD services 100% Task 5.4 Overlay monitoring and reacting system by security agents – 100% Task 7.1 Dissemination 100%

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- **<u>Task 1.1 Project management</u>**
  - On the request from SESM, THYIA took the role administrative "Project Coordinator" starting from 8th of December 2010 when signed the GA with the Artemis JU.
  - THYIA spends some additional effort for the administrative project coordination. The management effort was spent for WP2.
  - Contributions to D1.1.1, D1.1.2 and D1.1.3 documents
  - Results:
    - Repository BSCW server development and administration
    - An extra work was dedicated for development and finalisation of D1.1.1, D1.1.2 and D1.1.3 documents as support to SESM.

- **<u>Task 2.1 Multi-technology requirements & specification</u>**
  - Intensive contributions in D2.1.1

- Studies, analysis and R&D activities for the application scenario, pSHIELD system, node, network, middleware and overly requirements and specifications are performed.
- Additionally contributes with two internal deliverables
- Results:
  - Contributions on scenario, high level pSHIELD system definitions, Node, Network, Middleware and overlay requirements and specifications.
  - A pre-development phase for selecting the pSHIELD SPD components for the Demonstrator
  - A pre-development phase for designing the application scenario (simulation, HW and SW models and components)

- **Task 2.2 Multi-technology SPD metrics**
  - Intensive contributions on D2.2.1, defining appropriates SPD attributes and related metrics.
  - Studies, analysis and R&D activities for pSHIELD system, node, network, middleware and overly metrics requirements and specifications are performed.
  - Results:
    - Almost in a final draft version D2.2.1 that will be corrected in accordance with additional work performed for Formalised Conceptual Models (now as deliverable M0.1) and Aggregation Metrics (now as deliverable M0.2).
    - Selection of the conceptual models for the SPD metrics related to the WSNs, Enhanced-SPD nano, mikro/personal node.
    - Initial work for the simulation
    - Selection of the nano-micro architecture (HW and SW), Security and Dependability Metrics
- **Task 2.3 Multi-technology architectural design**
  - Contributions in D2.3.1 plus two internal deliverables for overly and cross-layer architecture
  - Studies, analysis and R&D activities for pSHIELD nano, micro/personal node architecture based of the D2.1.1 requirements and specifications are performed.
  - Results:
    - A final first draft version D2.3.1 that will be updated in accordance with additional work performed for deliverables M0.1 and M0.2
    - Selection of the pSHIELD reference architecture for the Demonstrator
    - Selection of the Enhanced SPD nano, micro/personal node that will be used for the Demonstrator
    - Initial architectural design of the pSHIELD Demonstrable Network.
    - Studies on the TiniOS, Contiki and Hydra sensor node solutions and their possible up-grade to SPD Nodes.
    - Study on the pSHIELD Gateway (GW) solution
- **Task 3.1 Nano, micro/personal node**
  - Contributions in D3.1
  - Studies, analysis and R&D activities for detailed specifications (HW and SW partition) for pSHIELD nano, micro/personal node architecture based of the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications.
  - Results:
    - A final first version D3.1 is developed.
    - Embedded System security base on the whole design pyramid is investigated (protocol, algorithm, architecture, micro-architecture and circuit level)
    - Potential architecture for SPD core module that include TPM and MTM features

- Secure firmware, secure boot and bootstrapping with key management is investigated
- An architectural solution of nano node analysed for 3D integration technology is considered as first choice that can be also modelled by conceptual models.
- An architectural solution for micro/personal node is analysed as a possible upgrade of Contiki and Hydra OS solutions.
- SPD conceptual models are proposed for sensor node based on the IEEE 802.11, IEEE 802.15.4 standards

Task 3.3 Dependable self-x and cryptographic technologies

- Contributions in D3.4
- Studies, analysis and R&D activities for detailed specifications regarding cryptography technologies based on the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications are performed.
- Results:
  - A first draft version D3.4 is developed.
  - Self-x technologies are studied in details, and possible solutions are identified.
  - Elliptic Curve Cryptography techniques (fast algorithms, TinyECC) are investigated for WSNs as possible solutions.
  - Automatic access control, denial-of-services, self-configuration and self-recovery as mechanisms in charge of preventing non authorised/malicious people to access the physical resources of the node are also investigated, and a potential model for the Demonstrator is identified.

Task 4.1 Smart SPD driven transmission

- Studies, analysis and R&D activities for detailed specifications regarding SPD smart driven transmission based on the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications are performed.
- Results:
  - Cognitive Radio and SDR are considered as candidate technologies.
  - Security technologies like IPsec for the network layer and possible modification (light version) for small sensor nodes are considered and compared with other possible SoC solutions.

Task 4.2 Trusted and dependable Connectivity

- Studies, analysis and R&D activities for detailed specifications regarding dependable connectivity based on the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications are performed.
- Results:
  - Different architectural solutions are considered for network management.

Task 5.1 SPD driven Semantics

- Studies, analysis and R&D activities for detailed specifications regarding semantic ontology based on the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications are performed.
- Results:
  - OWL technologies, an internal reports
  - Potential solutions are identified
  - New SW modules for middleware are identified

Task 5.2 Core SPD services

- Studies, analysis and R&D activities for detailed specifications regarding core SPD service based on the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications are performed.
- Results:
  - Lange based support for service oriented architecture – future direction
  - New SW modules for middleware are identified

Task 5.4 Overlay monitoring and reacting system by security agents

- Studies, analysis and R&D activities for detailed specifications regarding security agents based on the D2.1.1, D2.2.1, and D2.3.1 requirements and specifications are performed.
- Results:
  - AOA architectures
  - Developing secure agent system using delegation based trust management
  - New SW modules for middleware are identified

Task 7.1 Dissemination

- Dissemination versus national authority, external communications with industry and academy (notional and international). Support to CWIN dissemination activities.

Additional Information:

A summary progress towards objectives.

The fulfilment of project's task and objectives is almost 100% for reporting period. Details are provided below.

- Responsibility for the repository BSCW server development and administration
- An extra work dedicate for development and finalisation of D1.1.1, D1.1.2 and D1.1.3 documents as support to SESM
- Contribution to D2.2.1
- Selection of the pSHIELD SPD components for the Demonstrator
- Initial conceptual models for the application scenario (simulation, HW and SW models and components)
- Almost in a final draft version D2.2.1 that will be corrected in accordance with additional work performed for Formalised Conceptual Models (now as deliverable M0.1) and Aggregation Metrics (now as deliverable M0.2)
- Selection of the conceptual models for the SPD metrics related to the WSNs, Enhanced-SPD nano, mikro/personal node (now included in deliverable M0.1)
- Selection of the nano-micro architecture (HW and SW), Security and Dependability Metrics (now included in deliverable M0.1)
- A final first draft version D2.3.1
- Selection of the pSHIELD reference architecture for the Demonstrator (now included in deliverable M0.1)
- Selection of Enhanced SPD nano, micro/personal node that will be used for the Demonstrator (now included in deliverable M0.1)
- Initial architectural design of the pSHIELD Demonstrable Network (now included in deliverable M0.1)
- Study on the TiniOS, Contiki and Hydra sensor node solutions and their possible up-grade to SPD Nodes (now included in deliverable M0.1)
- Study on the pSHIELD Gateway (GW) solution (now included in deliverable M0.1)
- A final first version D3.1 is developed
- Embedded System security base on the whole design pyramid is investigated (protocol, algorithm, architecture, micro-architecture and circuit level) – ongoing work
- Potential architecture for SPD core module that include TPM and MTM futures – ongoing work

- Secure firmware and bootstrapping with key management is investigated – ongoing work
- An architectural solution of nano node analysed for 3D integration technology is considered as first choice that can be also modelled by conceptual models (now included in deliverable M0.1)
- An architectural solution for micro/personal node is analysed as a possible upgrade of Contiki and Hydra OS solutions (now included in deliverable M0.1)
- SPD conceptual models are proposed for sensor node based on the IEEE 802.11, IEEE 802.15.4 standards (now included in deliverable M0.1)
- A first draft version D3.4 is developed
- Self-x technologies are studied in details, and possible solutions are identified -ongoing work
- Elliptic Curve Cryptography techniques (fast algorithms, TinyECC) are investigated for WSNs as possible solutions – ongoing work
- Automatic access control, denial-of-services, self-configuration and self-recovery as mechanisms in charge of preventing non authorised/malicious people to access the physical resources of the node are also investigated, and a potential model for the Demonstrator is identified – ongoing work
- Cognitive Radio and SDR are considered as candidate technologies – ongoing work
- Security technologies like IPsec for the network layer and possible modification (light version) for small sensor nodes are considered and compared with other possible SoS solutions – ongoing work
- Different architectural solutions are considered for network management – ongoing work
- OWL technologies, an internal reports
- Lange based support for service oriented architecture – future direction
- AOA architectures – ongoing work
- Developing secure agent system using delegation based trust management – ongoing work

Clearly significant and tangible results

- Administrative coordination of the project and PM role
- Responsibility for repository BSCW server development and administration
- D1.1.1, D1.1.2 and D1.1.3 deliverables
- D2.1.1 deliverable
- D2.2.1 deliverable
- D2.3.1 deliverable
- D3.2 first draft
- D3.4 first draft contribution
- Selection of the conceptual models for the SPD metrics related to the WSNs, Enhanced-SPD nano, mikro/personal node (now included in deliverable M0.1)
- Selection of the nano-micro architecture (HW and SW), Security and Dependability Metrics (now included in deliverable M0.1)
- Selection of the pSHIELD reference architecture for the Demonstrator (now included in deliverable M0.1)
- Selection of the Enhanced SPD nano, micro/personal node that will be used for the Demonstrator (now included in deliverable M0.1)
- Initial architectural design of the pSHIELD Demonstrable Network (now included in deliverable M0.1)
- Study on the TiniOS, Contiki and Hydra sensor node solutions and their possible up-grade to

SPD Nodes (now included in deliverable M0.1)
- Study on the pSHIELD Gateway (GW) solution (now included in deliverable M0.1)
- An architectural solution of nano node analysed for 3D integration technology is considered as first choice that can be also modelled by conceptual models (now included in deliverable M0.1)
- An architectural solution for micro/personal node is analysed as a possible upgrade of Contiki and Hydra OS solutions (now included in deliverable M0.1)
- SPD conceptual models are proposed for sensor node based on the IEEE 802.11, IEEE 802.15.4 standards (now included in deliverable M0.1)

Reasons for deviations from Annex I and their impact on other tasks as well as on available resources and planning

In August 2010 the Coordinator SESM reported the causes for three month delay (agreed by the Project Assembly). A final delay was reported by THYIA (as Coordinator from December 2011) to the Project Officer by e-emails before the end of the reporting period and an official request of seven months of extension has been sent to JU Artemis on the 29 of March 2011.

Reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning

Some critical objectives were achieved by 31 of December 2010 (deliverables D1.1.1, D1.1.2, D2.1.1 and D7.1.1), but anyway an extension of 7 months has been considered as necessary in order to achieve the overall project objectives.

The consortium reached important technical agreement in the last months on the technical requirements for the application scenario, high level system requirements and other high level architectural requirements specification that can be considered as a first important step for the successful continuing of the project.

Use of resources

All resources were used as planed 100%.

Dissemination activities and exploitation perspectives

All dissemination activities are performed 100%, and an extra work is made to support other partners that are contributing in WP7.

Corrective actions

The corrective actions to be taken are:

1. Adoption of 7 months delay.
2. Additional corrective actions:
    - Partition of the work between the partners with clear task assigned for each participant in each WP
    - Set-up real and achievable outcomes from each WP
    - Adoption of Simple Approval Policy for Deliverables
    - Selection of the IAB members
    - Increasing Quality of the internal review process carry out by the IAB
    - Fixing face-to-face meeting of the TMC members for each millstone in which Deliverables are approved and accepted for delivering to the PO

– Fixing the schedule for the Phone Conferences for each work package, TMC, and PA. – Close collaboration between the participants in WP6 that carry out responsibility for proving the pSHIELD concepts and key enabling technologies – Close collaboration with the PO about administrative, finical and other aspects that contribute to a permanent implementation of the project objectives

3.12 Portugal

3.12.1. Critical Software

Beneficiary:	Critical Software - CS
Work Package(s)	**WP1 - Project Management**
Task(s)	Task 1.1 Project Management Task 1.2 Liaisons
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 1.1 – 1,2 PM Task 1.2 – 0,5 PM
Effort actual or spent in this period:	Task 1.1 – 1,0 PM Task 1.2 – 0,2 PM
% of work completed at the end of the period (indicative):	Task 1.1 – Actual = 50 % (Planned: 58%) Task 1.2 – Actual = 20 % (Planned: 55%)

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 1.1 – Project Management
  - During this first period of the project, Critical Software have used the effort related to this task to ensure there has been a representative from CSW attending all planned pSHIELD meetings relating to the overall Project Management. This has allowed CSW to ensure it has been involved within all required areas of consortium project management.
  - Presently we do not have a signed national Grant Agreement from FCT (*Fundação para a Ciência e a Tecnologia*) and have spent effort working with FCT to ensure they have all of the information that is needed to enable this to be completed as swiftly as possible.
  - Effort has been utilised at the beginning of the project to plan and cost all of the activities that are required for the successful completion of CSW's tasks and activities within the project. This effort has been needed to plan the work required and ensure that this work is efficiently arranged to allow the work to be undertaken in the manner required.
  - Within CSW we have planned for the work needed to deliver our inputs to the specific work packages. This effort from WP1 has been used to define our requirements for each WP and each specific task within the WP and to ensure that our requirements can be delivered within the amount of effort we have been budgeted.

- Task 1.2 - Liaisons
  - Within this task the effort has been used initially to verify if the other EC FP7 projects that are presently ongoing within Critical Software (e.g. project EMMON) have any common topics between them and pSHIELD. This has been done, as described in the project Technical Annex, with a view to creating a relationship between the projects where relevant information and knowledge can be shared. The aim of this has been to permit a useful exchange of knowledge among the projects and produce an improved, coordinated and synergetic continuation of the standardisation processes.
  - The pSHIELD identified technologies and solutions represent a reference guideline for the design and development of Embedded Systems (ES) where Security, Privacy & Dependability (SPD) capabilities are required. In particular, pSHIELD's results will be used for the cross fertilisation among projects and will be available for possible reuse to provide SPD features to the ES's that might be designed and developed in other projects. The aim being to encourage the reuse of features and technologies between projects.

Beneficiary:	Critical Software - CS
Work Package(s)	**WP2 - Scenarios, user requirements and architecture design**
Task(s)	Task 2.1 Multi-technology requirements & specification Task 2.2 Multi-technology SPD metrics Task 2.3 Multi-technology architectural design
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 2.1 – 1,0 PM Task 2.2 – 0,6 PM Task 2.3 – 0,6 PM

Effort actual or spent in this period:	Task 2.1 – 0,8 PM Task 2.2 – 0,5 PM Task 2.3 – 0,5 PM
% of work completed at the end of the period (indicative):	Task 2.1 – Actual = 80 % (Planned: 100%) Task 2.2 – Actual = 50 % (Planned: 63%) Task 2.3 – Actual = 50 % (Planned: 63%)
Description of the activities carried out during the period to reach specific objectives within the task/WP: • Task 2.1; Task 2.2; Task 2.3 ➢ Participation in WP2 meetings (physically at WP Leader premises and phone conferences organised by WP leader). ➢ Participation in the review of D2.1.1 "System Requirements and Specification"; D2.2.1 "Preliminary SPD Metrics Specification"; D2.3.1 "Preliminary System Architecture Design". ➢ Review and contribution to "Requirements and Specifications Definitions and Rules – Quality Manual for WP2".	
Additional information: ➢ WP2 focuses on the identification of the overall pSHIELD system requirements and specifications, its design and the definition of the SPD metrics. The main objective of the CSW participation in this WP is to ensure that we participate in the discussions and document elaboration that will form the basis of the pSHIELD work, namely the work to be performed within WP3, WP4, WP5 and WP6. ➢ In the WP Kick-Off Meeting, it was decided that CSW's main task will be related with the discussion and review of the three deliverables that are to be produced.	

Beneficiary:	Critical Software - CS
Work Package(s)	**WP3 - SPD Node**
Task(s)	Task 3.1 Nano, micro/personal node Task 3.3 Dependable self-x and cryptographic technologies
Period:	1st June 2010 – 31st December 2010
Effort planned in this period (Details from original TA):	Task 3.1 – 1,2 PM Task 3.3 – 9,6 PM
Planned effort as a result of consortium change proposal (see 'Additional Information'):	Task 3.1 – 0,0 PM Task 3.3 – 14,4 PM
Effort actual or spent in this period:	Task 3.1 – 0,0 PM Task 3.3 – 13,5 PM
% of work completed at the end of the period (indicative):	Task 3.1 – Actual = 00 % (Planned: 00%) Task 3.3 – Actual = 56 % (Planned: 60%)

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 3.1
  - This task was not addressed in CSW's contribution (see section "Additional Information").

- Task 3.3
  - Participation in WP3 meetings (phone conferences organised by WP leader).
  - Research of the state-of-the-art within the means of providing security in lightweight and networked embedded devices through an adequate cryptographic scheme.
  - Evaluation of asymmetric cryptography algorithms and their suitability to pSHIELD.
  - Evaluation of symmetric cryptography algorithms and their suitability to pSHIELD.
  - Evaluation of message authentication codes algorithms and their suitability to pSHIELD.
  - Results: The results of Task 3.3 activities are formalised within Deliverable 3.4 "SPD self-x and cryptographic technologies", available at pSHIELD BSCW Server: *https://bscw.juartemis-pshield.eu/bscw/bscw.cgi/d6076/pSHIELD-D3_4-SPD-self-x-and-cryptographic-technologies-prototype-report.docx*

Additional information:

- At consortium level, CSW have requested to focus its WP3 contribution on Task 3.3 instead of having contributions on both Tasks 3.1 and 3.3. The main reasons for this were the interest within the R&D activities regarding cryptographic paradigms addressed in Task 3.3, and also the fact task T3.1 is more "hardware-related" where CSW is not focusing on that area. Also, when fully assessed by CSW, it was verified that there was a need to increase the effort needed in software development and integration activities that are a part of Task 3.3 activities.
- This change is currently being informally managed at WP level and the effort reallocation will be formally addressed within the update to the Technical Annex.
- The indicative % of the completed work for Task 3.3 presented in this table has been calculated taking into account effort reallocation.
- The remaining work within Task 3.3 is expected to exhibit, by means of a physical set-up, a recommended cryptographic scheme deployed on a WSN platform (to be later integrated in pSHIELD's application scenario) including key exchange, authentication and secure communication, thus tightly related with the CSW work on Task 4.2.

Beneficiary:	Critical Software - CS
Work Package(s)	**WP4 - SPD Network**
Task(s)	Task 4.2 Trusted and dependable Connectivity
Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 4.2 – 7,2 PM
Effort actual or spent in this period:	Task 4.2 – 7,3 PM
% of work completed at the end of the period (indicative):	Task 4.2 – Actual = 60 % (Planned: 60%)

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 4.2
  - The activities performed in this task are being performed in parallel with the work on Task 3.3. The main activity undertaken was the research relating to the state-of-the-art technology within the means of providing security in lightweight and networked embedded devices through an adequate cryptographic scheme.
  - Evaluation of key management and distribution schemes and their suitability to pSHIELD.
  - Results: The results of Task 4.2 activities are formalised in Deliverable 4.2 "SPD network technologies prototypes report", available at the pSHIELD BSCW Server: *https://bscw.juartemis-pshield.eu/bscw/bscw.cgi/d6085/task-4-2-cs-contribution.docx*

Additional information:

- The remaining work within Task 4.2 is expected to exhibit, by means of a physical set-up, a recommended cryptographic scheme deployed on a WSN platform (to be later integrated in the application scenario) including key exchange, authentication and secure communication, thus tightly related with CSW work on Task 3.3 (as described above, this task is focused on key management schemes that is a part of the cryptographic scheme).

Beneficiary:	Critical Software - CS
Work Package(s)	**WP5 - SPD Middleware & Overlay**
Task(s)	Task 5.2 Core SPD services Task 5.3 Policy-based management Task 5.4 Overlay monitoring and reacting system by security agents
Period:	1st June 2010 – 31st December 2010
Effort planned in this period (Details from original TA):	Task 5.2 – 7,2 PM Task 5.3 – 1,2 PM Task 5.4 – 3,6 PM
Planned effort as a result of consortium change proposal (see 'Additional Information'):	Task 5.2 – 3,6 PM Task 5.3 – 4,8 PM Task 5.4 – 0,0 PM
Effort actual or spent in this period:	Task 5.2 – 1,5 PM Task 5.3 – 4,5 PM Task 5.4 – 0,0 PM
% of work completed at the end of the period (indicative):	Task 5.2 – Actual = 25 % (Planned: 60%) Task 5.3 – Actual = 56 % (Planned: 60%) Task 5.4 – Actual = 00 % (Planned: 00%)

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 5.2
  - Participation in WP5 meetings (phone conferences organised by WP leader).
  - Analysis of the web services specification stack and its applicability to pSHIELD, namely the use of standard WSDL specification for service description and security features as described within the OASIS WS-x standards, such as WS-Security and WS-Policy. Also addressed an analysis of the service publication into specific service repositories supported by registries that may rely on the UDDI standard for querying available services, service identification and service localisation.
  - The work was performed in an informal basis and will be later formalised in Deliverable 5.2 "SPD middleware and overlay functionalities prototype".

- Task 5.3
  - Participation in WP5 meetings (phone conferences organised by WP leader).
  - Research the state-of-the-art on the paradigm of policy-based management (PBM), namely regarding PBM architectures, policy specification languages and affiliated protocols, and an elaboration on the mapping to pSHIELD.
  - Results: The table of contents for the results of Task 5.3 activities has been formalised in Deliverable 5.2 "SPD middleware and overlay functionalities prototype": *https://bscw.juartemis-pshield.eu/bscw/bscw.cgi/d6047/D5.2_rev_0.2.docx*

- Task 5.4
  - This task was not addressed within the CSW contribution (see section "Additional Information").

Additional information:

- Instigated by CSW, our participation in WP5 was re-evaluated. This issue was discussed in the PA meeting held in Norway and CSW agreed to put more effort in T5.3 in order to provide a research study concerning PBM, continuing to have a reduced effort in T5.2. Due to the need to have extra effort for software development and integration activities in Task 3.3, the remaining WP5 effort was moved to that task.
- This change is currently being informally managed at WP level and the effort reallocation will be formally addressed within the update to the Technical Annex.
- The indicative % of the completed work for Task 5.2 and Task 5.3 presented in this table is taking into account effort reallocation.
- The remaining work in Task 5.2 involves the continuation of services' specification and contribution to pSHIELD demonstrator according to the task objectives.
- The remaining work in Task 5.3 involves an elaboration on the PBM study and its formalisation in Deliverable 5.2. This work is at the time being internally reviewed and it will be delivered to the consortium by week #17 (18-22 April).

Beneficiary:	Critical Software - CS
Work Package(s)	**WP6 - Platform integration, validation & demonstration**
Task(s)	Task 6.1 Multi-Technology System Integration Task 6.2 Multi-Technology Validation & Verification Task 6.3 Lifecycle SPD Support Task 6.4 Multi-Technology demonstration

Period:	1st June 2010 – 31st December 2010
Effort planned in this period:	Task 6.1 – 0,0 PM Task 6.2 – 0,0 PM Task 6.3 – 0,0 PM Task 6.4 – 0,2 PM
Effort actual or spent in this period:	Task 6.1 – 0,0 PM Task 6.2 – 0,0 PM Task 6.3 – 0,0 PM Task 6.4 – 0,0 PM
% of work completed at the end of the period (indicative):	Task 6.1 – Actual = 00 % (Planned: 00%) Task 6.2 – Actual = 00 % (Planned: 00%) Task 6.3 – Actual = 00 % (Planned: 00%) Task 6.4 – Actual = 00 % (Planned: 17%)

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 6.1
  - This Task is not due to start until T0+8 of the project, planned for 1st February 2011 which is outside of the scope of this report.
- Task 6.2
  - This Task is not due to start until T0+8 of the project, planned for 1st February 2011 which is outside of the scope of this report.
- Task 6.3
  - This Task is not due to start until T0+10 of the project, planned for 1st April 2011 which is outside of the scope of this report.
- Task 6.4
  - This Task was due to start in T0+6 of the project, planned for 1st December 2011; however, due to project overall delay, it did not start before the end of the reporting period.

Additional information:

- Task 6.4 was due to start at T0+6 of the project, planned for 1st December 2011; however, due to project overall delay, it did not start before the end of the reporting period.
- Due to project overall delay, the WP6 tasks are yet to be started and their start dates will be updated according to the project re-planning.

Beneficiary:	Critical Software - CS
Work Package(s)	**WP7 - Knowledge exchange and industrial validation**
Task(s)	Task 7.1 Dissemination Task 7.2 Exploitation
Period:	1st June 2010 – 31st December 2010

Effort planned in this period:	Task 7.1 – 0,5 PM Task 7.2 – 0,0 PM
Effort actual or spent in this period:	Task 7.1 – 0,7 PM Task 7.2 – 0,0 PM
% of work completed at the end of the period (indicative):	Task 7.1 – Actual = 65 % (Planned: 55%) Task 7.2 – Actual = 00 % (Planned: 00%)

Description of the activities carried out during the period to reach specific objectives within the task/WP:

- Task 7.1
  - pSHIELD team prepared and hosted an internal seminar (08-10-2010 - Coimbra, Portugal) regarding pSHIELD and security in embedded systems.
    The agenda included:
    1. pSHIELD overview
    2. Security in Embedded Systems
    3. Cryptography
       a. Asymmetric
       b. Symmetric
    4. Key Management
    5. Authentication
    6. Implementation Scenarios

    Within the scope of this work package CSW has also ensured the project details have been disseminated both internally (using the above mentioned seminar) and externally to our R&D partners with a view on the Reuse of information from pSHIELD.

- Task 7.2
  - This Task is not due to start until T0+8 of the project, planned for 1st February 2011 which is outside of the scope of this report.

A summary progress towards objectives

The work performed in **WP1** has mainly focused on project management tasks. Nonetheless, some initial contacts with other EC FP7 projects that are presently ongoing within the company were performed in order to create a connection between the projects through which relevant information and knowledge can be shared between them.

Regarding **WP2**, this work package focuses on the identification of the overall pSHIELD system requirements and specifications, its design and the definition of the SPD metrics. The main objective of CSW participation in this work package is to ensure that Critical Software participates in the discussions and document elaboration that will form the basis of pSHIELD work, namely the work to be performed in WP3, WP4, WP5 and WP6. These objectives have been achieved by participating in WP meetings and contributing to deliverables' development and review.

In accordance with CSW's contribution shown within the Technical Annex, CSW's main contribution to pSHIELD are in the areas of "*Cryptography for low cost nodes*" and "*Dependable authentic key distribution mechanisms*". These activities have been planned according to three main phases: **Research**, **Selection** and **Integration**. According to the SPD features and technologies description that were presented in the

Technical Annex (Table 2.2 – page 25), these two areas (mentioned above) fit into **WP3** and **WP4**, respectively. Nevertheless, since they are interrelated, the work is being performed in parallel.

Within this first period, the main activities have involved researching the state-of-the-art in the field of security in lightweight and networked embedded devices and selection of an adequate cryptographic scheme. Typical cryptographic schemes are essentially composed of a cyphering algorithm (whether symmetric or asymmetric), key management scheme and a message authentication scheme (MAC). The work that has been formalised in Deliverable 3.4 and 4.2 (available at pSHIELD BSCW Server) presents an evaluation of these technologies along with a suitability analysis of their applicability to the pSHIELD application scenario.

The main activities addressed within **WP5** included a state-of-the-art research study on the paradigm of policy-based management (PBM), namely regarding PBM architectures, policy specification languages and affiliated protocols, and an elaboration on the mapping of these to pSHIELD. Initial studies regarding the web services technologies that can be applicable to the pSHIELD architecture were also conducted.

At the end of the "research" phase of WP3 and WP4 activities, within the scope of **WP7**, pSHIELD team prepared and hosted an internal seminar where the results of that phase were presented. It was also an objective of this seminar to present pSHIELD's goals and main characteristics.

Use of resources

After the initial WP meetings and a thorough analysis of each WP objectives, at consortium level and in the interests of the consortium and Critical Software, CSW requested to reallocate the planned PM on different tasks.

This reallocation was needed to resolve the need to extra effort within the software development and integration activities in Task 3.3 and also to perform activities within task 5.3 that had not been initially planned but would be needed to support the future work on policy-based management. Overall it involved changes in both WP3 and WP5 and these changes had no negative effect on the development of the WP's deliverables, only positive benefits.

These changes are currently being informally managed at the WP level by the WP leaders.

After the Technical Annex update, Critical Software PM breakdown in WP3 and WP5 will be:

- T3.1: 0 PM, T3.2: 0 PM, T3.3: 24 PM

- T5.1: 0 PM, T5.2: 6 PM, T5.3: 8 PM, T5.4: 0 PM

With this new PM allocation, it will possible to ensure that the CSW objectives for the next period can be successfully achieved.

Corrective Actions

CSW proposes that an extension would be necessary to allow the project to produce the necessary deliverables that were agreed within the Technical Annex. The benefit of this is that it would allow the consortium chance to consolidate all the work produced and map this to the requirements from within the Technical Annex and ensure that the work done is delivered to the Project Officer in the format necessary. This proposal has been planned and has been presented separately to the Project Officer in the letter "Prolongation of the pSHIELD project – 29.03.2011".

4 Deliverables and milestones tables

4.1 Deliverables (excluding the periodic and final reports)

TABLE 1. DELIVERABLES

Del. no.	Deliverable name	WP no.	Lead beneficiary	Nature	Dissemination level	Delivery date from Annex I (proj month)	Delivered Yes/No	Actual / Forecast delivery date	Comments
D1.1.1	Collaborative tools and document repository	1	THYIA	O	PP	2	Yes	2	
D7.1.1	Web Site	7	SESM	O	PU	2	Yes	2	
D1.1.2	Quality Control Guidelines	1	SESM	R	PP	3	Yes	10	
D2.1.1	System Requirements and Specifications	2	ASTS	R	PU	3	Yes	10	
D2.2.1	Preliminary SPD Metrics Specifications	2	ESI/TECNALIA	R	PP	6	Yes	13	
D2.3.1	Preliminary System Architecture Design	2	HAI	R	PP	6	Yes	13	

4.2 Milestones

TABLE 2. MILESTONES

Milestone no.	Milestone name	Work package no	Lead beneficiary	Delivery date from Annex I	Achieved Yes/No	Actual / Forecast achievement date	Comments
M1	Website and document repository	WP1, WP7	THYIA, SESM	2	Yes	2	
M2	System requirements and specification	WP2	ASTS	3	Yes	10	
M6	Preliminary SPD metrics and system architecture design	WP2	ESI/TECNALIA, HAI	6	Yes	13	

Note: A new work plan accounting for all the changes required after Mid-Term Review Meeting, including all milestones, deliverables and corresponding new delivery dates, is under delivery (due date 15 April 2011).

5 Project management

5.1 Consortium management tasks and achievements

The management structure and tasks are defined in details in the Consortium Agreement.
All partners are included within that agreement according to the management structure described in the Technical Annex. In particular financial and technical actions were planed, the meetings and phone conferences (described below) of appropriate level were scheduled, the technical description of the work and the Consortium Agreement were maintained, the electronic media were maintained including website, collaborative tools, document repository and e-mail list. In frame of consortium management tasks the role of project coordinator who is a contact point with JU was maintained.

5.2 Encountered problems

Project Coordinator change

pSHIELD project encountered an important issue in terms of management: the Project Coordinator (PC) has to sign its national agreement before signing the ARTEMIS-JU grant-agreement. The pSHIELD PC (SESM), as all of the other Italian partners, does not have the national agreement signed, and this represents a problem for the entire consortium: without the signature of the ARTEMIS-JU agreement, the partners of the consortium cannot receive their national and/or European funds. Moreover the ARTEMIS-JU needs the signature of the ARTEMIS-JU Grant Agreement before the end of the November 2010, due to its funds allocation procedure.

The Project Coordinator (SESM), after informing the Project Officer (PO), proposed a solution already adopted for others previously founded projects: the solution consisted of appointing only the administrative role to one of the partners who already has the national agreement signed. The selected partner is responsible also to represent the consortium in front of the ARTEMIS-JU. This solution has been taken to “save the project” by overcoming the absence of a national agreement in Italy and in other countries.

The solution was presented and agreed by pSHIELD project consortium at the meeting held in Oslo on 5-6 of October 2010. The partner who agreed to take that role was THYIA. After meeting necessary amendment to Annex I was made and presented to Project Officer. Project Officer accepted change in December 2010.

New project coordination has been decided, SESM takes care the technical part of the coordination, THYIA would take the administrative part of the coordination including correspondence to internal agreement mentioned in the Annex I to the JU Artemis Grant Agreement

The above difficulties were reported by SESM in August 2010 to the Project Officer as causes for three month delay (agreed by the Project Assembly). A final delay was reported by THYIA (as Coordinator from December 2011) to the Project Officer by e-emails before the end of the reporting

period and an official request of seven months of extension has been sent to JU Artemis on the 29 of March 2011.

Project Management problems
SESM encountered difficulties in consortium coordination and technical management for creating an effective communication flow among partners within the period of this report. This was due primary to the fact that most of partners hadn't signed National Agreements and, as a consequence, there were uncertainties in the project.

SESM and THYIA agree that a change in Project Coordination is necessary to better balance and address managerial and technical tasks within the consortium, together with putting in place effectively internal management as it is described in TA.

As an example, Task and WP leadership will be empowered, and some control mechanisms (risk management) will be adopted in order to mitigate the risks for achieving the objectives; there will be scheduled regular meetings at TCM, WP and Tasks level.

It's needed a better coordination and communication between partners. The collaborative tools should be used exploiting at best its knowledge sharing capabilities. The activities should be tightly defined in order to satisfy the limited use case scenario due to the "pilot" nature of the project.

Work Package 3 leader change
Work Package 3 leader ETH informed partners that wants to withdraw from WP3 leadership. SESM offered itself to take that role since SESM is deeply involved in WP3 works. The change was accepted by project consortium at the meeting held in Oslo on 5-6 of October 2010.

5.3 Changes in the consortium

Greek partner ISD is withdrawing from the project. It was announced by them during Project Assembly phone conference on 15 February 2011.

5.4 Project meetings

Minutes of Meetings as well as corresponding documents are hold at the project official repository BSCW Server http://bscw.juartemis-pshield.eu .

Typology	Date and Venue
Physical Meetings	2010.06.08, pSHIELD kick-off meeting, SESM, Naples, Italy
	2010.07.19, pSHIELD WP2 meeting, THYIA, Ljubljana, Slovenia
	2010.10.5-6, pSHIELD Project meeting, CWIN, Oslo, Norway
	2010.10.20, pSHIELD WP2 meeting, ED, Rome, Italy
	2011.03.21-22, pSHIELD consortium pre-meeting and Mid-term review, JU, Brussels, Belgium

Phone Conferences	2010.07.06 PhC called by ED, WP5 general discussion & link to WP2
	2010.09.10 PhC called by THYIA, WP2 deliverable
	2010.09.16 PhC called by HAI, WP2 deliverable
	2010.09.07 PhC called by SESM, WP2 delivery
	2010.10.01 PhC called by THYIA, WP2 deliverables
	2011.01.20 PhC called by SESM, TMC extend with the PA PhC
	2011.02.08 PhC called by SESM, TMC extend with the PA PhC
	2011.02.15 PhC called by THYIA, PA PhC
	2011.03.09 PhC called by ED, TMC Mid-term review Technical Presentation PhC
	2011.03.16 PhC called by SESM, PA PhC
	2011.03.24 PhC called by SESM, Management PhC: PC, TCM, TM
	2011.03.28 PhC called by SESM, PA PhC
	2011.03.29 PhC called by SESM and ED, Technical PhC
	2011.04.01 PhC called by ED, Technical PhC
	2011.04.05 PhC called by SESM and ED, Technical PhC
	2011.04.11 PhC called by SESM and ED, Technical PhC

Table 1 – Project meetings

5.5 Project planning and status

The project is delayed. A proposal of seven months of extension has been sent to the Project Officer on 29.03.2011.

5.6 Impact of deviations

The impact of this deviation from the original plan is not marginal. With this deviation the consortium get extra initial time to deeply investigate the technological issues of this project and to select appropriate methodology for modelling SPD composability of ESNs.

Moreover, the impact of this deviation introduced an extra reporting period in September 2011.

5.7 Changes to the legal status

Spanish partner ESI changed its official name to TECNALIA.

5.8 Project website

- pSHIELD project website is available at address:
  http://www.pshield.eu
  It contains general project information, public deliverables, and is used for information, news and promotion of the project. The service is provided by SESM.

- Document Repository is available at address:
  http://bscw.juartemis-pshield.eu
  The access to repository is limited only to authorised persons. The service is provided by THYIA.

- Collaborative Tool is available at address:
  http://pshield.unik.no
  Semantic Media Wiki service is used by consortium for collaboration and day-to-day work. It allows on meetings and phone conferences planning and wiki style discussion on technical problems. The service is provided by CWIN.

5.9 Dissemination and exploitation activities

pSHIELD dissemination and exploitation activities are reported in §1 of this report.

5.10 Co-ordination activities

During the analysed period necessary co-ordination actions were taken. In particular a few physical meeting and phone conferences listed above were organised. Also dissemination and exploitation task listed above were done. Contact and exchange of information between partners was provided on daily basis by means of email, phone calls and mail.

6 Explanation of the use of the resources

Here below Person-Month Status and Cost tables are reported. Explanations on deviations in the use of resources are reported in § 3 and related beneficiaries forms.

Table 3 – Person-Month Status Table

Table 3. Person-Month Status Table																			
Contract N. 100204																			
Acronym: pSHIELD																			
Period: 01/06/2010-31/12/2010																			
		Total	SESM	ASTS	ED	ETH	SCOM	TRS	UNIGE	UNIROMA1	AS	TECNALIA	MGEP	ATHENA	HAI	CWIN	MAS	THYIA	CS
Work package 1:	Actual WP total	**12,12**	2,00	1,00	1,17	1,00	2,00	0,50				1,00	0,25				0,50	1,50	1,20
Management	Planned WP total	**29,45**	18,00	1,70	1,80	1,00	2,00	0,50				1,00	0,25				0,00	1,50	1,70
Work package 2:	Actual WP total	**62,46**	4,00	16,00	5,96	11,00	0,70					3,00		3,00	5,00	1,50	0,50	10,00	1,80
SPD Metrics, requirements and system design	Planned WP total	**77,70**	9,00	23,00	8,00	11,00	1,00					2,00		3,00	6,00	2,00	0,50	10,00	2,20
Work package 3:	Actual WP total	**44,50**	2,00			9,00					6,00			2,00		4,00	1,00	7,00	13,50
SPD Node	Planned WP total	**70,90**	14,00			21,00					6,00			2,00		4,00	2,50	7,00	14,40
Work package 4:	Actual WP total	**26,90**					6,00		8,60			0,00	4,00	0,50				0,50	7,30
SPD Network	Planned WP total	**31,20**					9,00		9,00			1,00	4,00	0,50				0,50	7,20
Work package 5:	Actual WP total	**44,88**			17,38			6,50		10,70		1,00				2,00		1,30	6,00
SPD Middleware & overlay	Planned WP total	**59,90**			26,50			6,50		13,20		1,00				3,00		1,30	8,40
Work package 6:	Actual WP total	**4,00**			0,00											2,50	1,50		0,00
Platform integration, validation & demonstration	Planned WP total	**10,70**			4,00											3,00	3,50		0,20
Work package 7:	Actual WP total	**3,40**	1,00		0,00											0,50	1,00	0,20	0,70
Support activities	Planned WP total	**5,70**	3,00		1,00											0,50	0,50	0,20	0,50
	Actual total	**198,26**	**9,00**	**17,00**	**24,51**	**21,00**	**8,70**	**7,00**	**8,60**	**10,70**	**6,00**	**5,00**	**4,25**	**5,50**	**5,00**	**10,50**	**4,50**	**20,50**	**30,50**

Tables 3.1 – Personnel, Subcontracting And Other Major Direct Cost Items

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY SESM FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1, 2, 3, 7	Personnel costs		51838,96		51838,96	Internal staff
3	Subcontracting		16540,00		16540,00	Consultancy
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs		6952,00		6952,00	Travel costs
TOTAL DIRECT COSTS[31]			75330,96		75330,96	
TOTAL INDIRECT COSTS			25919,48		25919,48	Overhead for personnel costs (rate 50%)

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY ASTS FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1, 2	Personnel costs		€ 81.000		€ 81.000	
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[32]			€81.000		€81.000	
TOTAL INDIRECT COSTS			€ 40.500		€ 40.500	Overhead for personnel costs (rate 50%)

[31] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

[32] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY ELSAGDATAMAT FOR THE PERIOD 1.6.10 – 31.12.10

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1,2,5,7	Personnel costs		141.642,95			24,5 PM for 4 senior researchers and 6 analysts
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[33]			141.642,95			
TOTAL INDIRECT COSTS			70.821,475			Overhead for personnel costs (rate 50%)

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY ETH FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1, 2, 3	Personnel costs	0	84000€	0	84000 €	Salary of engineers involved in research, design and development activities. Salary of personnel involved in management activities.
	Subcontracting	0	0	0	0	
	Remaining direct costs	0	0	0	0	
TOTAL DIRECT COSTS[34]		0	84000€	0	84000 €	
TOTAL INDIRECT COSTS		0	42000€	0	42000 €	Overhead for personnel costs (rate 50%)

[33] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

[34] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY SCOM FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
4	Personnel costs		109120.00		109120.00	
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[35]			109120.00		109120.00	
TOTAL INDIRECT COSTS			54560.00		54560.00	*overhead rate 50% of personnel costs*

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY TRS FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1, 5	Personnel costs		*39.147,37 €*	*12.587,98 €*	*51.735,35 €*	*Salaries of 2 senior systems engineer and one director for a total of seven months*
	Subcontracting					
5	Equipments		*1000,00 €*	*1000,00 €*	*2000,00 €*	*Development and Testing equipment*
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[36]			*40.147,37 €*	*13.587,98 €*	*53.735,35 €*	
TOTAL INDIRECT COSTS			*19.573,69 €*	*6.293,99 €*	*25.867,68 €*	*Overhead rate 50% of personnel costs*

[35] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

[36] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY UNIGE FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
4	Personnel costs		41664.00		41664.00	*Salary of PhD at University of Genoa, Salary of Assistant Professor (AP) and Full Professor (FP) at University of Genoa according to the following breakdown:* *1.61 PM PhD* *4 PM FP* *3 PM AP*
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[37]			41664.00		41664.00	
TOTAL INDIRECT COSTS			16248.96		16248.96	*overhead rate 39% of personnel costs*

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY UNIROMA1 FOR THE PERIOD 1.6.10 – 31.12.10

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
5	Personnel costs		93.229,00		93.229,00	10.7 PM for 5 professors and 4 researchers
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[38]			93.229,00		93.229,00	
TOTAL INDIRECT COSTS			46.614,50		46.614,50	

[37] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

[38] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY AS FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1, 3	Personnel costs		28063.15		28063.15	Corresponding to the involvement of project manager and project engineer in the project
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[39]			28063.15		28063.15	
TOTAL INDIRECT COSTS			5612.63		5612.63	*overhead rate 20% of personnel costs*

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY TECNALIA FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
WP1, WP2, WP4, WP5	Personnel costs		23.039,26		23.039,26	Personal Cost of 5p/m
	Subcontracting					
	Major cost item 'Travel'		2.739,92		2.739,92	Travels to Norway and Slovenia
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[40]			25.779,18		25.779,18	
TOTAL INDIRECT COSTS			4.607,6		4.607,6	

[39] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

[40] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY MGEP FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
WP1, WP4, WP7	Personnel costs		21760 €		21760 €	
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[41]			21760 €		21760 €	
TOTAL INDIRECT COSTS			4352 €		4352 €	20% of personnel costs

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY ATHENA FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1, 5	Personnel costs		*28.186 €*		*28.186 €*	
	Subcontracting					
	Equipments					
	Major cost item 'Y' ……..					
	Remaining direct costs (Travelling)		*3.827 €*		*3.827 €*	
TOTAL DIRECT COSTS[42]			*32.013 €*		*32.013 €*	
TOTAL INDIRECT COSTS			*6.402,6€*		*6.402,60*	

[41] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

[42] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY HAI FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
2	Personnel costs		34650 €		34650 €	
	Subcontracting					
	Major cost item 'X'					
	Major cost item 'Y' ……..					
	Remaining direct costs					
TOTAL DIRECT COSTS[43]			34650 €		34650 €	
TOTAL INDIRECT COSTS			894,83 €		894,83 €	

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY CWIN FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
2,3, 5, 6,7	Personnel costs		98 432		98 432	Salary
	Subcontracting					
	Remaining direct costs		4296		4296	Equipment costs
TOTAL DIRECT COSTS			102 728		102 728	
TOTAL INDIRECT COSTS						

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY MAS FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1,2,3,6,7	Personnel costs		70 610		70 610	Salary
	Subcontracting					
	Other direct costs		716		716	travel
	Remaining direct costs					
TOTAL DIRECT COSTS			71 326		71 326	
TOTAL INDIRECT COSTS						

[43] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY THYIA FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1,2,3,4,5, 7	Personnel costs		208991,06		208991,06	Salary of THYIA employees: 3 senior managers, 4 young researchers and administrative supporting personnel, TT Sarl as third party
	Subcontracting		39500,00		39500,00	Related to the companies IJUMP d.o.o, TT Sarl
	Other direct cost		12645,04		12645,04	Travels, consumables, materials, buildings, ...
	Remaining direct costs					
TOTAL DIRECT COSTS[44]			261136,10		261136,10	
TOTAL INDIRECT COSTS			0		0	

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR DIRECT COST ITEMS FOR BENEFICIARY CS FOR THE PERIOD 01/06/2010 – 31/12/2010

Work Package	Item description	Amounts				Explanations
		Fundamental research	industrial research	Experimental development	Total	
1,2,3,4,5, 7	Personnel costs		€ 80.572,86		€ 80.572,86	This has corresponded to the full resources used within the scope of the pSHIELD project during this reporting period.
	Subcontracting					
1,2	Travel costs		€ 2.454,29		€ 2.454,29	These costs have been incurred during CSW attendance at all the physical meetings held during the period and any costs incurred during Project Management and dissemination activities.
	Remaining direct costs					
TOTAL DIRECT COSTS[45]			€ 83.027,15		€ 83.027,15	
TOTAL INDIRECT COSTS			€ 16.114,57		€ 16.114,57	

[44] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

[45] Total direct and indirect costs have to be consistent with the direct and indirect costs claimed to the National funding Institution or, when applicable, to the JU.

7 Beneficiaries without a corresponding National Grant Agreement Financial statements – Form C and Summary financial report

Separate financial statement (Form C) from each beneficiary not having concluded a Grant Agreement with the respective National Authority will not be submitted in the frame of this periodic report, but as part of 1 Year Report.

7.1 Certificates

For this intermediate report no certificate is required, in accordance with Article IV.4.3 of the Grant Agreement.