Project no: 100204

p-SHIELD

pilot embedded **S**ystems arc**HI**tectur**E** for multi-**L**ayer **D**ependable solutions

Instrument type: Capability Project

Priority name: Embedded Systems /Rail Transportation Scenarios

Quality Control Report

For the
pSHIELD-project

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Contents

List of Figures

List of Tables

Glossary

API	Application Programming Interface
ESs	Embedded Systems
IdM	Identity Management
JU	Joint Undertaking
PM	Project Manager
pSHIELD	pilot embedded Systems arcHItecturE for multi-Layer Dependable solutions
R&D	Research and Development
SPD	Security Privacy Dependability
TA	Technical Annex
WP	Work Package

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1 Introduction

1.1 Purpose

This Quality Control Report describes an assessment of the Quality Control Guidelines (D1.1.2) being applied to the pSHIELD project. Thus, the Quality Control Process will first list the guidelines that the project team will follow to assure and control the quality of processes and outcomes produced during the course of the *pSHIELD* project. Each section of D1.1.2 provided a summary of challenges, which is repeated here. A short review is provided to each topic to assess if the identified challenges were complete.

All challenges are listed in tabular form in chapter 5 and 6, together with an initial assessment as of September 2011. This assessment will be revisited based on the end of the pSHIELD project.

According to Wikipedia quality control is an approach by which entities review the quality of form factors involved in the production [Wikipedia]. For a research project this means all factors being involved in the collaborative research and in the production of results:

- Quality control looks at processes and the identification of bottlenecks within the collaborative work environment.
- Quality control evaluates competence and results as compared to the state of technology.
- Quality control looks at soft elements such as personalities, organizational structures and relationships.

If any of these three aspects fails then the quality of the total collaborative project is at risk.

Quality assurance thus means introducing measures for all of the three aspects. Through this document we will look at the three aspects and will see how pSHIELD is organized and is working in order to comply with the fulfillment of the three aspects.

For pSHIELD quality management can thus much more be seen as an obstacle remover for achieving results, rather than the control of the project itself. The assessment provided at the end of each major section will provide the view of the project leadership team, and thus might differ from an assessment of individual project members.

1.2 Scope

The scope of this report includes the analysis of challenges in quality control for collaborative projects, and only later on identifies quality practices and procedures to be employed by *pSHIELD* for the development of all components of *pSHIELD.*

Quality control in project management is usually related to inspect the accomplished work in order to be in-line with the scope of the project. Thus an initial point of each quality control is to clearly point out the scope of pSHIELD.

pSHIELD is a pilot project developing and establishing pilot technologies for security, privacy and dependability in embedded systems. As the total project duration is limited to 19 months, the main focus is on advances in core technologies for embedded systems.

Thus the scope of pSHIELD includes the following four items:

- How can we ensure that our developments are state-of-the-art?
- How can we support the development of prototypical demonstrators?
- How can we establish an ecosystem for creating impact of SPD technologies identified by pSHIELD?
- How can we document the achievements in a sufficient manner?

This document is built up as follows: It first analyzes the impacts on quality control in research projects (chapter 2). It then analyzes in chapter 3 the scope of this pSHIELD project with respect to the "pilot" character of the collaborative research. Chapter 4 deals with the Action Plan for Quality Control, while the Conclusions provide an overview of this document.

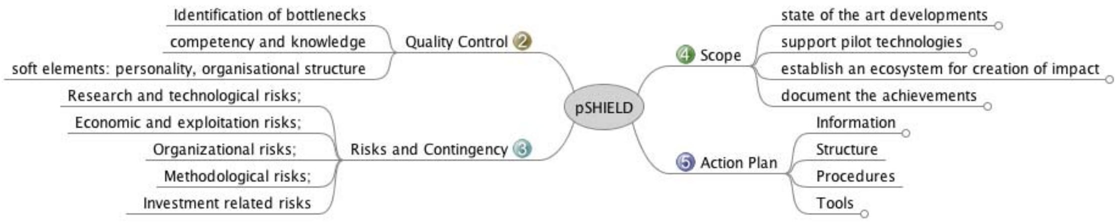

Figure 1-1: Elements of the quality control in pSHIELD

Figure 1-1 shows a mindmap of this document, indicating the areas of Quality control, of Scope and the resulting Action plan for pSHIELD.

2 Quality control in collaborative research

In a collaborative research the identification of obstacles is the main challenge. Figure 2-1 provides an overview over anticipated bottlenecks. In this section we will analyze the bottlenecks, and provide a ranking of the most severe ones with respect to the collaborative research project pSHIELD. The summarized challenges will then be ranked, and measures will be introduced in section 4 to ensure a quality control for pSHIELD.

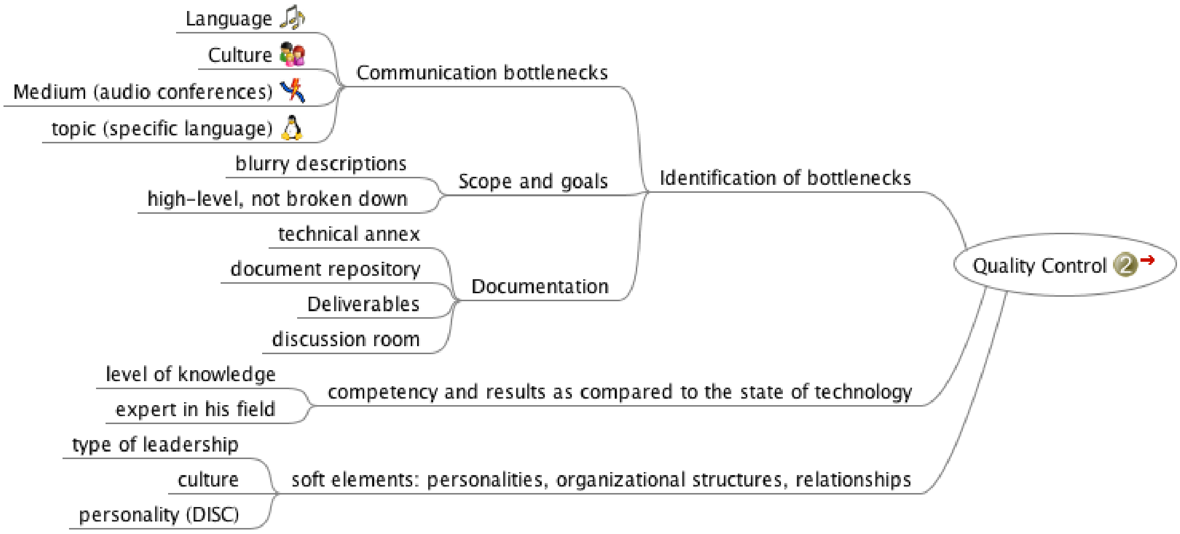

Figure 2-1: Quality control as identification of bottlenecks, competency management and soft elements

In a collaborative research project people don't work in the same location, they don't see each other on a regular basis, and the companies they are working for might have diverging goals. And even worse, these company goals might not be in-line with the project goals. The way goals are presented in a research project might be different from what members know from their own organization. This section will analyze the three areas:

- Identification of bottlenecks
- Competency and results with respect to the state-of-technology
- Soft elements, such as culture, personality and type of leadership required.

2.1 Identification of bottlenecks

The major source of misunderstanding is due to communication, even though communication should contribute to a better understanding. We have identified information exchange and information flow as one of the core assets for a successful project. Thus this document will first look into the challenges of information flow and later on look into the specific procedures for collaborative research. Though communication is often the main factor when interaction fails, the clear definition of scope and goals is also important. How information is exchanged and how it is documented is the third area of potential bottlenecks.

Identification of bottlenecks includes the three areas, which are analyzed more in detail in the subsections:

- Communication bottlenecks
- Scope and goals
- Documentation

2.1.1 Communication bottlenecks

Communication is based on Language, Culture, Medium and Topic, as indicated in Figure 2-2.

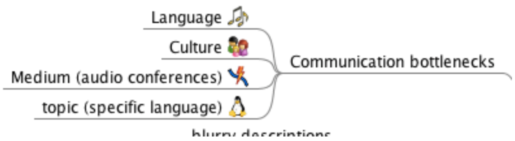

Figure 2-2: Aspects of communication

Language is the most obvious bottleneck, and is complicated by the fact that we often talk about a specific topic, which again might have a very distinct meaning in the language of the user. One example of such a term is Identity Management (IdM), which might be used as “access control”, as “management platform”, “prevention from identity theft” or as “data protection”.

The usage of terms might be subject to the culture of the company (or country). Thus even though one has agreed, “somewhere in writing”, on a meaning of terms, reality is often that the dominant understanding of the terminology comes from “daily life” rather than infrequent project meetings.

Talking with multiple users in an audio conference is a challenging task by itself. Voice quality is often reduced, participants might be difficult to be understood, and the level of incoming loudness is quite different. The effect of lines being dropped, people joining through mobile phones or skype, and the different times of arrival are additional challenges for a successful phone conference.

The following list of measures should be introduced to deal with the identified bottlenecks:

- 211A) Language and topic language -> support audio conferences with written agenda and minutes. Have the minutes ready as soon as possible after the meeting.
- 211B) Culture-> allow for space in physical meetings such that partners can meet and exchange information, thus enhancing the understanding of other cultures.
- 211C) Audio conferences -> ensure a good provider and keep the audio conferences to a maximum of 60 min.

The next section will analyze additional scope and goals.

2.1.2 Scope and goals

In research projects there is always a substantial time delay between the time of writing the proposal and the time of executing the activities. This time delay and the fact that the office in charge of the proposal might be identical to that performing the work is a major source of misunderstanding.

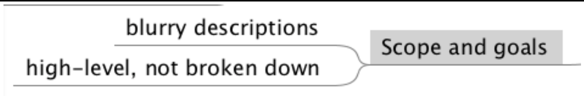

Figure 2-3: The challenges in the identification of scope and goals of a research project

Though the scope and goals of the project might be clear for the ones who have written them, the description might be somewhat blurry or remains on a high-level, as indicated in Figure 2-3. When writing the proposal, this might have been done on purpose, to ensure flexibility in executing the project.

However when it comes to execution of the project the blurry description might not help others than the ones working on the topic, to understand what is going to be performed in this area. Scope and goals, which are described just on a high level, and which are not broken down into sub goals, are another bottleneck for the execution of the project.

The countermeasures, which should be taken into consideration, may include:

- 212A) blurry descriptions -> establish measurable outcomes
- 212B) high-level scopes not broken down -> establish subgoals for each task, defined in expected outcomes for meetings and phone conferences.

The next subsection will look into bottlenecks related to documentation.

2.1.3 Documentation

Figure 2-4 provides an overview over the different types of documentation used in a project. The starting point of every project is the Technical Annex. This one describes in detail the work packages tasks and the expected outcomes in deliverables. However as there is typically a time delay of at least half a year between writing the Technical Annex and the execution of the tasks, the Technical Annex might not represent the actual state of technology. Furthermore, the Technical Annex is seen as a measure towards the JU, and it is not treated as a document supporting day-to-day operations. There might also be a different understanding of how to use the Technical Annex. Some partners will follow the Technical Annex word by word in order to comply with the tasks described in the TA, while others rather see the TA has Report and work according to the needs of technology and project goals.

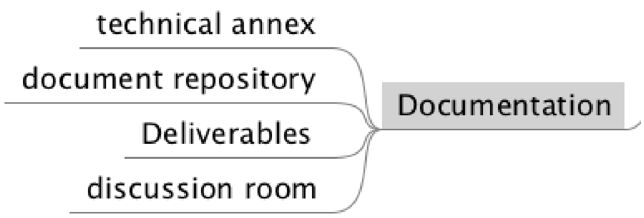

Figure 2-4: Bottlenecks related to documentation

The document repository is typically introduced to keep track of versions of documents. However, the document repository needs to have security architecture in order not to open documents for everyone. Furthermore, the document repository just keeps documents, it does not block discussions, it does not show relations between documents, and thus it is more an archive rather than the basis for collaboration.

Deliverables are the means to present work towards the JU, project partners, collaborating projects, and the public. However, deliverables often are produced after the work is done, don't carry discussions, but rather document the achievements. A programmer or a hardware developer will rather put his effort into software or hardware then producing documents.

Project collaboration tools often include discussion rooms. Similar to social media, the use of discussion rooms depends very much on the personality of the project participants. Most people would prefer e-mail to exchange views rather than documenting in a discussion room. As e-mails are decoupled from the normal project process, it is a challenge to capture the thoughts and results from those e-mail discussions into deliverables and documents.

The major challenge identified in bottlenecks for documentation is due to the fact that documentation is not synchronous to ongoing developments and discussions, but is rather of an archive type. Most companies have recognized that handling documentation in archives is a challenge on its own.

The countermeasures, which should be taken into account, include:

- 213A) Technical Annex -> reach an agreement with the JU and the consortium members on how the TA should be treated.
- 213B) Document repository -> use the document repository for archives, rather than for ongoing discussions.
- 213C) Deliverables -> establish deliverables as means of documenting the work, but rather use online collaboration for information exchange.
- 213D) Discussion room -> establish means for bringing discussions into a common collaboration tool, ensuring that also people not being present in the discussion can follow the reasoning for the results of the discussion.

This section analyzed the potential bottlenecks in a collaborative project, and provided some countermeasures for each of the aspects. The next section will look into competency of the partners and results as compared to the state of technology.

2.2 Competency and knowledge

People and organizations have different competency. Some might focus on the development, others are specialist in encryption, and others are business minded. In a collaborative project the level of knowledge even in the same field might be quite different. However, what we often find in research projects is that highly qualified experts meet to exchange knowledge. They are experts in their respective fields, and are keen on expanding their expertise rather than documenting it “yet another time”.

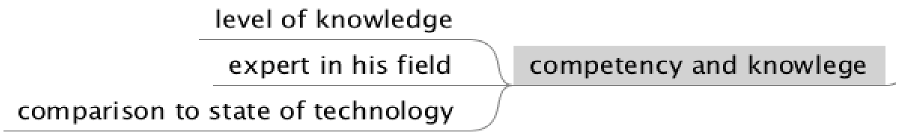

Figure 2-5: Competency and knowledge will vary amongst participants

Figure 2-5 indicates the challenges related to competency, and especially points out that competency and knowledge have to be compared to the state of technology. Though the wording “state of technology” is commonly used, it might not mean the same thing for participating people. A business-oriented person will always relate the results as how they can be brought to the market, while a research oriented person will always challenge himself as compared to other research results.

The measures in the competency and knowledge area may include:

- 221A) Level of knowledge -> establish training sessions for internal knowledge exchange
- 221B) Expert in this field -> define subgroups where experts in the fields can talk to each other rather than getting bothered by talks of no interest to them.
- 221C) Comparison to state of technology -> define the state of technology which should be reached, e.g. prototype development, algorithm development.

Having analyzed the competence and knowledge area, we will now look into soft elements such as personalities, organizational structures and relationships.

2.3 Soft elements

The area, which is often taken for granted, is the handling of soft elements in a project. Under soft elements we mean the personalities of the engaged people, the organizational structures that people find in their respective organization, and relationships of people. Figure 2-6 outlines the different elements.

Figure 2-6: Soft elements that might cause projects to fail

Project participants might be used to take leadership, which is very much linked to their culture, either being culture of the company, or being a culture of their respective area. These cultures might be quite different, where certain cultures tend to have a more collaborative approach, while other cultures prefer a more dominant leadership. While the dominant leader might be perfect for a dissemination and exploitation of results, he might not have the same understanding within the project. Thus for a project based on experts in the fields one needs to look for collaborative leadership, where the input from each partner contributes to the final success of the project.

Though participants in international projects have typically experience and are trained from their seniors, the personality of each participant will differ. Some are more fact oriented, others are more impulsive, while the third group might need a well functioning organization to be able to contribute at their best. In companies, project participants often go through the process of getting known to each other. They see each other on a daily basis and thus get used to the personality of their coworkers. This is not the case in an international research project, and thus it is a real challenge.

The countermeasures and the stage for successful collaborative project may include:

- 23A) Type of leadership -> a collaborative leadership structure, built on the expertise of experts in the domain.
- 23B) Culture -> allow for cultural exchange and understanding through openings in meetings
- 23C) Personality -> ensure to put together the leadership team which can satisfy the different personalities of the involved participants.

This chapter has analyzed the identification of bottlenecks, competence and knowledge, and soft elements of participants in a collaborative project. It has identified potential countermeasures to ensure a successful project. These countermeasures might be taken into consideration in the quality control. The next chapter will look into the scope of the project including state-of-the-art developments supporting pilot technologies, establish an ecosystem for the creation of impact, and the documentation of achievements.

3 Risk management as described in the Technical Annex

This section lists the risks and the risk handling as described in the Technical Annex. We feel that even though the section does not contribute new knowledge since the TA writing, it is worthwhile to include them in order to have a complete overview over additional risks for failure.

3.1 Known risks and contingency plan

The known risks in pSHIELD are related to the dimension of the project and the challenging objectives it wants to achieve. These risks relate to the following main areas, as indicated in Figure 3-1:

1. Research and technological risks;
2. Economic and exploitation risks;
3. Organizational risks;
4. Methodological risks;
5. Investment related risks.

Figure 3-1: Risk analysis from Technical Annex

These risks are described below, and the consequences and contingency actions are explained.

3.1.1 Research and technological risks

Due to the high number of SPD technologies that will be developed and integrated in the pSHIELD system, for the sake of simplicity, instead of listing all the risks associated to each technology, two macro-risks have been identified.

Risk 1. A technology development at node, network or middleware layer delays

Probability: [Medium]. As described in section 2.2 of TA, pSHIELD aims to enhance several SPD technologies at all levels of an ES. It is possible that one or more of challenging technologies can require more effort to be enhanced to match the specifications. However, as shown in section 5.3 of TA, for each technology at least two partners are involved in its development and approx the 2/3 of the consortium is always involved in R&D activities. So in the case one of the technologies is delaying the other partners can provide technical assistance or some more effort.

Gravity: [Medium/High]. The delay of one or more technologies can cause a delay in the delivery of a prototype and thus the entire project can be delayed.

Contingency plan. If a critical delay occurs in one or more of the SPD technologies, two main countermeasures can be taken. First of all the technology can be used at the state of the art, without enhancement, and adapted to be composable with the rest of the architecture. Secondly, taking advantage from the composability feature of the pSHIELD system, it can be replaced by other available SPD solutions (even if with less performance).

Risk 2. The composability concept fails

Probability: [Low/Medium]. As described in section 2.1 of TA, the leading pSHIELD concept is to demonstrate the composability of heterogeneous SPD technologies. It can occur the case that this innovative concept once deployed produces less benefit than the effort it requires to operate, even if the current research literature seems to demonstrate the contrary[1]. Moreover the pSHIELD workplan has been organized to check continuously (through integration, validation and verification processes) the achievements of the project milestones and results.

[1] "*A top-down, multi-abstraction layer approach for embedded security design reduces the risk of security flaws, letting designers maximize security while limiting area, energy, and computation costs.*". Source: D. D. Hwang, P. Schaumont, K. Tiri and I. Verbauwhede, "Securing Embedded Systems", published by the IEEE computer society, IEEE security & privacy, 2006.

Gravity: [Medium]. If the static and dynamic composability concept fails, the added value brought by the project is limited to the evolution of the single SPD technology in ESs and to the simplification of (re-)certification processes.

Contingency plan. To mitigate the effects of this risk, as soon as one of the checks fails (during the integration, the validation or the verification processes) less strict requirements and specifications and a more efficient system design can be studied, to improve the pSHIELD performances with the minimum effort.

3.1.2 Standardization and exploitation risks

Risk 3. Products appear on the market before the project work is completed

Probability: Low. The key players in this market are embedded system manufacturers, integrators and their suppliers, of which several major ones are in the consortium. Whilst partners are aware of ongoing work on small-scale single-technology, proprietary solutions, they are aware that especially from 2001 the SPD topics have become a worldwide priority. However, they have no knowledge of a similar activity to pSHIELD that takes such holistic approach to SPD, where a composable convergent over-layer can guarantee efficiency, reliability, adaptability, resiliency over different networked ES technologies.

Gravity: Medium/High. If a product will appear on the market before the project work is completed then this would be a serious situation that might impact to the project.

Contingency plan. If a seemingly competing product came to the market during the project's lifetime, it would have to be examined carefully. It is highly unlikely that all the types of technological advances proposed by pSHIELD with respect to the standard integrated SPD solution would be covered, or that all the features and functions of pSHIELD could be included in any product that could emerge within the next couple of years. Rather than closing the project, a realistic contingency plan would be to work together with the manufacturers to enhance their product with pSHIELD aspects that they do not have.

Risk 4. Standards emerge that prevent the deployment of the results, or lead towards a different solution to that being developed in the project

Probability: Low. The key players in standardization groups are present in the pSHIELD consortium. They are aware of the work in relevant standards organizations (refer to section 4.3 of TA).

Gravity: High. If standards did emerge that prevented the deployment of the results, or led towards a different solution from that being developed in the project then this would be a serious situation that might impact heavily to the project.

Contingency plan. If a standard emerged to handle ES SPD in all layers in a different manner, it might still be feasible to adapt the pSHIELD infrastructure to the new standard. The pSHIELD components are very modular and composable, and the necessary adaptations may be largely a case of modifying the external interfaces.

3.1.3 Organizational risks

Risk 5. Withdrawal of a key partner

Probability: High. In a project with so many partners lasting more than one year, the chances are high that at least one partner will have to leave the project due to an event such as major internal re-organization or takeover. Alternatively, a partner may find itself unable to complete its allocated responsibilities, due to the transfer of key personnel within, or outside, the company, financial problems, etc. In both cases it will be necessary to find a replacement partner.

Key partners are considered those with management roles (Coordinator, WP leaders), and those that provide node or network technologies not provided by other partner.

Gravity: Medium. Thanks to the good balance of the project consortium, a complete collapse of the project is highly unlikely, even if a key partner withdraws. Monitoring procedures will be put in place to detect early any under-achieving partner and the project will encourage open and honest reporting of problems, so that solutions can be found as soon as possible.

Contingency plan. The Consortium Agreement regulates the penalties that such a defaulting partner would have to pay, and this money can then be used to enable the work to be done by another partner. The consortium comprises major companies, who have expertise in several areas relevant to pSHIELD, and a transfer of resources to an existing partner would be the first choice for a replacement. Given the overwhelming interest expressed to be part of this consortium, if no replacement could be found internally, it is expected to be simple to find an external replacement organization to take over the work at relatively short notice.

Risk 6 Since WP6 builds on all other work packages, the main risk identified is the delaying of components delivery.

Probability: Medium. Because of the number and variety of components to be integrated onto the platform, there is a chance of not being able to produce working demonstrations of all expected features coping with the challenging scenarios addressed in WP7. pSHIELD has continuous verification mechanism that helps to identify potential delays and to react in time.

Gravity: Medium.

Contingency plan. Measures can be taken to minimize the risks if there's some foreseen delay; for example some components can be replaced with older versions or components already developed in other projects, so that a single delay should not compromise the final demonstration.

3.1.4 Methodological risks

These relate primarily to the need to merge research results from different organizations, with a potentially large degree of difference in methods, terminology, and outputs.

Risk 7 The consortium fails to deliver proper models and tools

Probability: Medium. The complexity and innovation of pSHIELD conceptual framework and related tools can lead to unforeseen design deadlocks.

Gravity: Medium. This methodological risk causes problems to system development.

Contingency plan. Contingency plans of the consortium foresee that in such a case the parameterization and configuration of the field test will be solely based on the extensive experience of the project partners in development of SPD systems and technologies. Drawbacks of this measure are that the evaluation of progress beyond the state-of-the-art cannot be executed at the quality intended and in a reproducible manner.

Risk 8 The consortium fails to deliver prototypes according to the specifications and requirements

Probability: Medium. To enable composability of SPD functionalities, pSHIELD requirements and specifications should be applied strictly. It is possible that one or more prototypes fails to respect the specifications.

Gravity: Medium. This methodological risk causes problems to the platform integration and the field tests.

Contingency plan. In this situation, a minimal combination of industrial partner existing products would provide a substitution for the prototype. Yet the results of such a substitution would not be able to provide all the functionalities of the project prototype. Therefore, the gravity of this risk is rated medium.

3.1.5 Investment related risks

Risk 9 Low or negative investment return

Probability: Medium. This is a sensitive issue for all participants since all investments need to be related to a return plan. Participants believe that potential benefits identified during the project definition phase are sufficient to guarantee valuable returns. However, the outcome of the project may be subject to re-definitions or deviations thus altering the initial expectations of the respective partners with respect to resources necessary to accomplish a certain task and wide-scale applicability of results.

Gravity: High.

Contingency plan. To enhance the possibility that investments bring a positive outcome to the project, acceptance preparation activities will be conducted starting from the beginning of the project.

3.2 Summary of risk assessment for quality control

The summary of the risk assessment includes the questions:

- 32A) Have research and technological risks been properly identified?
- 32B) Have economic and exploitation risks been properly identified?
- 32C) Have organizational risks been properly identified?
- 32D) Have methodological risks been properly identified?
- 32E) Have investment related risks been properly identified?

4 The scope of pSHIELD

This chapter defines challenges with respect to the scope of the pSHIELD project. We understand the scope of a research project is to establish state-of-the-art developments, to support pilot technologies, to establish an ecosystem for the creation of impact, and to document the achievements. Our view of the scope is presented in figure of 4-1.

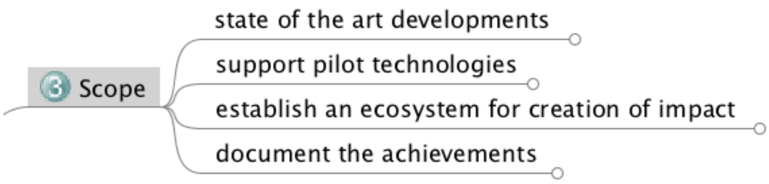

Figure 4-1: Categories contributing to the scope of a project

The following subsections will dive into each of these 4 identified areas, identify the challenges, and suggest supporting actions to see how the scope of the project can be achieved.

4.1 State-of-the-art developments

State of the art developments include multidisciplinary architectures, application interfaces, and sufficient system knowledge.

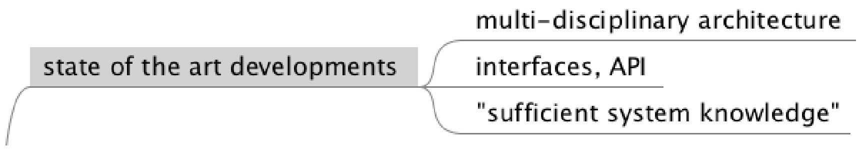

Figure 4-2: Aspects of state-of-the-art developments

Figure 4-2 shows details of the state-of-the-art developments. Research projects are put together collecting experts from multidisciplinary areas, and thus they require an architecture which takes into consideration each of these areas. While experts typically like to increase the knowledge in their specific areas, a system approach might only want to look at an architecture, which is good enough to satisfy the needs for the goals of the project.

The challenge of creating a "good enough" architecture requires sufficient system knowledge. This system knowledge is used to define interfaces and APIs, such that the different components will form the suitable architecture, and to ensure that components would play together.

The main suggestion and comes to the state-of-the-art developments is to establish:

- 41A) Has the project delivered a suitable architecture in the early phase of the project?
- 41B) Have suitable APIs been defined to ensure interworking?

The architecture and the APIs should also identify where potential bottlenecks are and open for new developments in the area. The next chapter will look into supporting pilot technologies.

4.2 Pilot technologies

There is a major challenge between developing pilot technologies and bringing those technologies into a prototype or a system. Figure 4-3 points out the components of such pilot technologies, indicating that project participants might like to have the freedom to perform R&D, that so that state-of-the-art research might fail, and that developments always take more time than expected.

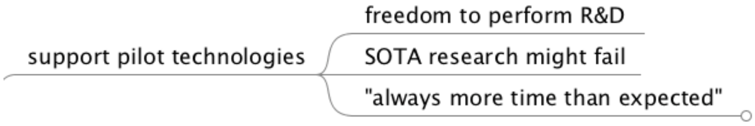

Figure 4-3: Aspects of pilot technologies and their impact on a project

The point that makes International Research interesting for partners is that it allows the freedom to perform advanced research work. A research project also allows for interworking between academic research and corporate research, the latter one being more and more reduced in companies.

The challenge for the research project is that state-of-the-art research might fail. Even though the researcher is an expert in this field, he might not understand the implication level, such that the integration of the envisaged idea might not be possible.

The most critical point in research and prototype development is that such developments always take more time than expected. An experience from generation work in Movation shows that the prototypical development is typically only about 10% technology, while 40% relates to graphical user interface and another 50% to system integration. This shows how critical the understanding of the complexity of the system is.

Bringing the technology to the market might add another 200% of effort in branding, team building, partnership and marketing efforts. From our knowledge the integration of prototypical technologies is tedious work, and does not necessarily help supporting the research goals of the project. As pSHIELD is a pilot project demonstrating SPD functionality, the focus should rather be on prototypical demonstration of core technologies than on tedious integration work. Such integration work is necessary to prove the concept in the market, but not to show SPD functionality.

In summary, the checklist of the support of pilot technologies shall include:

- 42A) Have the performed R&D approaches received the result?
- 42B) Are the results well in line with the state-of-the-art in research?
- 42C) Does the prototypical development demonstrate the key features?

4.3 Ecosystem for creation of impact

pSHIELD is all about pilot implementations and the project should have in mind to establish the path to an ecosystem where pSHIELD technologies are going to be used.

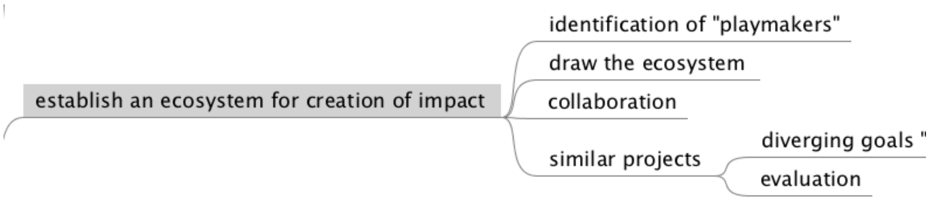

Figure 4-4: Elements of an ecosystem needed to establish an impact in the market

Such an ecosystem, as identified in the figure 4-4, includes the identification of playmakers, the overview of the necessary ecosystem, the building of collaboration with industrial partners and collaborations with projects in the field. In the research work related to pSHIELD we have identified projects working in the domains of security and privacy in embedded systems, and measures should be undertaken on what extent we established a closer collaboration.

The quality measure should include that dissemination or invitation for collaboration is towards partners that can help to establish the ecosystem. Such partners may include hardware manufacturers, system operators for industrial ultimate automation, common providers such as Telcos, and end-user support companies.

The measure of this ecosystem for the creation of impact will include:

- 43A) Is a map of the business ecosystem established?
- 43B) Does the map of the ecosystem contain the identification of playmakers?
- 43C) Have initial collaboration with playmakers and with a similar projects been established?

4.4 Documenting the achievements

The scope of the project includes the documentation of achievements through targeted dissemination, scientific dissemination, internal dissemination, and deliverables.

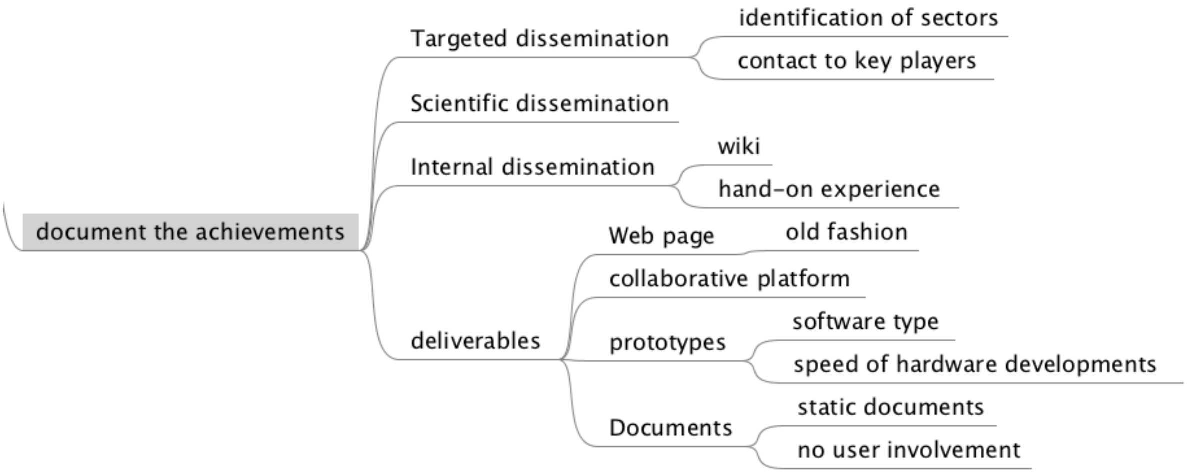

Figure 4-5: Types of documentation in a research project

Figure 4-5 provides an overview over aspects of documentation. Targeted dissemination is dissemination towards specified sectors and key players, as identified in the previous chapter on establishing the ecosystem. Having defined the ecosystem, key industry players should be addressed and their comments should be taken into consideration. If these considerations can’t be taken into account, then at least a listing of reactions from the market should be provided.

In order to ensure that the results achieved in the project are in line with the state of the art developments, the project should have a limited number of scientific papers to conferences and journals. During the scientific sessions in conferences, one has the opportunity of talking to other scientists and thus one can verify the value of the results. Contributions to journals will help to distribute the results on a much broader basis, and allows for partnership to research groups, which have not been identified previously.

In the previous section we have identified the value of internal trainings, in order to bring participants on to the same level of understanding. Such internal dissemination should include hands-on experience in order to achieve a better learning. However, trainings are not the only way of internal dissemination. They should go ahead with living documentation, which is nowadays often achieved through a wiki-based collaboration platform.

Last but not least, the project should create deliverables. These deliverables might be formed in terms of web pages, a collaborative platform, in terms of prototypes, or in terms of documents. Our understanding is that both web pages and documents often are static, and they don't have much user interaction. They represent “dead knowledge”, and are comparable to encyclopedias, which have a limited impact as compared to the living Wikipedia.

A better way of documenting the achievements is through collaborative platforms and prototypes. A collaborative platform will allow acting as a living document, where ideas and discussions can be contributed at any time. However the challenge of a collaborative platform is often that the content turns into an unstructured cloud of information. Thus the challenge is to generate the structure in a collaborative platform.

Prototypical developments might be in the form of software or instant form of hardware. These developments should be taken up to the point where they can prove certain theory, rather than trying to develop market solutions. The development of market solution requires certified software approaches, IT business edition, and an expectation plan for the time to market. Such market solutions are outside of the scope of the short time-limited pilot project pSHIELD.

In summary, the checklist of documents achievements shall include:

- 44A) Are key players identified?
- 44B) Is (initial) contact established?
- 44C) Is the scientific dissemination being taken towards both conferences and journals?
- 44D) Is the feedback from the scientific dissemination documented?
- 44E) Did internal dissemination take place, and did it include hands-on experience?
- 44F) Does the project have a solid base of basic information through Web pages and public documents?
- 44G) Does the project supports collaborative approaches?

The next chapter will set up a list of Quality management activities.

5 Quality management activities

The quality management introduced in pSHIELD will deal with the scope of the project, which was earlier identified as:

- How can we ensure that our developments are state-of-the-art?
- How can we support the development of prototypical demonstrators?
- How can we establish an ecosystem for creating impact of SPD technologies identified by pSHIELD?
- How can we document the achievements in a sufficient manner?

Each of these bullets was outlined in the earlier sections, and the list of bottlenecks in communication, in unclear description of scope and goals, and in topics related to documentation, was provided.

5.1 Identification of bottlenecks

This chapter will collect these listings of the bottlenecks in table 5-1, with the goal of providing the quality management with a checklist. The checklist is used to identify which of the bottlenecks are relevant for pSHIELD, which are identified, and which are dealt with.

Table 5-1: List of potential bottlenecks in pSHIELD

Topic	**Action**	**Relevance (-,o,+)**	**Sep2011 assessment** **Achieved (yes, no, partly)**	**Jan2012 Assessment** **Achieved (yes, no, partly)**
211a) Language and topic language	> support audio conferences with written agenda and minutes. Have the minutes ready as soon as possible after the meeting.	+	Yes	Yes
211B) Culture	> allow for space in physical meetings such that partners can meet and exchange information, thus enhancing the understanding of other cultures.	o	partly	partly
211C)Audio conferences	> ensure a good provider and keep the audio conferences to a maximum of 60 min.	o	yes	partly
212A)Blurry descriptions	> establish measurable outcomes	+	partly	Partly, only 2nd half
212B) High level scopes not broken down	> establish subgoals for each task, defined in expected outcomes for meetings and phone conferences.	+	partly	Partly, focus on deliverables
213A) Technical Annex	> reach an agreement with the JU and the consortium members on how the TA should be treated.	o	no	Partly/Yes (most partners)
213B)Document repository	> use the document repository for archives, rather than for ongoing discussions.	-	yes	yes
213C) Deliverables	> establish deliverables as means of documenting the work, but rather use online collaboration for information exchange.	o	partly	partly
213D) Discussion room	> establish means for bringing discussions into a common collaboration tool, ensuring that also people not being present in the discussion can follow the reasoning for the results of the discussion	+	partly	No/partly – need for improve–ments

22A)Level of knowledge	> establish training sessions for internal knowledge exchange	o	yes	yes
22B) Expert in this field	> define subgroups where experts in the fields can talk to each other rather than getting bothered by talks of no interest to them.	+	yes	Partly
22C)Comparison to state of technology	> define the state of technology which should be reached, e.g. prototype development, algorithm development.	+	partly	partly
23A) Type of leadership	> a collaborative leadership structure, built on the expertise of experts in the domain.	+		Yes in 2nd half
23B) Culture	> allow for cultural exchange and understanding through openings in meetings	o		Partly/no
23C) Personality	> ensure to put together the leadership team which can satisfy the different personalities of the involved participants.	-		Partly/yes

This table provides an initial identification of bottlenecks in the quality management approach for pSHIELD and the assessment both in Sep2011 and Jan2012 (after the end of the project). We have identified 7 areas being of core importance for the identification of bottlenecks, and bottlenecks in these 7 areas have been either partly or fully addressed. In the total picture, we see that only one bottleneck is not sufficiently solved. This is the treatment of the Technical Annex, where some partners treat the TA as a guiding document, while others want to fulfill the TA word-by-word.

In total we have good measures for five (out of 15) bottlenecks, nine areas are partly covered and only one area is not resolved.

5.2 Risk Management

The risk management was already outlined in the Technical Annex. As it is still relevant to answer the questions of the risk assessment, it has been repeated here:

- 32A) Have research and technological risks been properly identified?
- 32B) Have economic and exploitation risks been properly identified?
- 32C) Have organizational risks been properly identified?
- 32D) Have methodological risks been properly identified?

- 32E) Have investment related risks been properly identified?

Potential risks can be classified into the following groups:

- Partner problems (e.g., a partner is underperforming or a key partner is leaving the project)
- Expertise risks (e.g., a key person with a specific expertise is leaving the project)
- Market and user-related risks (e.g. the market environment or the user is subject to change and makes the results obsolete)
- Project execution risks (e.g., key milestones or critical deliverables are delayed)
- Agreement risks (e.g., consortium partners cannot agree because of differing interests)
- Technological risks (e.g., key technologies or components are not available at the expected time)
- Dissemination risks (e.g., no major customers for using the results are found)
- Competition risks (e.g., a competing solution comes up and makes the results less valuable)

Several of these potential risks can be assessed concerning their probability and level of (negative) impact. Risks with a high probability and a severe impact are handled with particular caution during the project. The following measures are foreseen to cope with those risks:

- Potential risks will be identified and analyzed in detail.
- For the ones with medium to high probability and severe impact countermeasures and contingency plans are discussed, and they will be flagged throughout the execution of the project as “risk items”. This ensures that all levels of the project take special care of those items.

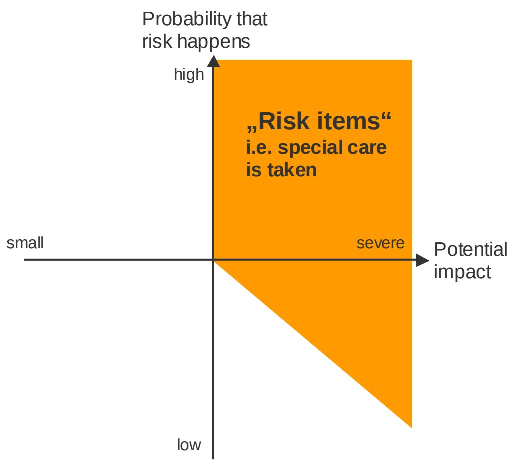

Figure 5-1 - Risks classification

- For the ones with low probability or low impact, and for the ones that cannot be foreseen at this stage, the technical management committee (TMC) will ensure that such risks are identified in an early phase, and that necessary countermeasures are taken.

The project management approach proposed for pSHIELD provides mechanisms to identify and resolve potential risks. The tight control both at the WP and project management level ensures that risks are identified. The project manager (PM) will ensure that risks management is an essential part of the regular project management phone conferences.

To our understanding, risk management is sufficiently taken care of.

5.3 Detailing the scope of pSHIELD

This section summarizes the details of the scope as identified in an earlier section. In table 5-2 a summary is provided of all the measures for pSHIELD, indicating the degree of achievements of the scope. It addresses the areas: suitable architecture, R&D approaches, establishing ecosystem, identify key players, and various forms of documentation/collaboration.

The table 5-2 is also filled with a preliminary analysis of the status at month M16, allowing for corrective measures until the end of the project. The measures taken from M16-M19 are reflected in the comments for each section.

Table 5-2: Measures on how pSHIELD has reached the scope

Aspect of scope	Achieved (-,o,+)	Comment
41A) Has the project delivered a suitable architecture in the early phase of the project?	o	The architecture was outlined only after the first review
41B) Have suitable APIs been defined to ensure interworking?	o	The selected semantic approach for interworking allows handling of heterogeneous components
42A) Have the performed R&D approaches received the result?	+	Technology developments are well under-way
42B) Are the results well in line with the state-of-the-art in research?	+	yes

42C) Does the prototypical development demonstrate the key features?	o, +	Some areas as the middleware clearly address the key features of pSHIELD, others still need to demonstrate SPD
43A) Is a map of the business ecosystem established?	o	Though the map has not been explicitly drawn, the key players have been identified.
43B) Does the map of the ecosystem contain the identification of playmakers?	+	Key players are partners in the project, and others outside of the project have been identified.
43C) Have initial contacts with playmakers and with a similar projects been established?	+, o	Initial contact with key players is established to the degree which can be expected for a pilot project. Contacts to other projects needs still to be improved
44A) Are key players identified?	+	Yes, ranging from both security domain, energy automation and communication
44B) Is (initial) contact established?	+	yes
44C) Is the scientific dissemination being taken towards both conferences and journals?	+	Yes, papers have been submitted to both conferences and journals
44D) Is the feedback from the scientific dissemination documented?	o	Feedback was given, and it has to be documented now
44E) Did internal dissemination take place, and did it include hand on experience?	+	Yes, internal dissemination is part of the physical meetings
44F) Does the project have a solid base of basic information through Web pages and public documents?	o	As a pilot project pSHIELD has initial documentation available. Work on public deliverables is ongoing
44G) Does the project supports collaborative approaches?	+	The project has established a well-functioning collaborative platform, and is using phone conferences to a good extent

The initial evaluation summarized in the table above shows that pSHIELD has received good results. Only two areas have not sufficiently outlined the achievements, while 5 areas are identified as areas for improvement. The scope has been sufficiently outlined in a majority of 10 areas.

In the remaining period of pSHIELD we will work with the results from this preliminary analysis.

6 Action plan for pSHIELD

The goal of this section is to establish an action plan and identify which actions have to be taken in order to have a successful quality management in the project. The previous sections have identified the bottlenecks, see section 2, have performed the risk analysis in section 3, and have established measures on how the scope of the project is outlined in section 4.

A summary of all the resulting recommendations is provided in section 5, to achieve the means for a measurable state of the project. A preliminary analysis of pSHIELD is provided, indicating that the overall progress is good, and that only a limited number of areas require further attention in the quality management.

A more detailed analysis is provided for each section, showing that a.o. three out of 9 risks became evident and have been handled.

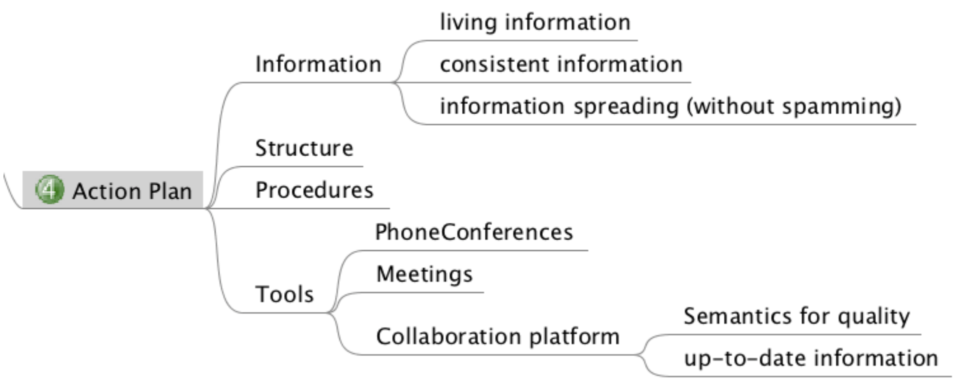

Figure 6-1: Areas for the action plan as result of the quality analysis

Figure 6-1 provides the details of the action plan, addressing the areas of information, structure, procedures, and tools.

When it comes to information, our major concern was how to achieve living information, which is consistent and which can be distributed to relevant experts without spamming them.

The conclusion on how to achieve living information was to establish the collaboration platform, based on a wiki implementation. However, as earlier pointed out, the main challenge in a Wiki is to keep a clear structure. The second challenge is to achieve consistent information. As the project addresses security privacy and dependability, our approach was to use semantics as a tool for dependable information. Dependable information means that the change in one topic should be reflected in all the other topics that are related to it. This requirement for consistent information led us to the semantic MediaWiki, where we ended up with defining specific extensions towards the need of a project.

The structure of the project is sufficiently described in the Technical Annex, addressing both the rules of the project management, the technical leadership and the duties of the workpackage and task leaders. We have further outlined the specific implementation for the pSHIELD in the "project internal Report" on the Wiki, available at http://pshield.unik.no/wiki/ProjectInternalGuidelines

Our main tools are the semantic MediaWiki for collaboration, and phone and physical meetings for communication. Though the structures are in place, we have identified the following challenges:

- Get the wiki being used as a tool for all project participants
- Bring discussions to the collaboration platform such that people not present in discussions can get notice about the topics
- Establish better semantic forms for the need of the project

All these areas were treated as subjects to further work. pSHIELD has provided this Quality Control Report D1.1.5 as an evidence of quality control in the project, and has critically evaluated the outcome of the quality control.

7 Conclusions

For quality control it is important to:

- Identify potential bottlenecks of a collaborative project
- Identify risks in the project and establish a contingency plan
- Clearly outline the scope of the project, including detailed sub-goals for workpackages, tasks and deliverables
- Establish an action plan.

This document has performed a detailed analysis of pSHIELD project quality management and has provided in a tabular form the measures for potential bottlenecks. It has further outlined the scope and has measured the outcome of this pilot project as compared to its scope.

The analysis of potential bottlenecks shows that we have a good measure for 5 out of the 15 bottlenecks, that we partly cover 9 areas and that only one area is not resolved.

Risk management is taken care of, risks are identified, and the contingency plan is established. Out of the 9 risks being identified as much as 30% of the risks became evident, and some of them caused a substantial delay of pSHIELD.

An initial evaluation at M16 and the final evaluation at M19 of the scope shows that we have received good results. Only 2 areas have not sufficiently outlined the achievements, five areas are identified as areas for improvement, and a majority of 10 areas is sufficiently outlined.

When it comes to the action plan, we have addressed and implemented the areas of information, structure, procedures, and tools as being the most relevant ones for pSHIELD. Our major concern was how to achieve living information, which was (partly) achieved through the use of a collaboration platform based on a Semantic MediaWiki.

References

[1] [Wikipedia] Quality Management, Wikipedia, http://en.wikipedia.org/wiki/Quality_management

Appendix A Project information

All information on the pSHIELD project is available in the collaboration platform, and this chapter provides some examples of "dependability", where consistency of the data can be checked.

The following screenshots show five examples of functionality of the pSHIELD Semantic MediaWiki, available at http://pshield.unik.no:

	Title	Due month	Lead partner	Editor	Dissemination level
D1.1.1	Collaborative tools and document repository	M09	Movation	Josef.Noll	Public
D7.1.1	The Project Website	M09	SESM	Przemek.Osocha	Public
M0.1	Formalized Conceptual Models of the Key pSHIELD Concepts	M09	SE	Fabrizio.deSeta	Restricted
M0.4	Request for Extension of the Project	M09	THYIA	Spase.Drakul	Restricted
M0.2	Proposal for the aggregation of SPD metrics during composition	M09	SE	Fabrizio.deSeta	Restricted
M0.5	The pSHIELD focus areas, the key innovations and project outputs	M09	Movation	Josef.Noll	Restricted
M0.3	Signed Endorsement	M09	THYIA	Spase.Drakul	Restricted
M0.6	Management Report	M09	THYIA	Spase.Drakul	Restricted
D1.1.2	Quality Control Guidelines	M10	Movation	Josef.Noll	Restricted
D2.1.1	System Requirements and Specifications	M10	ASTS	Francesco.Flammini	Public
D1.1.3	Management Report	M13	SESM	Francesca.Matarese	Restricted
D2.3.1	Preliminary system architecture design	M13	HAI	Nikolaos.Pappas	Restricted
D2.2.1	Preliminary SPD metrics specifications	M13	Tecnalia	Inaki.Eguia	Restricted
D4.1	SPD network technologies prototype	M13	SE	Marco.Cesena	Restricted
D2.1.2	System Requirements and Specifications - Next Realize	M15	ASTS	Francesco.Flammini	Public
D5.2	SPD middleware and overlay functionalities prototype	M15	UNIROMA1	Vincenzo.Suraci	Restricted

Figure 7-1: Functionality Example: sorting deliverables after due date

- WP1 also deals with internal structures in pSHIELD, further outlined in ProjectInternalGuidelines
- Here are the comments and notes from the MidTermReview, listed in MidTermReviewRecommendations
- CommunicationWithJU contains all communications with the JU

Partners in WP1

- T1.1 (Lead partner Movation Partner AS ASTS CS ETH HAI ISD MGEP SE SESM Tecnalia TRS UNIROMA1)
- T1.2 (Lead partner SESM Partner ASTS CS SE)

Figure 7-2: Functionality example: overview over documentation in a WP

Movation (MAS) leads

- D1.1.1 (Title Collaborative tools and document repository)
- D1.1.2 (Title Quality Control Guidelines)
- D1.1.5 (Title Quality Control Report)
- D7.2.1 (Title Exploitation Plan)
- M0.5 (Title The pSHIELD focus areas, the key innovations and project outputs)
- T1.1 (Title Project management)
- T7.2 (Title Exploitation)

Movation (MAS) is involved in the following activities

	Title
T3.1	Nano, Micro and Personal node
T6.1	Multi-Technology System Integration
T7.1	Dissemination
T7.2	Exploitation

Involvement of people and activities from Movation (MAS) in pSHIELD are

- Josef.Noll (Josef Noll *e:* josef.noll@movation.no p: +47 9083 8066 m: JosefNoll)
- Netta.Nyman (Netta Nyman *e:* netta.nyman@movation.no m: +47 90618353)
- Robert.Steine (Robert Steine *e:* robert.steine@movation.no m: +47 4030 0193)
- Truls.Berg (Truls Berg *e:* truls.berg@movation.no p: +47 9002 6806 m: +47 9002 6806)

Figure 7-3: Functionality example: Responsibilities and involvement of partners

Figure 7-4: Functionality Example: User information

User Przemek.Osocha is involved in the following activities:

- 20110328-A3 (for **Przemek.Osocha** AI: Prepare Management Reporting Template)
- AI03-201102 (for Fabrizio.deSeta **Przemek.Osocha** AI: Prepare internal meeting in Rome)
- AI20110525-04 (for **Przemek.Osocha** AI: Invite to PA in last week of May)
- Agenda-September2011 (for Josef.Noll **Przemek.Osocha**)
- Definition of nano, micro and personal nodes-AI001 (for **Przemek.Osocha** AI: Definition of nanc
- Generate Template for WP Review Presentation-AI001 (for **Przemek.Osocha** AI: Generate Tem
- PA 16. March 2011 (for **Przemek.Osocha**)
- PA PhC 20110624 (for **Przemek.Osocha**)
- PA Rome 20110712-13 (for **Przemek.Osocha** Andrea.Fiaschetti)
- PSHIELD PhC 20110902 (for **Przemek.Osocha** Josef.Noll)
- PSHIELD PhC 20110915 (for **Przemek.Osocha**)
- **Przemek.Osocha** (for **Przemek.Osocha**)
- Review-September2011 (for **Przemek.Osocha** Francesca.Matarese Josef.Noll)
- Technical 12. April 2011 (for Fabrizio.deSeta **Przemek.Osocha**)
- Technical 29. March 2011 (for Fabrizio.deSeta **Przemek.Osocha**)
- Technical 5. April 2011 (for Fabrizio.deSeta **Przemek.Osocha**)
- Technical 8. April 2011 (for Fabrizio.deSeta **Przemek.Osocha**)
- WP-all PhC 1. June 2011 (for **Przemek.Osocha**)
- WP3 PhC 20110418 (for **Przemek.Osocha**)
- WP3 PhC 20110524 (for **Przemek.Osocha**)
- WPall 20 Jan 2010 (for **Przemek.Osocha**)
- WPall 8 Feb 2011 (for **Przemek.Osocha**)

Figure 7-5: Functionality example: Involvement of each user