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Deliverable

D8.1

Requirements specification of the TELEIOS User Community

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Executive Summary

This document gives a description of the requirements gathering methodology applied in TELEIOS and the execution of the first TELEIOS User Community Workshop, which took place in Frascati, Italy on the 13th of October, 2010, with the kind support of ESA/ESRIN.

This deliverable complements deliverable D6.1 and D7.1 that present the requirements of the two TELEIOS use cases: "A Virtual Observatory for TerraSAR-X data" and "Real-time fire monitoring based on continuous acquisitions of EO images and geospatial data". This deliverable should be read before the deliverables D6.1 and D7.1 since it describes the requirements gathering methodology that was used in deliverables D6.1 and D7.1.

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1. Introduction

1.1. Purpose of this document

As described in [1], capturing the requirements for software systems is a problem of communication: "Those who want the new software (either to use or to sell) must communicate with those who build the new software". The purpose of this document is to describe the methodology applied in TELEIOS for structuring the communication process between potential users and stakeholders of the TELEIOS system and the developers. Further, the document contains a documentation of the execution and deliverables of the first TELEIOS User Community Workshop held in Frascati, 13th October, 2010.

1.2. Structure of this document

Chapter 2 gives the background on the requirements gathering methodology applied in TELEIOS.

Chapter 3 summarizes the activities related to the first user community workshop of TELEIOS, i.e., the methodology and an overview on the main deliverables of the workshop.

Chapter 4 gives details on the technical infrastructure used for requirements management.

Chapter 5 summarizes and concludes and gives an outlook on future steps.

2. Requirements Gathering Methodology – Background

The requirements gathering methodology applied in TELEIOS is based on several well-known and widely used methodologies such as AGILE methodologies [1], VOLERE templates [2] and the V-Model[1]. In short, at the beginning of the project and at the first TELEIOS User Community Workshop, we captured requirements at the level of user stories, known from AGILE software methodologies and described in several works such as [1]. The user stories as collected in advance of and at the first user community workshop were put into the Redmine[2] system and served as the basis for developing the two use case deliverables D6.1 [3] and D7.1 [4] on the TELEIOS Use Case requirements. For the structure of the requirement deliverables for both use cases ([3],[4]), we followed the V-Model, a systems development model which is widely used in developing software systems. Amongst other guidelines and documents, the V-Model provides a huge set of document templates, e.g., for requirements or architecture documents.

[1] http://www.v-modell.iabg.de/

[2] http://www.redmine.org/ (the TELEIOS installation is available at: http://www.earthobservatory.eu/manage/projects/teleios)

The following sections give a justification for using the mentioned methodologies, especially the AGILE ones, and give a short introduction.

2.1. User Roles and User Stories

The requirements gathering methodology in TELEIOS is partly based on what is known as AGILE methodologies for software development.[3] The common process for gathering requirements for software systems is to gather as many requirements as possible at the beginning of the project, assuming that the more requirements there are, the better the developed software will be. However, as described in [1]: "Extensive upfront requirements gathering and documentation can kill a project in many ways". This corresponds to the authors experience in software development projects. Capturing requirements in a few hundred pages documents without a clear prioritization of requirements, references to the tasks and use cases where the requirements are derived from, and explanations of ambiguous terms might result in a situation where it is almost impossible for the developers to start developing the software.

A second reason for choosing a requirements gathering methodology inspired by AGILE methodologies was the requirements gathering workshop planned within the first three months of the project. Due to the diversity of people attending the workshop (EO Experts, Domain Experts, Software Developers, End Users, etc.), we expected the discussions to be on a high level and so we focused on the overall system functionality rather than on individual components or detailed requirements on interfaces, performance related issues and technical details. Therefore, the AGILE methodologies, focusing on user tasks at the beginning and refining the high-level requirements in a communication process with the users and stakeholders afterwards seemed to fit quite well to the project. From our point of view, capturing all requirements at the beginning of a project is impossible. Requirements evolve during project runtime, especially when first prototypes are available and given to users.

Therefore, the methodology proposed by user stories seemed to be useful. The following subsections give an introduction.

2.1.1. User Roles

It is a common mistake in the process of capturing the functional requirements for a software system to lose sight of the type of user that issued a requirement. Often, the assumption is that there is a single type of user of a system and all requirement specifications (let them be IEEE-styled requirements a la "The SYSTEM should…" or user stories) are written for this single type of user, sometimes referred to as *"the user"*. However, in most cases, a software system has multiple types of users with different experiences, backgrounds and goals while using the software. Delivering requirement specifications without a clear reference to the type of user that issued the requirement leads to problems in grouping and especially prioritizing them. Therefore, it is of huge importance to clearly identify the types of users, called user roles in the sequel, and to unambiguously link them to the requirement specifications. In Section 3.3.2, we give a

[3] http://agilemanifesto.org/

description on how we came up with a set of user roles for the two use cases of TELEIOS during the first user community workshop.

2.1.2. User Stories

User stories are short natural language sentences of the intended functionality of a software system, written in the language of the user or stakeholder of the system. As described in [1], user stories are composed of three aspects:

- "a written description of the story used for planning and as a reminder"
- "conversations about the story that server to flesh out the details of the story"
- "tests that convey and document details and that can be used to determine when a story is complete."

As suggested in [1] and proven useful in several other works on requirements, a user story might follow the template:

As a <user>, I want <something> so that <benefit>.

Stories following that template usually contain some relevant information that might sometimes be missed, namely:

1. Which user role / actor issued the requirement (<user>) and
2. What is the rationale behind the requirement (<benefit>).

An example for a user story captured for TELEIOS is:

As an expert user (EO expert), I want to be able to visually overlay GIS data with EO data products in order to be able to visually inspect the quality of the EO product / extracted content.

Further, there can be different levels of details for user stories. Although, in general, user stories should be kept small in terms of the functionality to implement, there can be generic user stories that capture whole use cases in a single sentence. Such stories are often called *epics*. For example, a generic user story or epic derived from the TELEIOS use cases is *"As an end user, I want to search for EO images"*. Obviously, this is a rather generic user story capturing a whole use cases and therefore, a huge set of details is missing such as what are the search criteria (thematic, spatial or temporal or all of them), is it possible to store the queries, etc. Such details can be captured in additional low-level detailed user stories derived from the epic.

In literature on user stories and AGILE software development methodologies such as [1] or [5], it is suggested that good user stories should follow the INVEST model proposed by Wake [6]. The INVEST acronym stands for independent, negotiable, valuable, estimable, small and testable user stories. At the beginning of the first user community workshop, the model has shortly been presented to the participants.

2.2. From User Stories to Use Cases

As described in [1] and extensively discussed by the people who "invented" user stories (e.g., at several websites such as [7]), user stories differ from use cases. While user stories are short natural language sentences describing desired functionality of a system, use cases often follow a formal structure (template) and cover details such as preconditions, steps in a success scenario or processed data. However, the relationship between user stories and use cases is not simply a generic matter of detail but highly depends on the scope of a user story. In some cases, a single user story might be transferred to a whole use case specification. For example, the user story or epic *"As an employer, I want to post a job offering"* covers a whole use case. Instead, more detailed user stories such as *"As an employer, I want to put details on the job offering such as start date, payment and qualification"* do not cover a whole use case but only a single step in the main success scenario. The main differences between user stories and use cases can therefore be summarized as:

- User stories are shorter and do not follow a formal template
- User stories are written in the language of potential users of the system
- A single user story might be transferred to a single use case or to (steps in) a main success scenario of a use case.
- Use case specifications might already include details on the user interface, which should be avoided for user stories.

Therefore, the process of transferring user stories to use cases depends on the scope of the stories. A successful approach typically involves the following steps:

- Identify user stories that cover functional requirements on the system
- Group the user stories and identify related user stories and the nature of the relationship such as generalization, specialization.
- Identify user stories that can be transferred to whole use cases and those that correspond to parts of use cases.

In TELEIOS, the use cases and requirements will be captured in the deliverables [3] and [4] for the two TELEIOS Use Cases. The use case descriptions will be derived from the two generic use case specifications of TELEIOS directly and from the user stories collected at the user community workshop. The use case specifications will follow the formal template as given in Table 1 and the methodology for deriving use cases from user stories given in this section.

Identifier	The unique identfier for the use case in the form *TELEIOS UC1 <number>* for the TELEIOS Use Case 1 and *TELEIOS UC2 <number>* for the TELEIOS Use Case 2.
Version	*Specified in the form <Version>, <Date>.* *Example: 1.0, 23.02.2007* *Each minor change (changing descriptions within the use case) will be reflected by an increase by 0.1 of the version number.*
Description	*A short natural language description of the use case.*
Actors	*A reference to the actors as identified beforehand.*
Initial conditions	*A description of any relevant precondition that might be fulfilled before the use case can be executed.*
Final results	*A description of the final results of the use case.*
Main process	*The steps required for achieving the final result.*
Alternative processes	*Any alternatives that might occur in the main process.*
Exceptional situations	*Any exceptional situation that might occur durcing the main process.*
Processed data	*A description of the data types relevant / processes in this use case.*
Generated data	*A description of the data generated by executing this use case and, e.g., whether it is persisted or not.*
Activity diagram	*An activity diagram showing the main process diagrammatically.*
Related User Stories	*A reference to related user stories using the identifiers in the Redmine system.*

Table 1: Use Case Template

2.3. Requirement Categories

This section introduces the requirement categories for TELEIOS. The categories for non-functional requirements serve as a basis for categorizing and identifying the non-functional requirements for the two use cases. The non-functional requirement specifications follow the identifier scheme UC1.<requirement type abbreviation>.<number>. For example, a performance requirement for TELEIOS Use Case I might have the identifier UC1.PR.01.

2.3.1. Functional requirements

Functional requirements refer to requirements on what the system is expected to do. Functional requirements "present a complete description of how the system will

function from the users perspective. They should allow both business stakeholders and technical people to walk through the system and see every aspect of how it should work – before it is built." [8].

Different templates for expressing functional requirements exist, which range from more informal user stories to detailed use cases specifications and formal IEEE-styled requirements [9] like "The SYSTEM shall…".

Most of the requirements captured in the form of user stories during the user community workshop are functional requirements. Besides functional requirements, a set of requirement types exist that are usually subsumed by the term non-functional requirements.

2.3.2. Non-functional requirements

In addition to functional requirements, non-functional requirements exist that can be grouped into the following categories.

2.3.2.1. Performance requirements (PR)

Performance requirements typically relate to the response time of a system and the amount of data the system is expected to deal with. For TELEIOS, initial performance requirements are already indicated in the technical annex of the description of work.

2.3.2.2. Reliability Requirements (RR)

Reliability requirements usually relate to the availability and reliability of the system. Typical examples are: The system should be up at least 90% of the time.

2.3.2.3. System interface requirements (SIR)

Interface requirements refer to the software interfaces offered by the system. A typical system interface requirement is "The system should offer all mandatory operations of the OGC Web Feature Service standard version 1.1.0."

2.3.2.4. Security requirements (SR)

Security requirements refer to the any requirement related to access restriction to the system.

2.3.2.5. Standard requirements (STR)

Any requirement related to standards (OGC, ISO, etc.) can be grouped into this category.

2.3.2.6. Human-Machine interface requirements (HMR)

Human-Machine Interface requirements relate to requirements on the user interface offered by the system.

2.3.2.7. Documentation Requirements (DR)

Documentation requirements capture those requirements that are related to the software documentation such as "The user manual should be delivered in English and Greek".

2.4. Traceability of requirements

An important aspect is the traceability of the requirements. Different common characterizations of traceability exist, such as *"Requirements traceability refers to the ability to describe and follow the life of a requirement, in both forwards and backwards direction (i.e. from its origins, through its development and specification, to its subsequent deployment and use, and through all periods of on-going refinement and iteration in any of these phases.)"*[4] or *"Requirements traceability refers to the ability to define, capture and follow the traces left by requirements on other elements of the software development environment and the trace left by those elements on requirements."*[5]. Traceability in TELEIOS is ensured by the use of the Redmine system (see Chapter 4) and by providing clear references between all the different requirement related issues such as user roles, user stories, use cases or non functional requirements: Within the *Redmine* system, user roles are linked to the user stories. Further, user stories will be linked within the formal use case and non-functional requirements specifications.

During systems operation we will verify the coverage of requirements and document this in the deliverables related to the evaluation of the system ([12], [13], [14] and [15]).

3. Requirements Workshop

The first TELEIOS User Requirements Workshop took place at the premises of ESA in Frascati at the 13th of October, 2010. A set of around 30 participants, including 15 TELEIOS consortium members (from all partners) attended the workshop. The external participants had been proposed and invited (in a joined work with Fraunhofer and NKUA) by the TELEIOS partners NOA and DLR. The purpose of the workshop was twofold. First, it was agreed that the user workshop should be used for capturing an initial set of high-level requirements from relevant stakeholders and potential users of the TELEIOS system and infrastructure. Second, the TELEIOS ideas as described in the technical annex of the description of work should be presented and discussed with the participants.

3.1. Pre-Workshop Activities

In preparation of the workshop, several activities had to be carried out, which are summarized in the following. In advance of the workshop and the TELEIOS Kick-Off meeting, the TELEIOS consortium members (mainly DLR and NOA) proposed a set of approximately fifty potential workshop participants (people and institutions). At the end of July 2010, an invitation letter was sent out and for those who replied, a workshop

[4] http://en.wikipedia.org/wiki/Requirements_traceability#cite_note-5

[5] http://en.wikipedia.org/wiki/Requirements_traceability#cite_note-5

website was set up for further information and registration. In the TELEIOS budget, the coordinating node NKUA had already made provision for an amount of money that could be used to pay part of the expenses of invited participants (details will be provided in the appropriate financial reports of TELEIOS).

In order to have an initial set of user stories in advance of the workshop, two interviews were performed by the TELEIOS partner Fraunhofer, one for each of the TELEIOS use cases. The interviews can be found in Appendix 10.1. For the interviews, the following set of questions has been prepared, grouped into two categories:

How do you work with EO data?

- How do you work with / use EO data, which use cases do you have?
- How do you access EO data at the moment (do you use existing internet portals such as EOWEB etc?). Where do the EO images come from?
- How do you query EO data at the moment?
- How do you access the image content. Are the EO images pre-classified, when you access them, are they raw? Which tools (if ever) do you use for extracting semantic content out of the images?
- Which terminology do you use for image classification?
- Do you have experience with image information mining, i.e. the task of extracting features / semantic labels out of EO images?
- Do you deal with GIS (e.g. vector data) as well or only EO images (if yes, do you integrate the datasets, how?)
- What kind of ideal queries would you like to pose for discovering EO images in an EO image archive?
- What amounts of data do you deal with?
- In which parts of your work with EO data (querying, extracting image content etc...) would you like to have more automation?

What do you think of the TELEIOS ideas?

- From reading the TELEIOS overview, what generic expectations do you have towards the project?
- Do you have experience with declarative data query languages (e.g. SQl, but also semantic-web technologies such as SPARQL)? Would it improve your daily work if you could query an EO image archive using declarative queries on the content of the image (except just keywords?)
- Do you have experiences in your daily work with ontologies? Do you use ontologies?

- Do you expect the TELEIOS system to let you use your own terminology / ontologies for annotating EO images?

- Do you use ontologies already available on the web in your daily work?

- What kind of metadata would you like to query when you query an EO image archive? (e.g., Thematic, Spatial, Temporal)

The questions gave us an initial idea on how potential stakeholders and users of the TELEIOS software work with EO data and how they perceive the ideas proposed by TELEIOS.

3.2. Participants

Around 30 participants attended the first user community workshop of which 15 were TELEIOS Consortium Members. Including the TELEIOS partners, the distribution of participants was well-balanced between the roles *end user* of EO data, *service / data provider*, *EO expert / researcher* and *system developer / engineer*. However, a clear classification of users into these categories was not possible. A description of the non-TELEIOS participants can be found in the Appendix in 10.2.

3.3. Workshop Agenda

In advance of the workshop, we came up with a rough agenda as shown in Table 2.

9:00-10:00	**TELEIOS Introduction by TELEIOS Coordinator Manolis Koubarakis** In the first hour of the workshop, Thorsten Reitz from the TELEIOS partner Fraunhofer presented the methodology and agenda of the workshop. Then, the TELEIOS Coordinator Manolis Koubarakis gave a presentation on the TELEIOS partners and the TELEIOS ideas as described in the technical annex. Each TELEIOS partner shortly introduced himself.
10:00-12:00	**Introductory Round & initial discussions** In this session, the external workshop participants had the opportunity to give a statement on their generic expectations towards the project. For a summary of the session, see Section 3.3.1 and Appendix 10.2.
13:30 – 16:30	**Requirements Gathering Sessions** This session consisted of two parallel sessions (one for each TELEIOS Use Case) and was devoted to the actual requirements gathering. Details can be found in Section 3.3.2.
16:30-17:30	**Wrap-up of results and outlook**

	In this plenum session, we summarized the work achieved in the previous two parallel sessions. Further, we thanked the participants and gave an outlook on how we planned to proceed with the outputs of the workshop.

Table 2: Workshop Agenda

3.3.1. Introductory Round & Initial Discussions

During the introductory round, we wanted to give the participants the opportunity to describe their daily work with EO data and to give us some feedback on their generic expectations towards the project. For structuring the discussions, we prepared the following set of questions to be answered by the participants.

Please describe your daily work with EO data. Which user role describes your work with EO data best (scientific user, end user, software developer for EO software…)?

From the things that you heard before about TELEIOS:

- What are your generic expectations towards the project?
- How do you expect to benefit in your daily work from the TELEIOS software?
- What would you consider the most exciting development?
- Is there any important related problem that the TELEIOS project is not addressing?
- Which tools are you using for your work with EO data?
- Which use case group would you like to join this afternoon?

3.3.2. The Requirement Gathering Sessions

The afternoon sessions were meant to capture the requirements for the two TELEIOS use cases. Experience from organizing similar workshops e.g. in the HUMBOLDT project[6] has shown that, for requirements workshops, the smaller the groups, the better. In smaller groups, the possibility of involving each single participant in the discussions is much higher and the work on requirements can be more focused. In advance of the workshop the TELEIOS consortium members discussed about possible group sizes and, when the people attending the workshop were known, useful criteria for splitting them into groups. It was agreed that, due to the two TELEIOS use cases and the number of external participants, the best way to split the participants into groups would be to have one group per TELEIOS use case and to let the people decide which group they attend.

[6] http://www.esdi-humboldt.eu/home.html

Based on experience in previous projects and examples for requirements gathering sessions documented in the literature such as [1], it was agreed by the TELEIOS consortium members in advance of the workshop that the nature of the requirement sessions should be that of a brainstorming session. Similar to the workshop methodology described in [10], we did not apply any filtering or prioritization mechanism on requirements already at the workshop. Instead, we asked the participants to brainstorm on requirements in the form of user stories, which have been captured either in notes taken by previously selected TELEIOS partners or directly on cards. After the workshop, we transferred all of the requirements to the Redmine system (see Chapter 4) for further evaluation by the TELEIOS Use Case owners.

Choosing a suitable methodology for capturing the high-level requirements from stakeholders in the requirement gathering sessions was essential for the success of the workshop. Coming up with such a methodology mainly boiled down to answering the question: *How much formality / guidance is required to structure the discussions at the workshop*? Complete open discussions would have potentially let to a huge set of unstructured requirement specifications captured implicitly or explicitly in notes taken by the TELEIOS consortium members / note takers. On the other hand, a methodology based on more formal specifications such as use case templates or IEEE-requirement sentences to be developed by the attendees would not have reflected well the more generic discussion required at the beginning of a project. Therefore, user stories seemed to be a good trade-off between formality (formalizing the outcome already at the workshop) and openness of discussions. As described in Chapter 2, user stories (e.g., following the template as described in [1]) capture useful information in a semi-formal way. They are well suited for the level of detail for requirements we wanted to capture in the workshop since they help answering a set of questions, namely *"Who has this requirement / which type of user / user role?"*, "*What is the system expected to do (the requirement)?"* and *"What is the goal of the user / why does he need this functionality?"*.

Therefore, in advance of the workshop, we came up with the following agenda for the requirement sessions in the afternoon.

~ 10 Minutes	**User Role Brainstorming:** During this session, we let the participants individually brainstorm on potential users and user roles of the TELEIOS system based on what they have heard in the morning about the project and the two use cases. The participants were asked to not only describe their individual role in relation to the TELEIOS system but to brainstorm on and put down every role they can imagine.

~ 10 Minutes	**Collecting, Grouping and Consolidating User Roles:** In the group, the user roles gathered in the previous session have been collected, grouped and consolidated. The output of this session has been a set of consolidated user roles descriptions.
~ 45 Minutes	**Brainstorming on epics / goals / high-level user stories for the roles** For each of the user roles identified in the previous session, we let the participants individually brainstorm on / collect high level user stories / epics. To stimulate the discussions, we presented an initial set of user story examples derived from the interviews that took place in advance of the workshop. Further, we presented the requirements for good user stories such as the INVEST model as described in Section 2.1.2.
~ 10 Minutes	**Selection of most important epics / user stories** Based on the set of epics, we consolidated and grouped the user stories and identified the most important ones.
~ 45 Minutes	**Refinement of epics, derivation of low-level user stories** Based on the prioritized user stories, we let the users derive more specific, low level user stories
~ 30 Minutes	**Development of acceptance criteria / testing procedures**

Table 3: The Requirements Gathering Session Agenda

The agenda served as a basis for structuring the communications in the requirement gathering sessions in the afternoon.

3.4. Requirement Gathering Sessions - Deliverables

This chapter summarizes the set of requirements initially captured for the two use cases. Only examples are given in this chapter. The full set of requirements can be found in the deliverables for the two use cases ([3], [4]).

3.4.1. Use Case I Session

TELEIOS Use Case I "A Virtual Observatory for TerraSAR-X data" is concerned with the development of a virtual observatory for earth observation data. The term "virtual observatory" is derived from astronomy and describes a universal access point to archives of astronomical (in the TELEIOS case EO-) data. The TELEIOS system will be demonstrated by implementing a number of rapid mapping applications on top of the TELEIOS infrastructure. The use case leader is TELEIOS partner DLR.

In total, a set of around 10 non-TELEIOS and 8 TELEIOS participants attended this session. The session was moderated by Fraunhofer.

3.4.1.1. User Roles

A set of around twenty user roles related to use case I has been identified and grouped into the following categories.

System / Software Engineer / Processor Developer

Users of this type are technical people concerned with the development of applications in earth observation. They include system / software engineers who develop EO software and applications as well as processor developers who need EO data and computing facilities for their work but cannot afford their own facilities. Users of this type typically support Service Providers in providing services / data / products derived from EO data to end or scientific users. In TELEIOS, ACS is an example if this user category.

Service Provider

Service providers are people or institutions who process EO data to derive and provide information to end users. Examples include Information Agencies that sell (geolocated) information derived from EO images.

In TELEIOS, NOA is an example of this user category. Further, in TELEIOS Use Case I, the Center for Satellite Based Crisis Information (ZKI)[7] is an example.

End Users

End users are people or institutions that regularly work with EO products in their daily job. Typically, they do not work with EO data directly but with higher-level products / information derived from the data. Examples include firefighters that require the

[7] http://www.zki.dlr.de/

information on fires obtained from EO data. What differentiates them from *Domain Experts* is their level of expertise of working with EO data, which is rather low compared to the latter.

Casual Users

Typically, this type of user does not regularly work with EO data (e.g. images) but periodically. Examples are end users that require information for private purposes such as for planning a hiking trip through an area that might be have been affected by forest fires.

In TELEIOS, users of this type might e.g. infrequently check out satellite images at the DLR EOWEB portal [8]. They can be expected to have good knowledge on portals and end user applications for EO data such as google maps or google earth.

Domain Experts

Domain experts are users who are experienced in working with EO data in their daily work. They are mainly researchers, either in science directly related to EO topics or related to some specific domain that requires EO data for research such as archeology.

Domain Experts from EO fields (EO experts) / Scientific Researchers on EO topics

Users of this type are usually highly experienced in working with EO data. They include scientific researchers working on algorithms for processing EO data or, e.g., researchers working on rapid mapping applications. What distinguish this type of user from Domain Experts from non-EO fields is their level of expertise on EO data and the purpose of their research which is more oriented towards EO data than towards individual thematic domains. Due to their experience in EO data and products, such users typically have strict requirements on the quality of products, lineage information and/or transparency of the software they use for processing the data.

In TELEIOS Use Case I, examples of this type of users are SAR (synthetic aperture radar) experts or electrical engineers performing calibration and validation work as well as the DLR researchers working on the TELEIOS topics.

Domain Experts from non-EO fields / Scientific Researchers in non-EO fields

Users of this type typically employ EO images in their (research) work. Their research is less oriented towards EO research but towards specific, domain dependent topics such as geology, hydrology, or urban planning. Similar to experts from EO fields, they might have strong requirements on the quality of the products / data they use as a basis for their research.

[8] http://eoweb.dlr.de:8080/servlets/template/welcome/entryPage.vm

3.4.1.2. Use Case I User Stories

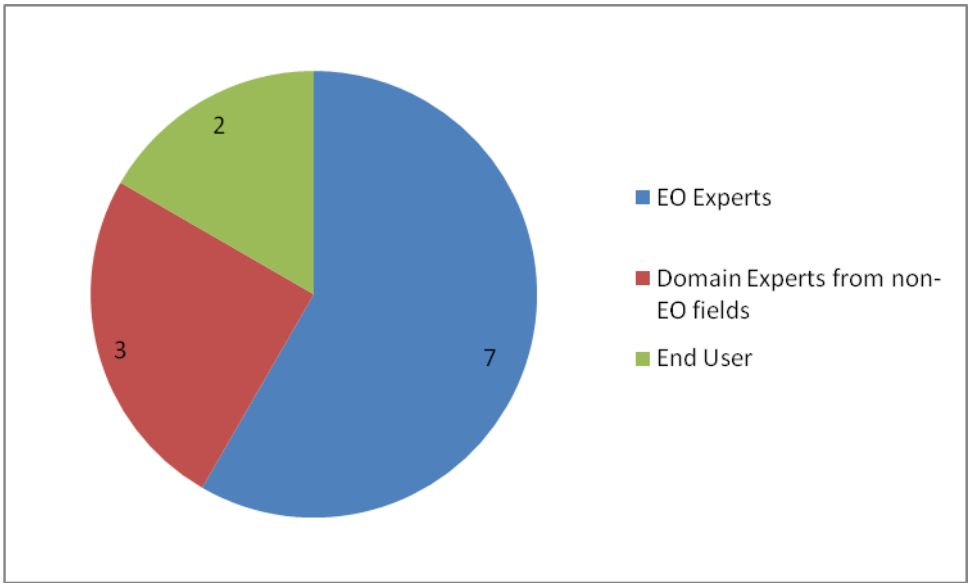

Figure 1: User Stories for Use Case I User Roles

Examples:

To give an impression of the collected user stories, a few user story examples are given below.

As an EO expert (and domain expert from non-EO fields), I want to have full transparency of all features of a software I use for Image Information Mining in order to be able to assess the suitability of the generated EO product for my needs

As an end user of EO data products, I want to query the products based on their semantic content and on the geographical extent using a single query in order to increase precision and recall in the EO image discovery process and to reduce manual effort

As an expert user (EO expert), I want to be able to visually overlay GIS data with EO data products in order to be able to visually inspect the quality of the EO product / extracted content.

As a scientific user / EO expert, i want to be able to query an EO image archive based on the product type (Spot image, panchromatic etc.)

As can be seen from the above user story example, most of the stories have a level of detail that corresponds to what has been called *epics* above. The set of 17 user stories collected during the workshop is accessible to TELEIOS consortium members via the Redmine system (see Chapter 4)[9]. Further, the user stories and use cases derived from the user stories are included and discussed in detail in the deliverable *D6.1 Requirements specification for the VO for TerraSAR-X data and applications.*

[9] http://www.earthobservatory.eu/manage/projects/uc1-us

3.4.2. Use Case II Session

The TELEIOS Use Case II "Real-time fire monitoring based on continuous acquisitions of EO images and geospatial data" aims at demonstrating the TELEIOS infrastructure for real time hot spot- and fire detection and burnt areas assessment. The Use Case is lead by TELEIOS partner NOA.

In total, 11 participants attended the requirements gathering session for use case II, 6 of them being TELEIOS consortium members. The session was moderated by Fraunhofer.

3.4.2.1. User Roles

The initial brainstorming on user roles resulted in a total set of around twenty user roles and descriptions, collected on cards. After the grouping and consolidation phase, five different user roles have been identified as most important for use case 2 and covering most of the original user roles.[10]

Service / Data Provider (SERVICE_PROVIDER)

Service Provider in TELEIOS Use Case II typically process low-level EO data such as raw or level 0 data to produce higher-level EO products to be consumed by 2nd Level Service Provides or End Users.

In TELEIOS Use Case II, NOA assumes this role by providing pre-processed, e.g. calibrated MSG/SEVIRI data.

2nd Level Service Provider (INTERMEDIATE_SERVICE_PROVIDER)

Intermediate End User (2nd Level Service Providers) typically receive a first or second level product (e.g., raw or calibrated images) and apply some processing to generate higher-level, value-added EO products, required and consumed by end users. Examples are governmental authorities.

In TELEIOS Use Case, NOA assumes this role by producing vector maps of forest fires (shp, kml formats) from pre-processed EO images such as calibrated MSG/SEVIRI data.

End User (END_USER)

This class of users represents the real or true end users in the sense that users of this type require easy to be understood, higher-level products generated from EO data.

In TELEOS Use Case II, examples for end users are fire fighters that use maps of forest fires in their daily work, e.g. provided via a web portal or via an attachment in an e-mail notification as shape- or kml-files (see [4]).

[10] The user roles written in brackets refer to the roles used in the use case specifications of deliverable 7.1 [4].

EO Scientist / Scientific User (EO_SCIENTIST)

Users of this category typically process EO data for scientific reasons such as for testing and running algorithms, etc.

In TELEIOS Use Case II, NOA can be considered as a Scientific User, aiming at enhancing their existing capabilities for detecting hot spots.

Software Component

Software components are understood as client systems accessing the TELEIOS system and infrastructure via software interfaces or APIs.

In TELEIOS Use Case II, any software client of the notification system (see [4]) might be categorized into this user role.

Administrator

Users who have full access to the system and may change configuration data can be categorized into this user role.

In the framework of the project, the TELEIOS partner NOA assumes this role.

3.4.2.2. Use Case II User Stories

A total of 38 User Stories has been collected in the Use Case II session, each story formulated from the perspective of a single or several user roles. Figure 2 gives an indication of how many user stories have been collected for the different user roles.

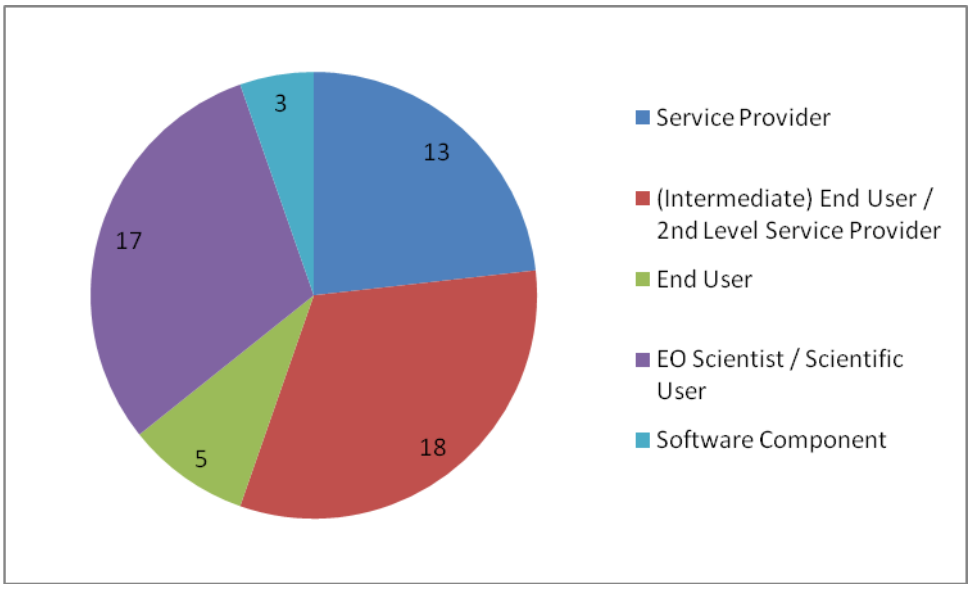

Figure 2: User Stories for Use Case II User Roles

As can be seen in the Figure, a majority of stories has been collected for the roles *Service Provider*, *(Intermediate) End User / 2nd Level Service Provider* and *EO Scientist*. This is partly due to the experience, background and personal role of the

sessions participants and partly due to the nature of the TELEIOS Use Case II. The role *Software Component*, did not play a big part in the discussions since software requirements have not been in the focus of the initial requirements gathering. The discussions during the session took place at a much higher, conceptual level. Further, the role *End User*, representing users that work with the products and data generated by the TELEIOS system (in this Use Case, data on forest fires) such as firefighters, has not been the focus as well.

The set of 38 user stories have been prioritized and categorized by TELEIOS partner NOA after the workshop, resulting in a slightly lower number of user stories documented in [4].

Examples

As an expert (EO Scientist / Scientific User, Service Provider) user, I want the system to maintain a set of threshold values for fire detection that are parameterized by location, type of product (FFM-1 or BSM) and the underlying land cover so that the accuracy of fire detection can be improved.

As an expert user (EO Scientist / Scientific User, Service Provider), I want to be able to input the information on "validated hotspots" into the system that influences the fire detection algorithms / updates the thresholds.

As an expert user (EO Scientist / Scientific User, Service Provider), I want to be able to trigger a computation that updates the threshold values based on the information on "validated hotspots" I have input before.

As an expert user (2nd Level Service Provider) i want to have the possibility to modify any parameter of any algorithm used by TELEIOS.

The set of user stories collected during the workshop is accessible to TELEIOS consortium members via the Redmine system (see Chapter 4)[11]. Further, the requirements and use cases derived from the user stories are discussed in detail in the deliverable *D7.1 Requirements specification for the real-time fire monitoring application.*

3.4.3. Requirement Categorization

In Figure 3, the user stories / requirements are categorized. The categories used are not generic requirement categories as, e.g., described in Section 2.3 but are specifically derived from the collected user stories and the TELEIOS ideas.

[11] http://www.earthobservatory.eu/manage/projects/uc2-us

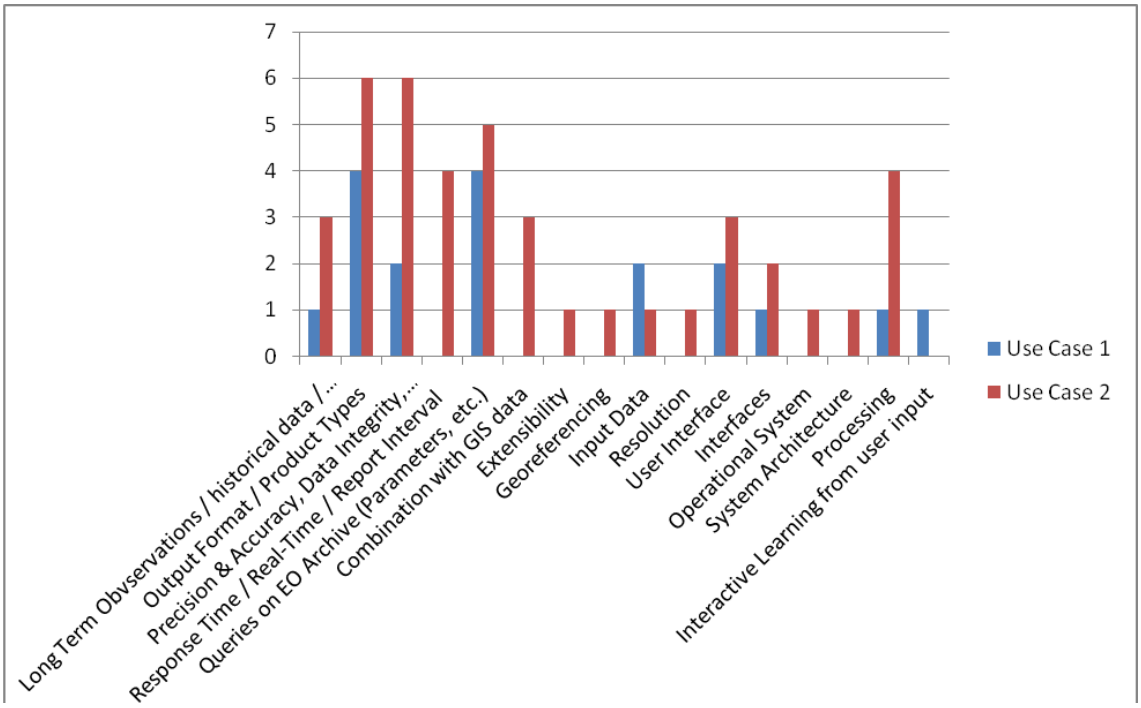

Figure 3: User Story Categorizations Diagram

Table 4 gives a mapping of user stories to categories.

Type	**Definition / Description**	**Use Case I User Stories**	**Use Case II User Stories**
Long term observations / historical data	This category contains any user story related to the use of time series of EO images, historical data etc.	#64	#83, #43, #41
Output Format, Product Types	This category contains user stories related to the output formats / product types generated by the system.	#79, #67, #66, #57	#81, #47, #31, #24, #22, #21
Precision, Accuracy, Data Integrity	The term data integrity has different meanings depending on the context. In terms of databases, data integrity might refer to “the process of ensuring that	#60, #59	#49, #42, #40, #39, #29, #25

	a database remains an accurate reflection on the universe of discourse it is modeling or representing"[12]. Sometimes the term is used for data that has is accompanied by complete metadata such as lineage information etc. Further, this category contains requirements on accuracy and precision of the data processed and generated by the TELEIOS system.		
Response Time, Report Interval, Real Time	Requirements on: - Response time - Real time (strict time constraints on the response time of TELEIOS - Report Intervals		#47, #28, #26, #22
Queries on EO Archive (Parameters etc.)	Requirements on the query functionality of TELEIOS.	#84, #77, #56, #55	#43, #32, #30, #14, #8
Combination with GIS data	Requirements on the capability of the system to integrate GIS and EO data.		#42, #34, #15
Georeferencing	Requirements on georeferencing functionality.		#36
Input Data	Requirements on the input data, the system	#76, #66	#35

[12] http://en.wikipedia.org/wiki/Data_integrity

	should be capable of working with.		
Resolution	Requirements on the resolution of		#33
User Interface / Human Machine Interfaces	Requirements on user interfaces of the TELEIOS system.	#63, #58	#33, #9, #80
Interfaces	Requirements on software interfaces of the TELEIOS system.	#78	#23, #9
Operational System	Requirements on the operation system, the TELEIOS software should work with.		#20
System Architecture	Requirements on the system architecture such as modularity.		#19, #37
Processing / Algorithms	Requirements on algorithms used by the system.	#61	#17, #16, #13, #10
Interactive Learning from User Input	Requirements on the interactivity of the system w.r.t. to user input.	#75	

Table 4: User Story Categorizations

3.5. Experiences Gained and Post-Workshop Activities

The methodology based on user stories has shown useful for capturing requirements on the level required at the beginning of a project such as TELEIOS. The simple sentence structure *"As a <user>, I want <something> so that <benefit>",* provided just enough formality for capturing the high-level requirements in the brainstorming sessions successfully. Further, the technique of letting participants write user roles and user stories on cards was useful since we had a lot of material to work with after the workshop. Since we captured the names of the participants that initiated a requirement / user story, we were able to clarify most questions related to content or terminology after the workshop by directly contacting them. Further, after the workshop, we inserted the user stories into the Redmine system. The user roles and user stories from Redmine have been prioritized and categorized by the TELEIOS use cases leaders NOA and DLR

after the workshop and served as a basis for developing the two use case requirements deliverables.

The workshop agenda developed in advance has proven to be realistic in the sense that we did not have any major delays. However, the agenda of the afternoon sessions has proven to be too tight in the sense that we did not achieve in working on every topic proposed in the agenda. The progress within the two use case groups has been different. While the Use Case II group spent most of the time in developing user stories for the use roles identified, resulting in a set of 38 user stories (mostly epics), the Use Case I session spent most of the time on the user roles (resulting in a set of around 20 roles) and only little on user stories. Both groups did not have time left to work on acceptance criteria for the user stories. Therefore and since we consider acceptance criteria as an essential part of requirement specifications, in future workshops, we would either extend the time for the workshop or establish more rigorous time constraints on the individual topics.

4. Technical Infrastructure for Requirements Management

4.1. Redmine

Due to positive experience of the TELEIOS partner Fraunhofer, e.g., from the HUMBOLDT project, we choose Redmine[13] as a system for managing the user stories and requirements. Redmine is an open source *issue tracking system* that comes with all required features for creating, managing, maintaining and categorizing issues such as software requirements and for assigning them to people, prioritizing them and setting deadlines for their implementation. The TELEIOS partner NKUA provided an installation of the Redmine system at their premises shortly after the workshop. Redmine accounts have been created for all project partners of TELEIOS

4.1.1. Definition of User Roles and User Stories in Redmine

We customized the fields in Redmine and added issue categories (in Redmine called *Trackers*) named *"User Roles"* and *"User Stories"*. Further, we inserted all user roles and user stories as derived from the description of work, the documents delivered by the use cases, the interviews and the first user community workshop.

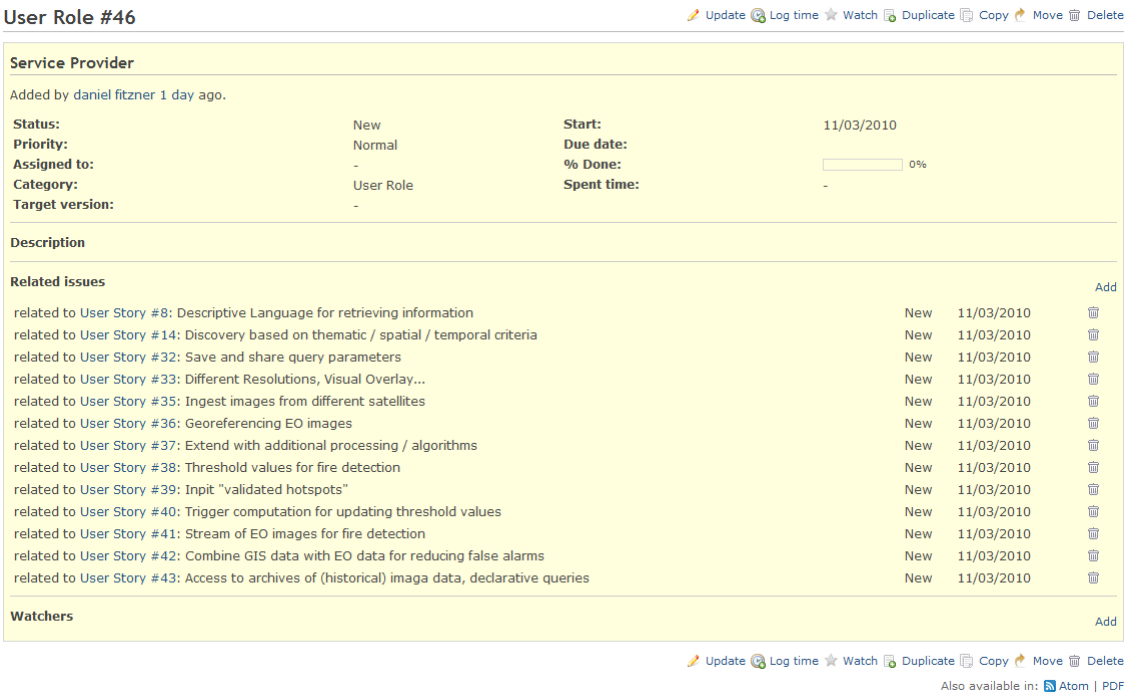

Figure 4: Redmine Screenshot

13 http://www.redmine.org/

4.1.2. Tracebility in Redmine and further use

As described above, Redmine allows specifying relationships between issues that allow an easy navigation, e.g., from user roles to related user stories or vice versa. Further, issues in Redmine get unique identifiers that are maintained throughout their whole lifecycle in Redmine and that can therefore be easily referenced. Further, in the development phase of TELEIOS, we plan to use Redmine as a requirements monitoring and management system. This means, all requirements as being developed in the initial phase of the project and later on will be transferred into the Redmine system and will reference, where possible, the user roles and user stories currently maintained in the system. Further, for all TELEIOS developers, accounts will be created, allowing the assignment of requirements / issues to developers and the tracking of the implementation progress, e.g., via Gantt-charts available in Redmine.

5. Summary

The deliverable gave an introduction to the requirements gathering methodology applied in TELEIOS. Further, the activities at the first TELEIOS User Community Workshop were summarized and an overview of the workshop deliverables has been given. Future steps consist in:

- contacting people who raised a requirement for clarifications and refinement. This has already been performed for some of the user stories but is an ongoing activity.

- deriving and developing more specific requirements from the high-level user stories. This has already been done and the output can be found in the use case deliverables D6.1 [3] and D7.1 [4]. However, this is an ongoing activity.

- deriving the TELEIOS software architecture (D1.2.1 "The TELEIOS software architecture – Phase I and preliminary TELEIOS infrastructure" [11]) from the requirement documents.

- weighting and estimating requirements and planning of the development phase. This is a process that already started at the level of user stories but is an ongoing activity as well and consists in integrating all of the requirements currently contained in D6.1 [3] and D7.1 [4] into Redmine, assigning priorities to them as well as people responsible for the implementation.

- Evaluating the TELEIOS software and infrastructure based on the user stories and requirements initially captured and on the user feedback. The outcome will be part of D8.2.1 "An evaluation of the TELEIOS infrastructure (Version 1) by the TELEIOS community" [12], D8.2.2 "An evaluation of the TELEIOS infrastructure (Final version) by the TELEIOS User Community" [13], D6.5 "An evaluation of the VO for TerraSAR-X data and applications" [14] and D7.4 "An evaluation of the real-time fire monitoring application and the TELEIOS infrastructure" [15].

6. List of Abbreviations

EO	Earth Observation
API	Application Programming Interface
PR	Performance requirements
RR	Reliability Requirements
SIR	Security requirements
STR	Standard requirements
HMR	Human-Machine interface requirements
DR	Documentation Requirements
UC	Use Case

7. List of Figures

8. List of Tables

9. References

[1] M. Cohn, *User Stories Applied: For Agile Software Development*. Addison-Wesley Longman, Amsterdam, 2004.

[2] S. Robertson und J. C. Robertson, *Mastering the Requirements Process*, 2nd Edition. Addison-Wesley Professional, 2006.

[3] D6.1 Requirements specification for the VO for TerraSAR-X data and applications. .

[4] D7.1 Requirements specification for the real-time fire monitoring application.

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[11] D1.2.1 "The TELEIOS software architecture – Phase I and preliminary TELEIOS infrastructure"

[12] D8.2.1 "An evaluation of the TELEIOS infrastructure (Version 1) by the TELEIOS community"

[13] D8.2.1 "An evaluation of the TELEIOS infrastructure (Final version) by the TELEIOS community"

[14] D6.5 "An evaluation of the VO for TerraSAR-X data and applications"

[15] D7.4 "An evaluation of the real-time fire monitoring application and the TELEIOS infrastructure"

10. Appendix

10.1. Interviews

Both interviews have been performed via phone, in advance of the first user community workshop.

10.1.1. Interview 1

Participant: Inés María Gómez Muñoz (INDRA)

Date: October, 6th, 2010 via phone

How do you work with EO data?	Work in different Use Cases such as security, defense, environment, urban planning The concrete work depends on the concrete project e.g. • SAFER / GMES projects • Mapping of natural risks / risk areas • Example: MDCP project. A defense project dealing with the cartography of Marocco • She has been involved in such projects as a software developer Common task: extraction of objects of different types in the images. This is usually done manual, employing GIS systems such as ERDAS / ArcGIS ➔ SAFER: they have WPs dealing with IIM → they develop new methodologies for searching on the content of images
How do you access EO data at the moment (do you use existing internet portals such as EOWEB etc?). Where do the EO images come from?	Employed tools: • EOWEB / ASI (Internet Portal, accessible at http://eoweb.dlr.de:8080/servlets/template/welcome/entryPage.vm)

	• ESA, DENA • SA • USGS (accessible at: http://www.usgs.gov/) • Spot (http://www.spotimage.com/?countryCode=DE&languageCode=fr) • Infoterra (http://www.infoterra-global.com/)
How do you query EO data at the moment?	Most important is the spatial query. Further, querying on the type of product (e.g. SPOT, panchromatic), temporal characteristic (e.g. Date).
How do you access the image content. Are the EO images pre-classified, when you access them, are they raw? Which tools (if ever) do you use for extracting semantic content out of the images?	Typically level 1 data.
Which terminology do you use for image classification?	The extracted content is captured e.g. using shapefiles. Sometimes, own terminology is used, sometimes e.g. CORINE or MDCP (national military terms). No experience with ontologies.
Do you deal with GIS (e.g. vector data) as well or only EO images (if yes, do you integrate the datasets, how?)	Typically visual overlay of EO data with vector data, e.g. DEM data with hydrological data for quality control. She has been involved in the development of viewers for EO & GIS data.
What kind of ideal queries would you like to pose for discovering EO images in an EO image archive?	A typical task is to derive a higher-level target product from some original / source product. The information on the source product and the algorithms employed for deriving the target product shall be kept, allowing to answer queries like: “Give me all products generated from product X” or “Give me all products, product X has been generated from”. These are standard catalogue queries

	but there is no existing catalogue that allows such kinds of queries.
What amounts of data do you deal with?	In the MDCP project: Terrabytes of data (1 harddisk a week). Example: north of Africa: 1 degree x 1 degree cells, 100 images per cell The amount usually depends on the project, sometimes only gigabytes.
In which parts of your work with EO data (querying, extracting image content etc...) would you like to have more automation?	Quality Control, e.g. percentage of clouds in an image. Classification, e.g. thematic maps for CORINE. Change detection.
From reading the TELEIOS overview, what generic expectations do you have towards the project?	Most important: Management of huge amounts of data • Performance vs. quality is always the issue • Managing vector data is easier than raster data • Having good response times for high resolution images is difficult. E.g. if you built a viewer, you need quick responses Query a catalogue by image content. At the moment, companies do not allow this SAFER: Look for features in the images. Combination of query on content with query on coordinates / geographic extent
Do you have experience with declarative data query languages (e.g. SQl, but also semantic-web technologies such as SPARQL)? Would it improve your daily work if you could query an EO image archive using declarative queries on the content of the image (except just keywords?)	See above.
Do you have experiences in your daily work	No. See above.

with ontologies? Do you use ontologies?	
Do you expect the TELEIOS system to let you use your own terminology / ontologies for annotating EO images?	Depends on the project. See above.
Do you use ontologies already available on the web in your daily work?	No. See above.
What kind of metadata would you like to query when you query an EO image archive? (Thematic, Spatial, Temporal)	See above.

10.1.2. Interview 2

Participant: Kathrin Molch (DLR)

Date: October, 4th, 2010 via phone

How do you work with EO data?	3. Scientific Work in urban mapping and geological monitoring from satellite data. Development of methodologies for extracting semantic information from satellite images. Focus is more on pattern recognition, less on terminology. 4. Emergency Mapping for the European Commission (JRC). Example: (Automatically) detect every /damaged) building on a scene. Important Factors: Precision, response time (fast / quick detection) and transparency (which algorithms etc. have been applied).
How do you access EO data at the moment (do you use existing internet portals such as EOWEB etc?). Where do the EO images come from? How do you query EO data?	Typically first coarse grained, then refined queries. Scientific Work: • For scientific work, it is important to access satellite images at an early stage in the processing pipeline (level 0, level 1) in order to have full control of all algorithms / parameters

	• Image Access via EOWEB / CeoCAT, EOLI, GLCF (Landsat) • Classical queries on: Area of interest (the basis), sensor type (very important), Interferometric suitability (baseline, doppler), time of acquisition (e.g. images in summer etc.), acquisition mode (angle, etc.) Work on Emergency Mapping: • Queries on the semantic content important, e.g. “Give me all satellite images showing areas with buildings”.
How do you access the image content. Are the EO images pre-classified, when you access them, are they raw? Which tools (if ever) do you use for extracting semantic content out of the images?	The images are not preclassified. The goal is to receive images as early as possible in the processing chain. The processing from level 1 (sometimes even level 0 data) is done by herself. Higher-level processing / products which are not completely transparent are not useful (it is not possible to base scientific research on them). Tools: Professional Image processing tools such as ENVI, PCI- and GIS (ArcGIS) at later stages.
Which terminology do you use for image classification?	No experience with ontologies. The existing annotation terminologies are too rigid: In EO Products, annotations like “Industrial Site”, “housing / residential area” are built with a specific use case in mind that prevent the products from being used in other use cases. ➔ Products generated from EO images are often too use case specific. ➔ Goal: Built products based on atomic elements in an EO image that allow the usage in several different use cases / Extract Use Case independent

	information from EO images
Do you have experience with image information mining, i.e. the task of extracting features / semantic labels out of EO images?	Yes, from evaluation of the KIM system in an emergency mapping use case ("where are the buildings"), no time series, usually 1 huge EO image of a certain area (e.g. lybia) with very high-resolution.
Do you deal with GIS (e.g. vector data) as well or only EO images (if yes, do you integrate the datasets, how?)	Yes, e.g. ArcGIS shapefiles, ENVI vector formats (ROI). Mainly for two purposes: At later stages for verification of georeferencing (Image to GIS) and for retrieving areas of interest to do statistical and other analyses (e.g. delineating urban homogeneous areas)
What kind of ideal queries would you like to pose for discovering EO images in an EO image archive?	Scientific Context: What is there suffices (except Interferometry). User / Use Case perspective (emergency mapping): Query on image content would be beneficial such as "images with houses, images with lakes / rivers / water bodies". The output could be given as shapefiles to the users.
What amounts of data do you deal with?	Scientific Context: 1-5Scenes (one at a time, 500 MB – 2 GB) on hard drive. Emergency Mapping Context: 1 Before-Scene, 1 After-Scene, 0.5-1 m resolution → huge due to resolution, > 2 GB images
In which parts of your work with EO data (querying, extracting image content etc...) would you like to have more automation?	Information Extraction, BUT: Reliability must be ensured (Integrity, Provenance, Lineage ….)
From reading the TELEIOS overview, what generic expectations do you have towards the project?	Very good approach for getting EO data / products closer to the end user, who want to get an answer to concrete questions Close the gap between scientific research and end users → end users often do not understand what the researchers do, they do not understand the methods, algorithms etc… They just want to get an answer to their

	question Important: Integration of heterogeneous geodata. End users do not care where the data comes from (which sensors, which algorithm used for extraction, whether radar or optical etc…), they are just interested in having an answer to their questions, but: The information like sensor, processing algorithms etc…. **must** still be captured, even in this case (since the end user should have the possibility to ask an expert on whether the data is reliable)
Do you have experience with declarative data query languages (e.g. SQl, but also semantic-web technologies such as SPARQL)? Would it improve your daily work if you could query an EO image archive using declarative queries on the content of the image (except just keywords?)	No experience, except for some minor use in GIS for querying vector data What kinds of queries could I pose?
Do you have experiences in your daily work with ontologies? Do you use ontologies?	No, see above.
Do you expect the TELEIOS system to let you use your own terminology / ontologies for annotating EO images?	Own terminology would be useful, how will others then be able to use the derived information.
Do you use ontologies already available on the web in your daily work?	No.
What kind of metadata would you like to query when you query an EO image archive? (Thematic, Spatial, Temporal)	Spatial Sensor Sensor mode (mode, beam, polarization, etc.) Temporal (seasonal search!!!) Specific image content (emergancy mapping) - built-up areas, water bodies, etc.

10.2. Participants of the Workshop and Roles

Please note, the table is not fully complete in the sense that it does not capture every single participant of the workshop and the two requirement gathering sessions. This is due to the fact that some participants attended as listeners without registering to the workshop at the website and without providing input in the discussions. The numbers of participants reported above (30 in the workshop, 18 in the UC I session, 11 in the UC II session) refer to the number of people counted. The table below contains the people who either registered in advance or introduced themselves at the introductory session. Further, it does not contain TELEIOS consortium members.

Participant	**Company**	**Role**	**Requirement Session**
Sergio D`Elia	ESA	Ground Segment Technology Provider. Interested in pattern matching applied to earth observation data. Interested in answering the question: Does DBMS technology bring real benefits to pattern matching?	Use Case I
Jose-Luis Casanova	University of Valladolid	Provides real-time services based on remote sensing, mainly related to fire detection. The services include burned area assessment in 24 hours, forecast of fire evolution, fire properties (fire height, etc.), information about the evolution of the fire in 15 minute frequency. Interested in integrating their processes and techniques in TELEIOS.	Use Case II
Thomas Lankester	Infoterra Ltd.	Involved in the application of EO data to land cover phenology. Working with vegetation indexes (ecosystem services, biodiversity users), deforestation, temporal features (seasonal etc). Interested in getting answers to queries about legal/illegal deforestations.	Use Case I

		In addition to the basic TELEIOS aims, the demonstrator "Real-time fire monitoring based on continuous acquisitions of satellite images in combination with land cover data" is particularly of interest to him.	
Alessandro Berni	Nato Research Center NURC	Low and high resolution images for NATO security research, mainly on maritime/oceanographic surveillance, environmental monitoring (for both civil and military use). Deals with real time or near time services: a couple of hours (4-5) after data is acquired. Example use case: Pinpoint suspecting behavior from ships that deviate from the statistical observed behavior. Also interested in providing information for disaster relief. Support scientists by providing EO data. Particularly interested in TELEIOS Use Case II. Mentioned limited collaboration possibilities between NATO / EU due to political constraints.	Use Case I
Salvatore Pinto	ESA	Technology oriented. Interested in DB technology and TELEIOS Use Case II.	Use Case I
Simone Mantovani	MEEO	Developer. Deals with land cover applications. Interested in implementing and applying evolution models, automatisation of processing chains / information extraction modules. Mentioned interoperability issues, e.g., for extending & integrating the TELEIOS software with other SW.	Use Case I

Lucio Colaiocomo		End user of EO data. Deals with all kinds of data (low res. to high res.). Project partner in Virtuoso, a project for classifying information in EO images based on open information on the internet. He mentioned that JRC has done a similar implementation, which should be evaluated.	Use Case I
Alan Beccati	MEOO	Works in the development/programming part of the earth observation systems in MEEO. More interested in the technology layer of the TELEIOS architecture.	Use Case II
Panagiotis Balatsos	Ministry of Environment Greece	Received applications from the community and interested in providing feedback for improving the current services for fire monitoring, etc. Expects from TELEIOS to receive products of enhanced quality. Particularly interested in the fire monitoring use case.	Use Case II
Kathrin Molch	DLR	Has an interest in the next generation EO data & product user services, allowing for data access and information retrieval beyond traditional data search and ordering procedures. Particularly interested in improving the access to the earth observation data archive of DLR. DLR has data from 80 real missions (38 airborne, satellite, etc), and this huge amount of data that can only be accessed in a basic way. Existing users may be already satisfied with this functionality but other end-users of information products need	Use Case I

		new advancements at higher levels of image processing. Represents two types of users: scientific users of EO data and operational End Users.	
Robert Cossu	ESA	GENESI-DEC coordinator. Work on connecting and integrating heterogeneous data. The GENESI-DR web portal provides spatial and temporal query capabilities based on the meta-data of the images. Currently holding 4 millions of records in their database. Interested in attracting digital earth communities (DEC). Interested in the virtual observatory group.	Use Case I
Didier Giacobbo	Spot Image	Deals with huge numbers of (multiple) EO sources. The goal is to deliver to users not only data but more preferably information. All the initiatives/research that give more ability to user to explore/extract/qualify the tremendous EO data archive has to be followed. He is working for years on the thematic feature extraction domain to serve information to user and not only data. Add semantic information on top of the catalogue might help the user to exploit more efficiently the data. He is interested in discussing all of these aspects with users.	Use Case I