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D8.5 Specification of Pilot Use Cases in PESCaDO

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Author(s)	Harald Bosch, Maria Myllynen, Ari Karppinen, Mervi Haakana, Marco Rospocher, Stefanos Vrochidis
Internal Reviewer	Virpi Tarvainen, FMI
EC Project Officer	Manuel Monteiro
Abstract	This deliverable specifies the functionality of the PESCaDO system from the user's point of view and illustrates how the decision support is delivered to the user drawing upon a number of pilot use cases.

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1. Executive Summary

The main goal of the PESCaDO system is to support users in making decisions that are influenced by environmental aspects. This deliverable specifies the functionality of the PESCaDO system from the user's point of view and describes how the decision support is delivered to the user.

For this purpose, this deliverable first summarizes and references related documents that contain the background knowledge that is needed to model the user's requirements and his interaction with the system to cover his information need. These resources comprise the definition of the Problem Description Language in deliverable D5.1 "Decision support request and problem specification language", the definition of the PESCaDO service architectures in deliverable D8.3 "Specification of the PESCaDO architecture", and especially the evaluation of the users' characteristics and information need in the deliverable D8.4 "User Typology in PESCaDO".

The specification of the functionality is modelled as individual use cases that describe the interaction between the user and the system for a clearly defined user goal. A single use case contains a definition of the context, preconditions, the interaction, postconditions, and exceptions to the main success scenario. The description also specifies which part of the PESCaDO service oriented architecture can be tested with which use case. This information is used to evaluate how well the functionality of the PESCaDO services is covered by the described use cases.

The individual use cases are organized into two Pilot Use Cases according to their relevant user classes and scenarios. The first Pilot Use Case addresses non-professional and administrative users with a need for decision support in the area of environmental education, health and safety, and administration. The second Pilot Use Case addresses non-professional and also environmental expert users that have to set-up, manage and assess environmental services.

2. Introduction

This document shall provide a specification of the relevant functionality of the PESCaDO system from the user's point of view. It describes the functionality at a "per *use case"* level. Each use case is part of a specific scenario which states the context of its cases by defining the relevant user groups and user interests. Each of these scenarios is again part of *pilot use cases* which show greater differences in user groups, i.e. non-professional and administrative users in the first Pilot Use Case and non-professional and environmental expert users in the second Pilot Use Case.

During a software development process, *use cases* are often employed to describe a system's behaviour from an actor's point of view. They describe in a formalized way: what can be done with the system and who does what during the interaction. They are driven by individual scenarios that, together, capture the functional requirements of the system. The word *use case* was first coined by Ivar Jacobson as a translation of the Swedish term *användningsfall*. The most prominent author advertising use cases for documenting behavioural requirements, besides Jacobson, is Alistair Cockburn. From his book "*Writing Effective Use Cases*" is the following description of use cases [COC2001]:

> *"A use case captures a contract between the stakeholders of a system about its behavior. The use case describes the system's behavior under various conditions as it responds to a request from one of the stakeholders, called the primary actor. The primary actor initiates an interaction with the system to accomplish some goal. The system responds, protecting the interests of all the stakeholders. Different sequences of behavior, or scenarios, can unfold, depending on the particular requests made and conditions surrounding the requests. The use case collects together those different scenarios"*

The specification of the use cases in this document has two important properties. First, it documents the functional requirements of the users; and second, it evaluates if the planned functionality of the system can be used to activate each part of the system's architecture, and therefore address each work package of the project.

In Section 3, we describe the methodology that was used for the specification of the Pilot Use Cases of PESCaDO, including a short summary of the relevant deliverables on which this document builds upon. It will also contain an evaluation how well the specified use cases cover the services of the PESCaDO system as well as a description of the actors that are used for the description of the use cases. Sections 4, 5 and 6 contain the actual specification of the use cases. Please note that the Pilot Use Case 1 scenarios are described in greater detail as the Pilot Use Case 2 scenarios because the first demonstrator of the PESCaDO system only covers scenarios from the first Pilot Use Case. The second Pilot Use Case will be refined during the later stages of the project. Section 7 concludes the deliverable.

3. Methodology

To document the user's requirements we will specify small and coherent cases of the interaction between the user and the system with a given goal of the user in mind, commonly known as *use cases*. The functional extent of a single use case is rather limited to be able to have a self-contained description of the user's requirements for this single case and to be able to discuss one case without too much variation contained in it.

For the specification of each use case we will employ a uniform template, so that the specified aspects of each use case are consistent throughout the document. The tabular template will contain the following information for each use case (based on the model of Cockburn):

1. **Context of the use case and use case ID**: The use case ID for referencing a use case consists of the Pilot Use Case (1 or 2), the scenario (1-3), and a consecutive number. The context of the use case describes the situation of the user and the goal that he/she wants to achieve with the system.
2. **Primary actor**: Who is the main stakeholder?
3. **Related user classes according to D8.4**: Which user class (defined in D8.4, Section 4.1) does this use case cover. The user class is a combination of the reason for the information need (A = Personal, B = Professional, C = Supportive) and the type of decision that has to be supported by the system (1 = Instant reaction to a warning, 2 = Short term action, 3 = Long term planning)
4. **Tested Services**: Defines for which services this use case can function as a test case.
5. **Preconditions**: Defines the state in which the system (including the user) has to be, in order to be able to execute the use case. "*The preconditions section of the use case declares its valid operating conditions. The precondition must be something the system can ensure will be true. You document the preconditions because you will not check those conditions again in the use case.*" [COC2001]
6. **Postconditions**: Defines the state of the system (including the user) after the execution of the use case. This can also be the precondition for other use cases.
7. **Main Success Scenario**: Defines the main flow of events between the user and the system during the execution, given that nothing goes wrong. The actor and his/her intention should be clearly stated for each step in the process.
8. **Extensions**: "*Describes what can happen differently during that scenario. The numbers in the extensions refer to the step numbers in the main success scenario at which each different situation gets detected (for instance, steps 4a and 4b indicate two different conditions that could show up at step 4). When a use case references another use case, the second use case is written in italics or underlined."* [COC2001]

This document builds upon earlier deliverables of the PESCaDO project. The description of available data, services and user typologies will be limited to short

summarizations and references to the according documents. Most relevant to the description of the use cases are the Problem Description Language (PDL), the available services of the system's architecture and the user typology.

Inquiries to the PESCaDO system have to be expressed in the PDL. The PDL is an ontology that is described using the OWL Web Ontology Language. Every inquiry is an instantiation of a "problem" class and consists of a user, a type of activity that the user wants to follow, and a kind of request which the user wants to have answered. An example of the activities and requests that are currently available in the initial PDL definition can be found in Figure 1. The users do not have to formulate the inquiry directly in the PDL, but will be supported by the user interface which will translate the requests into PDL documents. More information about the PDL is available in deliverable D5.1.

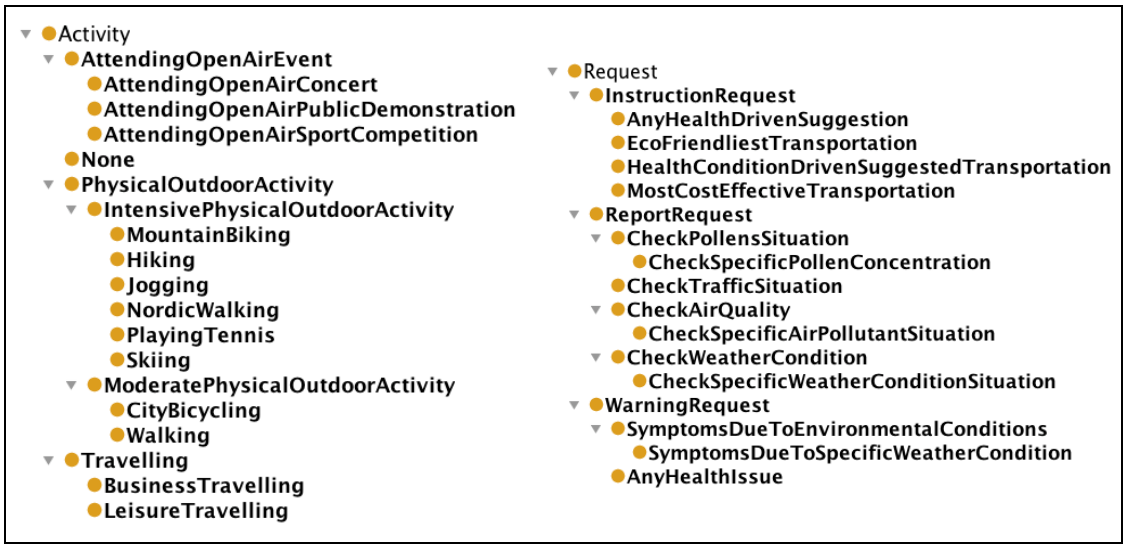

Figure 1: Classes of the initial PDL

3.1. Coverage of the services by the use cases

One goal of this deliverable is to specify a set of use cases that – taken together – can be used to evaluate the functionality of the prototypical system. This section reflects on this goal by examine how the service architecture of the prototype is covered by the proposed use cases.

Excluding the general research project related work packages WP1 (Project Management), WP9 (Assessment and Evaluation), and WP10 (Dissemination etc.), the PESCaDO project consist of seven productive work packages: (1) Environmental service node discovery, (2) Environmental service orchestration, (3) Environmental ontology construction, (4) Reasoning & user tailored decision support, (5) User interaction and visualization, (6) Multilingual and multimodal environmental information production, and (7) System development. The system's service oriented architecture, described in the deliverable D8.3, proposes fourteen services in which all of these seven work packages are reflected. If the use cases can serve as test cases for these services, then every work package should be covered by the system's prototype.

The services of the PESCaDO architecture are the following

1. Answer Service (AS)
2. User Profile Management Service (UPMS)
3. Problem Description Generation Service (PDGS)
4. Knowledge Base Access Service (KBAS)
5. Related Aspects Computation Service (RACS)
6. Route Calculation Service (RCS)
7. Data Node Repository Service (DNRS)
8. Intersection Service (IS)
9. Data Retrieval Service (DRS)
10. Fusion Service (FS)
11. Decision Service (DS)
12. Content Selection Service (CSS)
13. Information Production Service (IPS)
14. User Interaction Service (UIS)

Addressing every service in at least one use case may not be enough to address every research interest of the PESCaDO project. For different user classes, different aspects of the services are of relevance. Therefore our examination of the test cases includes the user classes that were established in the deliverable D8.4. Every use case states the tested service / work package as well as the related user class in its description. The following table serves as a reference for this information. Some cells of the table cover multiple user classes because some services' functionality does not differ for the different user classes or the different reasons for information need.

Services \ User Classes	A1	A2	A3	B1	B2	B3	C1	C2	C3
1. AS	PUC0S0_4	PUC1S1_1	PUC1S2_2	PUC1S3_5	PUC1S3_2			PUC2S1_1	
2. UPMS	PUC1S1_1, 2 and 3			PUC1S3_1			N/A (no special health conditions)		
3. PDGS	PUC0S0_4	PUC1S1_1	PUC1S2_2	PUC1S3_1	PUC1S3_2			PUC2S1_1	
4. KBAS	PUC1S1_1			PUC1S3_2 and 5				PUC2S1_1	
5. RACS	PUC0S0_4	PUC1S1_1	PUC1S2_2	PUC1S3_1	PUC1S3_2			PUC2S1_1	
6. RCS	PUC1S1_1 (Route calculation is user class independent)								
7. DNRS	PUC0S0_2, PUC1S2_2			PUC0S0_2, PUC1S3_2 and 5			PUC0S0_2	PUC2S1_1	PUC0S0_2
8. IS	PUC1S2_2			PUC1S3_4 and 5				PUC2S1_1	
9. DRS	PUC0S0_2, PUC1S2_2			PUC0S0_2, PUC1S3_2 and 5			PUC0S0_2	PUC2S1_1	PUC0S0_2
10. FS	PUC1S2_2			PUC1S3_2 and 5				PUC2S1_1	
11. DS	PUC0S0_4	PUC1S1_1	PUC1S2_2	PUC1S3_1	PUC1S3_2			PUC2S1_1	
12. CSS	PUC0S0_4	PUC1S1_1	PUC1S2_2	PUC1S3_1	PUC1S3_3		PUC0S0_1		
13. IPS	PUC0S0_4	PUC1S1_1	PUC1S2_2	PUC1S3_1	PUC1S3_3			PUC2S1_1	
14. UIS	N/A (email)	PUC1S1_1	PUC1S2_2	PUC1S3_1	PUC1S3_2			PUC2S1_1	

3.2. Definition of Personas

In order to make the description easier to read and easier to follow, we use *Personas*. The concept of Personas was popularized mainly by Alan Cooper [COO1999] and their use in software development is manifold. Personas are fictional characters that are based on the target audience of a product or system. Often, they are designed elaborately to account for the real customer data, but also quickly sketched "ad-hoc" Personas [PRU2006] have been proven to be very useful for making a single meeting or design sessions more user-oriented. The most important advantages of Personas are: (1) having a common language for different stakeholders; (2) enforcing a more detailed view on the users by avoiding generic statements like "the users" when in reality there are multiple types of users, and (3) adding an empathetic focus to the design instead of having a seemingly arbitrary collection of features. In our case, Personas shall mainly give the actors in the use cases a motivation and a personal background, thus putting the use cases in a coherent context. Each scenario of the Pilot Use Cases in this document features one or more of the following Personas.

Fiona Fit is 28 years old and lives in the municipality of Espoo near Helsinki. She works in the city centre of Helsinki as a Technician for a big company and therefore commutes every day between home and work place. Fiona likes to be active in her leisure time and often goes on hikes or cross-country skiing. During her study, Fiona learned to use a computer effectively while searching for information about certain topics. While she is conscious of her health and the environmental situation, she still likes to use her own car for going to work in the morning. Fiona is allergic to birch pollen.

Arnold Admin is 51 years old and the father of two children. He studied civil engineering at the Tampere University of Technology and graduated with a Master's degree. Currently, he is working for the city of Helsinki in the environmental centre. He works as an administrative personnel and follows the environmental situation and prepares decisions concerning the air quality action plans to protect the citizens from pollutants. Using the PESCaDO system is part of his daily routine. He is comfortable using a computer and refers to himself as an intermediate Internet user.

Mick Manager, age 48, is a governmental officer of an autonomous, Swedish speaking island between Finland and Sweden. Mick's duties cover various environmental issues, among them the regional air quality in the territory. The island has no air quality monitoring network. The nearest monitoring stations are in Finland and in Sweden. Mick has an administrative background and no experience in environmental monitoring. His computer skills are average. Some time ago he attended a seminar for environmental officials in the Baltic region, where he saw a demonstration of the PESCaDO service and became interested in the possibilities it might offer to facilitate setting up an air quality information system that would cover his territory.

Eva Expert, age 26, is an on duty meteorologist in the FMI. In addition to meteorology, Eva has studied environmental sciences. She has good computer skills and is an avid Internet user. She works in rotating shifts, compiling weather forecasts, communicating with the media and answering calls in the service phone. Due to increased environmental awareness of the Finnish population, the responsibilities of the on duty meteorologists in FMI have recently been expanded to also cover routine checks of the air quality situation in Finland. This is facilitated by the national air quality portal where

the measured concentrations are shown in real time. Because of her background, Eva has found it easy to adapt to these new tasks. Like all on duty meteorologists in FMI, Eva is familiar with the PESCaDO service and uses it to search for answers to questions concerning areas outside of Finland.

4. Scenario Independent Use Cases

The following use cases describe the necessary functionality of the system that is independent of the user classes or scenarios of the Pilot Use Cases. This subchapter describes mainly the functionality that is not related to a concrete inquiry but that is necessary to establish the preconditions for delivering personalized decision support.

Context of Use Case PUC0S0_1
In other use cases, a content selection policy is applied to select relevant facts from the knowledge base that should be presented to the user as the answer. In order to learn or improve this policy, an expert has to review possible content elements in relation to a given query and context (i.e. user profile and measurements) and deliver relevance feedback to the system. This training of the content selection policy is done asynchronously from the end-user interaction and during the setup of the PESCaDO system.
Primary actors
An expert user – the expert
Related user classes according to D8.4
Environmental professional user (C)
Tested Services
Content Selection Service (CSS)
Preconditions
1. At set of initial (artificial) queries and context descriptions is accessible to the system.
Postconditions
1. The relevance feedback of the expert is incorporated into the content selection policy.
Main Success Scenario
1. The system presents to the expert simultaneously: a. the artificial query, b. the artificial context, i.e. mainly the user profile and the knowledgebase content that is available as potential content elements for the answer, including individual measurement stations,

c. the answer that the system would give,

d. the initial / intermediate content selection policy,

e. and means to provide relevance feedback

2. The expert rates the relevance of the content element, includes new elements from the knowledgebase, or discards formerly selected elements.
3. The expert submits the input to the system an receives an updated answer of the system
4. The steps 1-3 are repeated until the expert is satisfied with relevance of the result in relation to the context.

Extensions

1. This feedback cycle could also be employed to review real and anonymized user sessions for further improvement of the policy.

Context of Use Case PUC0S0_2
In order to improve the results provided by the system and steer the Data Retrieval Service according to the user needs, the user will be involved in a relevance feedback loop in which he/she will be able to select/deselect specific environmental services or stations that should be included or not for the answer generation.
Primary actors
The user
Related user classes according to D8.4
non-professional user (A), Administrative user (B), Environmental professional user (C)
Tested Services
Data Node Repository Service (DNRS), Data retrieval service (DRS)
Preconditions
1. At least one user query session is performed and the results are presented to the user so he/she can provide feedback.
Postconditions
1. The data retrieval service receives a new query based on the user feedback and outputs data by the user selected services.
Main Success Scenario

1. The system presents to the user/expert simultaneously: a. the query, b. the answer of the system, c. the environmental services/nodes/stations that were considered for the answer generation including statistical information (e.g. part of area covered etc.) and confidence values that were considered during the fusion. 2. The user selects/deselects the nodes considered by the system. 3. The user submits the input to the system and receives an updated answer of the system 4. The steps 1-3 are repeated until the user is satisfied with relevance of the result in relation to the context.
Extensions
-

Context of Use Case PUC0S0_3
A potential user wants to create a personalized user profile in the PESCaDO system.
Primary actors
non-professional user (A), Administrative user (B), Environmental professional user (C)
Related user classes according to D8.4
General Public
Tested Services
This use case tests the creation of user profiles and their expressiveness. User Profile Management Service (UPMS), Problem Description Generation Service (PDGS), Related Aspects Computation Service (RACS), User Interaction Service (UIS)
Preconditions
none
Postconditions
1. The user has created a personalized user profile. Her future requests will be processed with respect to this profile.
Main Success Scenario

1. In any view of the PESCaDO user interface the user clicks on a link or button to take her to the user profile management service.
2. She states her email address and chooses a password for authentication.
3. After the profile was created, the user can supply additional information
    a. health related information (age, gender, fitness, diseases, allergies, pregnancy)
    b. location related information (home, work, and additional locations)
    c. additional preferences (type of information display, hobbies)
    d. notification preferences (subscribed types of warning/notification messages)
    e. the general type of the user according to D8.4 (non-professional, administrative, environmental expert)
4. The system stores the information in the user profile management.

Extensions

1. The email address is already registered with an account. A password recovery option is presented.
2. The user updates an already existing user profile.

Context of Use Case PUC0S0_4
In order to inform users of the system proactively, the system evaluates a set of queries on a regular bases and acts accordingly.
Primary actors
The system
Related user classes according to D8.4
non-professional user (A), Administrative user (B), Environmental professional user (C)
Tested Services
This use case tests if the system can handle subscription for proactive notification. Of interest is especially if the PESCaDO system can scale with the number of different user profiles and personal notification subscriptions. All services are addressed but the focus lies on: Answer Service (AS), User Profile Management Service (UPMS), Problem Description Generation Service (PDGS), and Information Production Service (IPS)

Preconditions
1. Users have saved queries as a regular notification requests. 2. General (user independent) warning messages are saved as a query to be run regularly.
Postconditions
1. The users are notified of warning messages and notification requests
Main Success Scenario
1. On regular basis, the system runs a saved set of queries to determine if general warning messages or personal notification requests have to be sent out. 2. If messages have to be sent, a. the system creates messages for each registered users that wants to receive this type of warning or notification. b. For legally mandatory warnings, all registered users are informed. c. The messages are personalized for each user according to the user profile, e.g. in the preferred language of the user. 3. The system presents the message to the user via email notification.
Extensions

5. Specification of Pilot Use Case 1

The users addressed in the first Pilot Use Case are citizens with no professional background on environmental services as well as administrative personnel working on transport system planning, air quality management, etc. This reflects the users of services offered by the PESCaDO project partner HSY and their administrative clients. HSY provides transport system planning, regional public transport provision, waste management and air quality management for its four member municipalities. HSY plans to improve on the current services for these users in three different areas which form the three scenarios of this pilot use case: (1) Environmental education support, (2) Health and safety related decision support, and (3) Administrative decision support. These three scenarios will address the research topics of distributed and multilingual information provisioning because not all data needed are available to HSY and services that offer the data can be located outside of Finland and therefore feature a variety of languages.

5.1. Scenario 1 – Environmental Education Support

Season-dependent air quality (AQ) episodes promote sustainability-oriented behaviour among Helsinki metropolitan area (HMA) citizens concerning mobility. Citizens should be able to consult the system whether AQ-conditions allow for the use of a private car to move in HMA for different purposes, advice to use public transport, or advise to stay at home. The service should also implement an active information mode in case of poor AQ in order to inform/recommend/impose the use of public (instead of private) transportation.

In this scenario the environmentally conscious Fiona Fit wants to know more about her daily commuting between her home and place of work. Therefore she uses the PESCaDO service to decide her means of transportation. She has not used the PESCaDO system before and has not yet a personalized profile.

5.1.1. Basic Use Case

Context of Use Case PUC1S1_1 (Pilot Use Case 1, Scenario 1 – Case 1)
Fiona Fit needs to go to work in the morning. She wants to know if the environmental situation at that time restricts the use of her private car.
Primary actors
Fiona Fit – the user
Related user classes according to D8.4
General public, short-term decision (A2)
Tested Services
This use case tests the basic interaction with the system and if it can handle requests that

do not contain a personalized user profile.

All services are addressed but the focus lies on: Answer Service (AS), User Profile Management Service (UPMS), Problem Description Generation Service (PDGS), Related Aspects Computation Service (RACS), Route Calculation Service (RCS), Decision Service (DS), Content Selection Service (CSS), Information Production Service (IPS), and User Interaction Service (UIS)

Preconditions

1. The problem description language is capable of expressing the request.
2. The system has the details on what kind of knowledge is related to the query.
3. The system has a content selection policy for the output. This policy results from a previously executed interactive training procedure with expert users.

Postconditions

1. The user's information need is satisfied.

Main Success Scenario

1. The user formulates her inquiry via the graphical user interface:
    a. She states the type of request ("any environmental restriction for private car usage") and type of planned activity ("business travelling/commuting")
    b. The system prompts for additional information according to the activity. In this case, the start and end location and the available means of travel.
2. No individual user profile existed. The system presents to the user a set of predefined generic user profiles (e.g. "sporty", "asthmatic", "air quality sensitive" ...).
3. The user selects one of the presented profiles.
4. The system creates a description of the problem.
5. The system calculates the route of travel to infer the regions of interest.
6. The system infers the related environmental aspects (traffic jams, traffic announcements, air quality and meteorological conditions) to answer the inquiry.
7. The system determines the relevant environmental nodes.
8. The system retrieves the data of the corresponding nodes from the database.
9. The system instantiates the needed individuals in the knowledgebase.
10. The system selects the set of relevant content elements to answer the question.
11. The system generates the answer.
12. The system presents to the user an answer which contains:

a. The most current traffic related AQ measurements. b. A statement if legal restrictions for private transportations are in force c. A suggestion which means of travel is suited according to the measurements. d. An explanation of the suggestion. e. Note: the system does not calculate individual routes for different means of transportation!
Extensions
4. The inquiry cannot be translated automatically into the Problem Description Language. a. The user or an administrator is informed to complete the inquiry manually. 12. The answer of the system does not satisfy the user. a. The user changes her inquiry and receives a new answer.

5.2. Scenario 2 – Health and Safety Related Decision Support

This scenario is aimed at individuals that may change their behaviour according to real-time air quality and weather information in order to reduce negative health effects or safety risks. Especially sensitive citizens need to be able to solicit decision support on whether measured or forecasted AQ- and/or weather conditions allow for determined types of activities by citizens with a determined profile. But also the healthy general public has request about safe travel and the avoiding of risks to, e.g., dangerous road conditions. As in scenario 1, an active information mode and a decision support modes will be implemented.

For the description of the use cases Fiona Fit now has a PESCaDO user profile. She plans some activities in the near future and seeks decision support from PESCaDO. First she wants to go on a hike in the Nuuksio National Park near Helsinki at the same day and then she plans her upcoming vacation with respect to air quality.

5.2.1. Basic Use Case

Context of Use Case PUC1S2_1
Fiona Fit wants to go hiking in a nearby national park and wants to know if there could be any health or safety issues that are related to the environmental situation and her personal health situation
Primary actors
Fiona Fit – the user

Related user classes according to D8.4
General public, short-term decision (A2)
Tested Services
This use case tests the basic interaction like PUC1S1_1 but this time with a personalized user profile. All services are addressed but the focus lies on: Answer Service (AS), User Profile Management Service (UPMS), Problem Description Generation Service (PDGS), Knowledge Base Access Service (KBAS), Related Aspects Computation Service (RACS), Decision Service (DS), Content Selection Service (CSS), Information Production Service (IPS), User Interaction Service (UIS)
Preconditions
1. A user profile for the end user is available in the knowledge base and the user is logged into the system. 2. The system has the details on what kind of knowledge is related to the query. 3. The system has a content selection policy for the output. This policy results from a previously executed interactive training procedure with expert users.
Postconditions
1. The user is advised about the threats to her personal health and safety in the region of the hike today.
Main Success Scenario
1. The user formulates her inquiry via the graphical user interface. a. She states the type of request (“any-health-issues”) and type of planned activity (“hiking (intense physical outdoor activity)”) b. The system prompts for additional information according to the activity. In this case, the region of the hike. 2. The system creates a description of the problem. 3. The system maps the region of interest to locations for which environmental data can be queried (geographical names, coordinates, height). 4. The system infers the related environmental aspects related to the user profile and common threats (air quality and meteorological conditions) to answer the inquiry. 5. The system determines the relevant environmental nodes. 6. The system retrieves the data of the corresponding nodes from the database. 7. The system instantiates the needed individuals in the knowledgebase.

8. The system selects the set of relevant content elements to answer the question. 9. The system generates the answer 10. The system presents to the user an answer which contains a. A map of the hiking region for reference b. Information about the general weather condition c. Information about birch pollen concentration due to Fiona Fits allergy d. Health and safety related information depending on the current measurements e. Textual summary of the findings of the system.
Extensions
1. Aspects of the inquiry can already be guessed from the user profile which shortens the step 1, e.g. preferred activity is suggested or home location is region of the activity. 6. No data can be found. The system generates a statement that no data are available for the relevant region to provide information.

5.2.2. Variations of the Basic Use Case

After PESCaDO told Fiona Fit that she should not go hiking today due to a high concentration of birch pollen, she spends the afternoon planning her upcoming vacation.

Context of Use Case PUC1S2_2
Fiona Fit seeks advice for choosing a vacation area and therefore wants the PESCaDO system to compare long term statistics about the general air quality of multiple regions of interest.
Primary actors
Fiona Fit – the user
Related user classes according to D8.4
General public, long term planning (A3)
Tested Services
This use case tests the possibility to compare air qualities and the possibility to work with long term statistical data. The focus of addressed services lies on: Problem Description Generation Service (PDGS), Related Aspects Computation Service (RACS), Data Node Repository Service (DNRS), Intersection Service (IS), Data Retrieval Service (DRS), Fusion Service (FS),

Decision Service (DS), Information Production Service (IPS)
Preconditions
1. The system has the details on what kind of knowledge is related to the query. 2. The system has a content selection policy for the output. This policy results from a previously executed interactive training procedure with expert users. 3. The requested long term statistics are available through environmental nodes.
Postconditions
1. The user has a report that enables her to compare the general air quality and the air quality aspects related to her personal user profile (if available) of the specified locations.
Main Success Scenario
1. The user formulates her inquiry via the graphical user interface. a. She states the type of request (“report / compare general air quality”) and type of planned activity (“vacation”) b. The system prompts for additional information according to the activity or request. In this case, the number of regions, the individual regions that should be compared and the timeframe for the comparison. 2. The system creates a description of the problem. 3. The system maps the regions of interest to locations for which environmental data can be queried (geographical names, coordinates). 4. The system infers what aspects are most relevant to “general air quality”. 5. The system determines the relevant environmental nodes. 6. The system retrieves the data of the corresponding nodes from the database. 7. The system instantiates the needed individuals in the knowledgebase. 8. The system selects the set of relevant content elements to answer the question. 9. The system generates the answer. 10. The system presents to the user an answer containing: a. Long term information about frequent pollutants influencing the general AQ for each region of interest. b. The answer does only directly contrast values that are in the same domain to minimize confusion of the user, i.e. does not compare qualitative and quantitative statements about air quality, but shows them as individual statements.
Extensions
5. The system cannot find environmental nodes that can deliver long term statistics

for the regions of interest and aborts the execution with a descriptive error message.

11. The user wants to change her request to a specific pollutant or a more detailed report about only one specific region.
    a. The user selects one of the available pollutants within the result page to poll more information about it or navigates back to her initial inquiry to adjust it accordingly.
    b. The user selects one of the regions within the result page to poll more information about it or navigates back to her initial inquiry to adjust it accordingly.

5.3. Scenario 3 – Administrative Decision Support

In various kinds of AQ episodes, a number of authorities from different branches of administration are involved and diverse information is required. For instance, in the case of PM or NO2 episodes, when the concentrations rise, HSY informs the Environmental Centres of the HMA cities and the institutions responsible for road and street maintenance, so they can take suitable measures. The decisions on the appropriate measures depend on a number of environmental and other types of conditions, administrative action plans, etc. PESCaDO will provide support for decision making in this scenario.

In this scenario, Arnold Admin works with the PESCaDO system during his work day. He usually starts with checking the general AQ situation of the day. If problematic AQ measurements exist, he investigates his results deeper and potentially issues a warning to the general public. If the conditions are severe or show no tendency to improve, he has to decide if and what action are taken against the situation.

5.3.1. Basic Use Case

Context of Use Case PUC1S3_1
Arnold Admin wants to know if any of the measurements of air pollutants at that time and in the region of his responsibility are above or near the limit values.
Primary actors
Arnold Admin – the user
Related user classes according to D8.4
Administrative Personnel, warning (B1)
Tested Services
This use case tests if the PESCaDO system is capable of monitoring pollutant concentrations for which legal limits exist. This case is interesting because a

personalized user profile might exist but is only relevant to the presentation of the information and does not influence which aspects are related to the AQ situation (e.g. no special illness).

The focus of addressed services lies on: User Profile Management Service (UPMS), Problem Description Generation Service (PDGS), Related Aspects Computation Service (RACS), Decision Service (DS), Content Selection Service (CSS), Information Production Service (IPS), User Interaction Service (UIS)

Preconditions

1. The user has logged into the system and has a personalized user profile.
2. The system has the details on what kind of knowledge is related to the query.
3. The system has a content selection policy for the output. This policy results from a previously executed interactive training procedure with expert users.

Postconditions

1. The user has knowledge about the air quality at that time and whether it is problematic. He has the needed information – including the sources of data instead of a yes/no answer – to sketch his further steps to analysis the AQ situation.

Main Success Scenario

1. The user formulates his inquiry via the graphical user interface.
    a. He states the type of request (“report / check-air-quality-limits”) without a type of planned activity (the system deduced the activity “none”)
    b. He states the region of interest for the report and no specific time (the system deduces “now/as close to real-time as possible”)
2. The system creates a description of the problem.
3. The system maps the region of interest to locations for which environmental data can be queried (geographical names, coordinates, height).
4. The system infers/looks up for which environmental information legal limits exist.
5. The system determines the relevant environmental nodes.
6. The system retrieves the data of the corresponding nodes from the database.
7. The system instantiates the needed individuals in the knowledgebase.
8. The system selects the set of relevant content elements to answer the question.
9. The system generates the answer.
10. The system presents the report to the user.
    a. The report contains a description of the current AQ and relevant thresholds (see postcondition)

b. Due to the role of the user, elements like distribution maps, tables and source information are selected preferably for presentation.
Extensions
1. The user wants to know if the AQ situation is relevant for a specific user group instead of the general public / legal limit values. a. He creates an additional, temporary and limited user profile with the specific conditions of interest (e.g. asthmatic) b. or selects a predefined generic user profile (see PUC1S1_1) c. This profile is taken into account for the computation of related aspects and limit values but not for the personalized representation of the answer. 12. The user wants to create follow up inquiries: a. The user changes his original inquiry or combines it with elements of the result page, see PUC1S3_2.

5.3.2. Variations of the Basic Use Case

Arnold Admin was informed by the answer of PUC1S3_1 that the PM10 measurements are above the legal limit and he wants to have a forecast of a specific pollutant in the region where the limit was exceeded.

Context of Use Case PUC1S3_2
Arnold Admin wants to create a report with a forecast of a specific pollutant in a specific region using elements of an earlier inquiry to formulate the inquiry.
Primary actors
Arnold Admin – the user
Related user classes according to D8.4
Administrative Personnel, short term decision (B2)
Tested Services
This use case tests if the PESCaDO system can report forecasts and if the reuse of formally executed queries is possible in the user interface. The focus of addressed services lies on: Problem Description Generation Service (PDGS), Knowledge Base Access Service (KBAS), Related Aspects Computation Service (RACS), Data Node Repository Service (DNRS),Data Retrieval Service (DRS), Fusion Service (FS), Decision Service (DS), User Interaction Service (UIS)

Preconditions
1. The user completed PUC1S3_1 or otherwise has a result of an inquiry containing a pollutant and a region of interest. 2. A forecast is available through an environmental node.
Postconditions
1. The user has a forecast of the desired pollutant and an explanation of the forecast (e.g. source and uncertainty).
Main Success Scenario
1. The user selects the pollutant of interest in the former result or warning message. 2. The system creates a new inquiry that already contains the context of the former result or warning and the selection of the user (region of interest, specific pollutant, time frame). 3. The user specifies the type of request (“report / forecast”) and adjusts the time frame. 4. The system maps the region of interest to locations for which environmental data can be queried (geographical names, coordinates, height). 5. The system determines the relevant environmental nodes. 6. The system retrieves the data of the corresponding nodes from the database. 7. The system instantiates the needed individuals in the knowledgebase. 8. The system selects the set of relevant content elements to answer the question. 9. The system presents the report to the user. a. Due to the role of the user, elements like distribution maps, tables and source information are selected preferably for presentation.
Extensions
6. No forecast can be retrieved from the available environmental nodes. The system aborts the execution of the request with a descriptive error message.

Arnold Admin has got information about the air quality and a forecast about its development. Now, he wants to inform the general public about the air quality issue and uses the PESCaDO service to formulate the report.

Context of Use Case PUC1S3_3
Arnold Admin wants to formulate a warning message for dissemination to the general public.

Primary actors
Arnold Admin – the user
Related user classes according to D8.4
Administrative Personnel, short term decision support (B2)
Tested Services
This use case tests if the PESCaDO system is capable of adjusting the output of a report dynamically to the need of the user so that it can be used, e.g., as a textual report for print media. The focus of addressed services lies on: Answer Service (AS), Problem Description Generation Service (PDGS), Related Aspects Computation Service (RACS), Decision Service (DS), Content Selection Service (CSS), Information Production Service (IPS)
Preconditions
1. The system has the details on what kind of knowledge is related to the query. 2. The system has a content selection policy for the output. This policy results from a previously executed interactive training procedure with expert users.
Postconditions
1. The user has a report that requires minimal adjustments to be publishable as a warning message to the public and can optionally set this report as warning message to be presented to all users of the system.
Main Success Scenario
1. The user formulates his inquiry via the graphical user interface. a. The user selects the type of request (“warning message due to environmental conditions”). b. The user specifies the region of interest by a map or textual input. c. The user specifies additional constraints, e.g. the output characteristics (“plain text” / “with forecast”) 2. The system creates a formal description of the problem. 3. The system maps the region of interest to locations for which environmental data can be queried (geographical names, coordinates, height). 11. The system infers the related environmental aspects (air quality and meteorological conditions) to answer the inquiry. 4. The system determines the relevant environmental nodes. 5. The system retrieves the data of the corresponding nodes from the database.

6. The system instantiates the needed individuals in the knowledgebase. 7. The system selects the set of relevant content elements to answer the question. 8. The system presents the report to the user (see postconditions).
Extensions
1. If the user has a result from a previous inquiry on his screen, he can select pollutants and individual content element (e.g. graphical representations of forecasts) to be important aspects to the warning message. 1. The user wants to address special user groups or activities with this message a. The user states the activity for which the warning is relevant or selects "none" if the warning is of general nature. b. The user states the health characteristics for which the warning is relevant or selects "none" if the warning is of general nature.

Arnold Admin wants to do something about the high PM10 concentration. He checks the PESCaDO system what he could do about this situation.

Context of Use Case PUC1S3_4
Arnold Admin wants to know if there are actions that he should take according to the administrative action plans in view of a high PM10 concentration.
Primary actors
Arnold Admin – the user
Related user classes according to D8.4
Administrative Personnel, short term decision support (B2)
Tested Services
This use case tests how complex an answer of can become. In this case the result should be an action plan or a list of possible actions to improve the situation. This requires elaborated rules in the environmental ontology. The focus of addressed services lies on: Answer Service (AS), Problem Description Generation Service (PDGS), Knowledge Base Access Service (KBAS) , Related Aspects Computation Service (RACS), Data Node Retrieval Service (DNRS), Intersection Service (IS), Data Retrieval Service (DRS), Decision Service (DS), Content Selection Service (CSS), Information Production Service (IPS)
Preconditions
1. The system has the details on what kind of knowledge is related to the query.

2. The system has a content selection policy for the output. This policy results from a previously executed interactive training procedure with expert users.
Postconditions
1. The user has a result that contains information about the available actions, the current situation, and the short term history of relevant measurement to be able to judge what actions are suitable.
Main Success Scenario
1. The user formulates his inquiry via the graphical user interface. a. He states the type of request (“suggest administrative actions”) and the activity (“none”). b. He states the pollutants of interest. 2. The system creates a description of the problem. 3. The system maps the region of interest to locations for which environmental data can be queried (geographical names, coordinates, height). 4. The system determines the relevant environmental nodes. 5. The system retrieves the data of the corresponding nodes from the database. 6. The system instantiates the needed individuals in the knowledgebase. 7. The system selects the set of relevant content elements to answer the question. 8. The system presents the report to the user (see post conditions).
Extensions
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Arnold Admin wants to be pro-active and uses the PESCaDO system to evaluate if the weather conditions affect the safety of traffic.

Context of Use Case PUC1S3_5
For a different and rural region, Arnold Admin wants to know if the weather condition at that time favours the creation of black ice.
Primary actors
The user
Related user classes according to D8.4
Administrative Personnel, warning (B1)

Tested Services
This use case tests how much complexity the PESCaDO system supports. But unlike PUC1S3_4, it tests the complexity of the request and necessary background computation (many relevant factors, potentially large covered region). The focus of addressed services lies on: Answer Service (AS), Problem Description Generation Service (PDGS), Knowledge Base Access Service (KBAS), Related Aspects Computation Service (RACS), Data Node Repository Service (DNRS), Intersection Service (IS), Data Retrieval Service (DRS), Fusion Service (FS), Decision Service (DS), User Interaction Service (UIS)
Preconditions
1. The user has logged into the system. 2. The system has the details on what kind of knowledge is related to the query. 3. The system has a content selection policy for the output. This policy results from a previously executed interactive training procedure with expert users.
Postconditions
2. The user is has an overview over the current values of the factors that favour the creation of black ice and can therefore initiate countermeasures.
Main Success Scenario
1. The user formulates his inquiry via the graphical user interface. a. He states the type of request (“check black ice conditions”) and the activity “travel”. b. He states the region of interest for the report and no specific time (the system deduces “now/as current as possible”) 2. The system creates a description of the problem. 3. The system maps the region of interest to locations for which environmental data can be queried (geographical names, coordinates, height). 4. The system determines the relevant environmental nodes. 5. The system retrieves the data of the corresponding nodes from the database. 6. The system instantiates the needed individuals in the knowledgebase. 7. The system selects the set of relevant content elements to answer the question. 8. The system presents the report to the user (see postconditions). a. Due to the role of the user, elements like distribution maps, tables and source information are added to the textual report.
Extensions

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6. Specification of Pilot Use Case 2

The range of users addressed in the second use case covers both professional and non-professional users. Professional users are from FMI. The targeted non-professional users are clients and users of the FMI-services. Within the use case, two scenarios will be considered for implementation: (1) Management support for setting up environment management systems, (2) Quality assessment support to FMI staff.

The research and development effort in the first phase of the project was focused on the first prototypical demonstrator of the PESCaDO system. This demonstrator features functionality which is mainly related to the second scenario in the first Pilot Use Case. Therefore, the second Pilot Use Case scenarios are currently not fully specified and we cannot describe them more specifically in this deliverable but will refine them in later stages of the project.

6.1. Scenario 1 – Management Support for Setting up an Environmental Service

In the first scenario, a national or regional authority institution or a private entity wants to set up a reliable environmental information service to answer an information need or support decision making.

Mick Manager needs to set up an air quality monitoring system that allows him to assess in real time the air quality in his territory, despite of the fact that no air quality measurements are carried out on the small autonomous island. He uses PESCaDO to set up an environmental service to:

i) Find nodes with real time AQ measurement data in Finland and Sweden (stations nearest to the island or within a distance defined by the user).

ii) Extract information about different pollutants.

iii) Deliver this information in graphic form (e.g. numbers on a map, or graphs, or both, depending on the request by the user).

iv) If any of the EU limit values are exceeded, provide also textual information about the exceedances (which pollutant, which limit, where, measured value). This information is requested in Swedish which is the official language of the island.

v) Orchestrate the nodes to update the service hourly.

6.1.1. Basic Use Case

Context of Use Case PUC2S1_1
Mick Manager needs a service to assess in real time the air quality in his territory.
Primary actors
Mick Manager – the user
Related user classes according to D8.4
Environmental user, short term planning (C2)
Tested Services
Answer Service (AS), Problem Description Generation Service (PDGS), Knowledge Base Access Service (KBAS), Related Aspects Computation Service (RACS), Data Node Repository Service (DNRS), Intersection Service (IS), Data Retrieval Service (DRS), Fusion Service (FS), Decision Service (DS), Content Selection Service (CSS), Information Production Service (IPS), User Interaction Service (UIS)
Preconditions
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Postconditions
1. The user has a saved configuration of queries and can rerun them.
Main Success Scenario
1. The user defines queries that offer information about the subject. 2. The system result consists of a list of data providers. 3. The user selects the environmental nodes that are related to the requested information. 4. The user states how the data of the nodes should be combined and how it should be presented. 5. The system presents the result of the combination. 6. The user is able to save this configuration of queries (possible new services are not excluded) and rerun them.
Extensions
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6.2. Scenario 2 – Quality Assessment Support

This scenario is designed to facilitate the work of the FMI staff in assessing the quality of information available on an air quality episode outside of Finland that could potentially have a great impact on the air quality situation in Finland.

In this scenario Eva Expert is the on-duty meteorologist answering the service phone late on a Friday night in August. The caller is the organizer of the annual Helsinki City Marathon which takes place the next day. During the past two weeks, all of Central Europe has suffered from an exceptional heat wave, during which also the ozone concentrations have risen to levels that are hazardous for health. In Finland, the weather has thus far been fairly cool due to the passage of several low pressures over Finland towards Russia. However, the weather patterns have changed and polluted air has already started to flow towards the North. Now the organizers of the Marathon are concerned about the possible health effects of ozone on the runners and consider cancelling the event or, alternatively, warning the runners that sensitive people should consult their physician before starting the run. The organizers want to know how high the ozone concentrations will be during Saturday and whether it would be well advised to permit the runners on the route.

Eva Expert uses the PESCaDO service to find and pull together ozone concentration data abroad, especially in the origin and along the route of the air masses headed for Helsinki, which she is able to define using her in-house facilities. Eva also needs ozone forecasts which cover southern Finland. Because of her wide expertise she will be able to analyse this information and estimate the possible ozone concentrations in Helsinki on Saturday. However, to arrive at the right conclusions she needs support from PESCaDO for the assessment of the quality of the data and the forecasts in order to decide which of the possibly conflicting information is the most reliable to base her conclusions on. Eva also needs the built-in information in the PESCaDO service about the health effects of air pollutants at various concentration levels (based on the WHO recommendations) when estimating the possible threat to the runners.

7. Summary and Conclusions

The main goal of the PESCaDO system is to support users in making decisions that are influenced by environmental aspects. In this deliverable, we specified the functionality of the PESCaDO system from the user's point of view and described how the decision support is delivered to the user. For this purpose this deliverable first summarized and referenced related documents that contain the background knowledge that was needed to model the user's requirements and his interaction with the system to cover his information need. The actual specification was modelled as individual use cases that describe the interaction between the user and the system for a clearly defined user goal. A single use case features a specification of the context, preconditions, interactions, postconditions, and exceptions to the main success scenario. It also contains information about which part of the PESCaDO service oriented architecture can be tested with this use case. This information was used to evaluate how well the functionality of the services is covered by the described use cases.

It can be seen from the structure of the described use cases, that the "reason for information need", i.e. if the user is interested in being warned or if he wants to receive short/long term decision support, is not very discriminative for the interaction process. The main course of events is rather similar in each use case, and especially the backend services for, e.g., knowledgebase and data access are independent of the user class and request type. With this insight, the test case coverage of the system's services can be seen as almost complete. Single user class / service combinations exist where no dedicated use case was specified. In these cases the functionality of the services does not differ to an already covered user case / service combination.

Almost all presented use cases in this document belong to the scenarios of the first Pilot Use Case. This is due to the fact, that these are the scenarios that will be in the focus of the first demonstrator of the PESCaDO system and therefore were discussed in greater detail within the consortium. For the first demonstrator, a subset of the described functionality will be implemented. The second Pilot Use Case was presented in an informal way and will be further analyzed and developed during the course of the project.

8. References

[COC2000] Cockburn, Allistor: “Writing Effective Use Cases.” Pearson Education Inc., Addison Wesley, 2001

[COO1999] Alan Cooper: "The Inmates Are Running the Asylum." Sams Publishing, Indianapolis, 1999.

[PRU2006] John Pruitt & Tamara Adlin: "The Persona Lifecycle: Keeping people in mind during product design." Morgan Kaufmann Press, San Francisco, 2006.