Abstract (for dissemination)

This User Requirements analysis identifies user requirements through use cases. The idSpace target user groups are staff members of organizations and companies in different European countries, who are conducting creative innovative processes. The user perspective will be considered from two perspectives:

The definition of functional requirements in terms of the information and data required and of the modes of access to this data, transactions and modifications of data.

The identification and description of the context of use and non-functional requirements, such as subjective preferences and others.

As a result of this task the analysis describes different use cases for the implementation of idSpace.

Keywords List

User requirements, target users, functional requirements, use cases
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1. Introduction to Deliverable 5.1

Deliverable 5.1 is an output from WP5, User Requirements and Evaluation. D5.1 has two major objectives:

- Gathering and defining usage scenarios.
- Eliciting User Requirements to guide the development of the idSpace prototype v2.

Deliverable 5.1 is a synthesis of contributions from almost all partners.

1.1. Purpose of the document

The main objectives is to investigate, through use case analysis, the factors that constrain the kind of platform idSpace intends to build.

This document describes the user requirements for the web-based idSpace platform. This document will feed the development of the platform and will be a basis for the evaluation of the platform at a later stage of the idSpace project.

This document is intended to be read by the developers of WP1, WP2, WP3, and WP4.

1.2. Scope of the idSpace Platform

IdSpace will be a platform for the effective design of innovative products. The idSpace project attempts to help teams to effectively learn from each other during the collaborative design process and to resolve the limitations of existing tooling by developing an integrated design environment that fosters creativity and facilitates teams to design inventive products effectively.

Market demands innovations more frequently than ever, especially in areas such as software, services, and pharmacy.

Innovation may refer to both radical and incremental changes to products, processes or services, with the implicit goal of solving a problem. New ideas need to be learned, refined, and explored.

1.3. Used Methods

As foundation of this document and the definition of the user requirements we have used the software process standard PSS-05 of ESA (European Space Agency) (ESA, 1991).
This is a widely accepted standard and one of our partners (SAS) is using it on a regular basis. We also followed the guidelines of the standard ISO 13407 (Human-Centered Design Process) (ISO 13407, 1999). This is a standard established by the International Standards Organization for how user research should be involved in designing products.

The standard specifies an iterative cycle of these 4 activities:

- Specify the context of use
  - Part of this document D5.1
- Specify the user requirements
  - Part of this document D5.1
- Produce design solutions
  - Part of deliverable D4.1 (WP4 - Platform development)
- Evaluate designs against requirements
  - Part of deliverable D5.2 (Evaluation Planning) and D5.3 (Evaluation Results)

1.3.1. Initial

User Requirements are the quantifiable and verifiable behaviours that a system must possess and the constraints within which a system must work. In the project phase of agreeing on the user requirements, the scope of the system will be defined.

It is also the process of gathering information about user needs. The PSS-05 standard recommends that:

- User requirements should be clarified through criticism and experience of existing software and prototypes.
- Wide agreement should be established through interviews and surveys.
- Knowledge and experience of the development team should be used to help decide on implementation feasibility and build prototypes.

1.3.2. Used Methods

The following methods were used to define the user requirements and to compile this document.

1. Interviews

- We interviewed staff members from different companies of the network of LiNK MV and the staff members of SAS.
- We used several deliberations with our expert: Prof. Dr.-Ing. habil. Hans-Jochen Günther, Hochschule Wismar, University of Technology, Business and Design.
2. Status quo survey
   • We observed real ideation sessions of SAS and learned about the status quo of this company.

3. Studies of existing software
   • We analyzed a variety of existing software within WP5 and used the state of the art results of WP1 and WP2 (pedagogical scenarios and creativity tools).

4. Feasibility studies
   • In brainstorming sessions with the developers we investigated the implementation possibilities for potential user requirements.

5. Prototyping
   • We analyzed the prototype v1 that is used as the starting point of the implementation of the idSpace platform. This prototype is based on the Microcosmos (Microcosmos, 2008) platform.

6. Use cases and scenarios
   • The usage scenarios conducted were the main source for the elaboration of the user requirements of this document.

Note that some of the requirements presented here are not formal requirements. For example, requirement containing “shall be minimal” is usually not a testable requirement. In the future, those informal requirements should be reformulated as formal requirements that can be tested.

On the other hand, idSpace is a research project and no product development. Thus it is sometimes not possible to formulate formal requirements, before the research work packages have found answers to specific questions.

1.4. Used Documents

Used Internal Project documents:

- Inputs to the IdSpace Vision, SAS, SAS-IDS-IDEAS-101.doc
- Ideation Process in Space Applications Services, SAS, SAS-IDS-IDEATION-100.pdf
- idSpace Geny Smart core use case, OUNL, idSpace_usecase_GenySmart_bit_V_1.doc
- Usage narratives and scenarios, UCY, UCY_Usage_Scenario.doc
- A technology-enhanced learning scenario for helping students collaboratively learn how to design usable web applications., UPRC, UPRC_scenario_HCIdesign.doc
- An Example of how to use Topic Maps in idSpace, MORPH, An Example of how to use Topic Maps in idSpace.doc
- Usage Scenario: MCIS, MORPH, Usage Scenario MCIS - Morpheus.ppt
- Usage Scenarios of Space Applications Services, SAS, SAS-IDS-USAGE1-100.doc
- Usage Scenario: 'Bullet Trap', LiNK, Usage-Scenario_Bullet-Trap.doc
- Usage Scenario: 'NAWARO', LiNK, Usage-Scenario_NAWARO.doc
1.5. **Definitions and Glossary**

NPD  
New Product Development  

Moderator  
Person who initiates an ideation session  

SME’s  
Small and Medium Enterprises  

WP  
Work Package  

UR  
User Requirement  

UR-ID  
User Requirement Identification  

M  
Mandatory priority  

D  
Desirable priority  

O  
Optional priority  

X  
Not testable requirement  

PE  
Platform Engineering  

PS  
Pedagogical Scenarios  

CA  
Context Awareness  

CT  
Creativity Techniques  

1.6. **Overview**

The remainder of this document is structured as follows.

The second chapter describes:

- Product perspective,
- Context of Use,
- User characteristics / user roles,
- Abstract Use Case.

The third chapter defines the user requirements.

Appendix A gives an overview of the collected user scenarios.

Appendix B contains a short state of the art that was used to substantiate the user requirements.
2. General Description

2.1. Product perspective

IdSpace aims to provide an appropriate and useful web-based platform and toolset to support distributed collaboration in creativity, which is the process of generating new ideas, and innovation, which is the translation of the ideas into new products, services, or production methods.

IdSpace Platform - Aspiration Refinement

The idSpace platform is focused on idea generation methods for the "brainstorming" phase. The platform offers methods and tooling to effectively and systematically enhance the collaborative co-construction process of innovative design as a unified whole.

The Key Aspects of Creativity / Ideation / Innovation are:

- Generating ideas
- Capturing ideas
- Evaluating ideas
- Prototyping
- Transferring ideas into new products
- Launching ideas / products

To support the user in realizing their innovation goals, idSpace will offer these key features and attributes:

idSpace will be a Workspace / Platform to:

- Meet, work, and learn
- Create, share, and explore different ideas

The platform will unlock people’s abilities to:

- Access ideas
- Master them
- Explore them
- Transfer them to desired contexts
idSpace will provide:

- Conceptual modeling techniques to represent refine and explore different ideas;
- Context-aware methods to suggest different conceptual views on the ideas, different refinements and transformations of them as well as early product views;
- Pedagogical scenarios guiding the collaborative learning in innovation product design;

Knowledge and ideas will be represented in different conceptual models:

- They can be reused and combined with other ideas
- Context-aware approaches that are used to deliver the conceptual views most relevant for currently explored ideas

The system will support organizational learning processes for innovation:

- Conceptual modeling
- Context-aware methods
- Pedagogical scenarios

The platform will prohibit information overload:

- By context awareness
  - It orders and recommends views on knowledge and ideas

IdSpace is a web-based environment:

- Virtual
- Workplace-like
- Unified access mechanism to knowledge and competences
- Supports other tools

Team Necessity:

Distributed Synchronous / Distributed Asynchronous Collaboration
2.2. **Context of Use**

2.2.1. **Description of the environment**

This chapter gives an account of the real world in which IdSpace will operate. The operational environment is the description of the context of use and the environment for which IdSpace will be developed. It gives a view on the context, the audience and the work to be done.

**Context, audience and New Product Development**

IdSpace aims to support creativity and innovation in the context of New Product Development (NPD). Target audiences are NPD-teams in private and public industrial organizations of different size, ranging from Small and Medium Enterprises (SMEs) to large companies and variety of enterprise forms and sizes. The actors are multidisciplinary team members, participants to the project design, but also possible also stakeholders and representatives of consumers/customers. Innovators go through cycles of divergence, in which new ideas are generated and explored, and convergence, in which new ideas are valued and detailed.

**Description of the environment**

IdSpace can be described by the next 10 keywords (from the idSpace Prime Objectives session Brussels):

1. Web-based collaborative platform for distributed usage
2. Capturing, organizing and reusing ideas
3. Innovative products design
4. Context aware support
5. Learning (about the subject domain) (strategies)
6. Topic maps
7. Creativity techniques
8. Authentic use cases
9. Multi-perspective (different perspectives on different techniques)
10. Domain-aware users

These 10 keywords will be explained below.

1. **Web-based collaborative platform for distributed usage**

IdSpace is a learning- and work environment. It’s more than a support system. It’s a web based environment for collaboration for creative and innovative projects/problem solving. It includes an awareness tool for the collaboration of teams that provides information on activities of persons ideas.
2. **Capturing, organizing and reusing ideas**

IdSpace is an environment where people can experiment by extending the information of that moment in several manners (tagging, enriching with additional information/associations) and by examining it from several perspectives. IdSpace keeps track of the ideas/contributions and the process. It stores the information in an easily accessible way. It reacts during a new project on key words with information from a historical project that is stored. The environment has tools to generate ideas, reuse them, take them apart, criticize them, or even reject them. It’s easy to use. Users experience the merits in the short term.

3. **Innovative products design**

The scope is the solving of ill-defined problems in the context of NPD that are new and cannot be solved with already known procedures.

4. **Context aware support**

IdSpace is an environment that is aware of the problems that the team is occupied with and which generates available knowledge and recommendations for tackling the problem. You can find information about

- Tips and guidance on how to use IdSpace
- Several creative techniques, (what to use, when)
- Optimal team composition, based on actual task and phase
- Phases in a process and the actions

5. **Learning (about the subject domain) (strategies)**

IdSpace provides learner support. It supports informal learning and learning in function of the performance the team should deliver. It gives tips during the ideation and guidance through the product design process. It supports learning on-the-job/learning by doing. For this purpose it gives among others recommendations on smart use of creativity techniques and guidelines for creativity sessions. IdSpace supports informal learning on the subject domain and formal learning on tools and techniques.

6. **Topic maps**

IdSpace enables multiple representations and manipulations of ideas (free writing, imagination and visualization as well as collages like mood boards, enrichment of information via tags and using the concept of topic maps to support relations between the (various components) of ideas.

7. **Creativity techniques**

IdSpace is primarily a work environment with support for main pedagogical strategies and creative techniques for individual and collective ideation.
8. **Authentic use cases**

Target audiences are NPD-teams in private and public industrial organizations of different size, ranging from SMEs to large companies and variety of enterprise forms and sizes.

9. **Multi-perspective (different perspectives on different techniques)**

IdSpace permits experiments and supports to this end several techniques. It supports collaboration, communication, documentation, semi-automatic tagging and saving.

10. **Domain aware users**

IdSpace provides a generic basis with functionalities to tailor the work environment to fit the purpose of creative ideation in a dedicated setting: hence it is possible to adapt and compose the environment for the team and company.

### 2.2.2. Hardware / Software Requirement

The system concept shall create code that is not vendor specific at the client side host. If it is necessary to bind the content to the technology of the specific vendor then there should exist freely downloadable tools for most used operating systems, i.e. Microsoft Windows and Linux and Mac OSX.

However, for the purposes of the project, one platform will be chosen and the project results will be tested only on that platform. Content should be adapted to Internet needs or provided in different sizes/resolutions, so users with small bandwidth can access it (e.g. users should not offer a 20GB movie).

### 2.2.3. The interfaces of the software

The interfaces of the software with external systems will be decided by the developers. As graphical user interface a standard web-browser will be used.
2.3. **User characteristics / User roles**

The target groups are staff members of organizations and companies in different European countries, who are conducting creative innovative processes.

**User groups**
- **End user**
  - The normal user of the system who uses the software to collaborate in an ideation session.
- **Experts (pedagogical scenarios developers)**
  - The experts have to provide the pedagogical scenarios and other learning content and as they are not software developers, they are considered as users.

2.4. **Abstract Use Case**

From the analysis of the user scenarios (c.f. Appendix A) and the state of the art we can see that there is a general procedure for the systematic approach of invention. We can identify three main phases that are necessary for innovation. These three phases represent the abstract use case of idSpace.

**Three Main Elements of Innovation**

1. **Preparation**
   - Problem definition / topic clarification
   - Identifying / contacting / inviting the participants
   - Defining the objectives and the timeframe
   - Ensuring that everyone understands the topic and objective
   - Providing context and additional material
   - Establishing a coherent scope within the team

2. **Ideation Event / Creativity Session**
   - Choosing a useful systematic
   - Using an innovation room
   - Choosing an appropriate creativity technique
   - Generating 'wild' ideas
     - People must learn from each other
       - Clarifying the underlying rationale for their ideas
       - By contextualizing them
   - Sharing ideas
     - Constructively critiquing of ideas
• Critically assessing ideas
  o Their innovative value
  o Look for design oddities
  o Contradictions
• Logging.

3. **Post processing**
• Compiling minutes
• Evaluating, ranking of generated ideas
• Finalizing new ideas or designs
  • Ideas need to be transformed to new products or product features.
  • Alignment with broader goals (e.g. generating value for an organization)
• Goal achieved?
  o No: Start iteration.
  o Yes: Communicating to superior or customer.
### 3. User Requirements

The user requirements will be given in the following table format.

<table>
<thead>
<tr>
<th>UR-ID</th>
<th>UR Description</th>
<th>Priority</th>
<th>Aspect</th>
</tr>
</thead>
</table>

In the case of necessary clarification, additional information will be given in the text below the table row.

**Keys:**

**UR-ID:** User Requirement Identification: UR-classification.number

**Priority:**

- **M** - Mandatory, **D** - Desirable, **O** - Optional, **X** - Not testable

**M** - Mandatory: A mandatory requirement is absolutely necessary to implement. It constitutes a core requirement of the project or a requirement whose non-implementation impacts the essence of the project.

**D** - Desirable: A requirement marked as desirable indicates that the requirement should be implemented. It defines a valuable requirement yet its non-implementation does not impact the essence of the project. Its non-implementation, however, has to be justified.

**O** - Optional: A requirement is rated optional when the requirement is not fundamental (i.e., it provides a marginal added value). Its implementation should be dropped if it interferes with a mandatory or desirable requirement, or if its implementation could jeopardize the timely delivery or budget of the project.

**X** - Not testable: “High level” user requirement that, because of its nature, will not be subject to acceptance tests but is mentioned because it may influence the way in which the system is defined.

**R** - Not defined: yet still to be transformed as an MDOX requirement.

**Aspect:** Relevant Aspect of idSpace. This indicates the work package that has the main responsibility for the implementation of the respective user requirement.

- **PE - Platform Engineering (WP4)**
- **PS - Pedagogical Scenarios (WP2)**
- **CA - Context Awareness (WP1)**
- **CT - Creativity Techniques**
The user requirements are structured in the following classification. The order or classification of the user requirements are no indication of their importance. The importance of the user requirements is only given by the priority (MDOX).

The first three classes match the three main elements of the abstract use case of idSpace.

- Preparation of the Ideation Session (Phase 1)
- Ideation Event / Creativity Session (Phase 2)
- Post processing of the Ideation Session (Phase 3)

User Requirements that are relevant in more than one of the main elements are structured in the classes below. These classes are sorted in alphabetical order.

- Accessibility
- Asynchronous/Synchronous Communication
- Collaboration and Content Sharing
- Content Dependent Functionality
- Creativity Techniques
- Miscellaneous Functionality
- Pedagogical Issues
- Personalization
- Tools
- Tracking
- Usability.
3.1. Preparation of the Ideation Session

**UR-1.1** The platform shall have an assistant, template, or form for the easy definition of the problem.

From a pedagogical perspective clarification of terminology used and agreeing on that and reformulating / restating / rephrasing a problem helps the “understanding of the problem more thoroughly”. For further creativity enhancement in problem analysis and problem solving it is necessary to assess the problem from different perspectives.

**UR-1.2** idSpace assistance shall aid team members to formulate the problem from their perspective and discuss their formulation.

Important for finding shared understanding/common ground between team members.

**UR-1.3** The system shall assist the users by recommending appropriate methods to systematically clarify and explore the initial problem statement using for example prime objective method, methods to restate the problem.

Pedagogical advice will be accompanied by rationale: an explanation of reason and way of use plus the expected added value for the user.

**UR-1.4** The visualization shall help to clarify the subject.

Regardless which technique will be used (e.g. lists, mind maps, topic maps, etc.) the user interface shall provide a good overview of the subject. Visualization granularity and flexibility needs to be in line with purpose. idSpace support might help to select/how to interpret visualization of necessary/new information to the user/group.

The system will alert the user how at certain point a certain representation helps to gain overview, discover yet under-considered issues or articulate shared understanding.

**UR-1.5** The system shall support the identification of the participants of an ideation session.

The system shall provide identification and profiling at the start of each project. Since the role of participants in projects might differ instantiation of id/profiling will be configured at the start of a new project.

Depending on the organizational settings the identification and the profiling of persons might differ.

Since certain information on domain expertise, context and prior experience information is known to be important for trust building, idSpace will provide possibilities to profile team members accordingly. Users need to have the possibility to adapt and update their personal information in the profile.
<table>
<thead>
<tr>
<th>UR-1.6</th>
<th>The system shall allow to contact and invite the participants of an ideation session.</th>
<th>M</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>System shall provide the user with profiling opportunities functional to role fulfillment.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| UR-1.7 | During the invitation of participants to an ideation session, the system shall be able to propose experts with a profile relevant to the specific session. | O | CA,PS |
| Addition: system must be able (in necessary situations) to support optimal group composition. Based on what is known regarding necessary balance of expertise and creative heterogeneity. |

| UR-1.8 | The system shall support the definition of the problem at hand in a distributed collaborative way. | M | PE |
| This means that people can contribute to the definition of the problem while sitting in their offices, and using the system remotely. |

| UR-1.9 | The system shall support the selection of synchronous - asynchronous and hybrid work modes. | M | PE,CA |
| Awareness module will have to adapt it’s processing of supportive actions to the choice of the users/team. |

| UR-1.10 | The system shall support the definition of the objectives and the timeframe of the project and / or the scheduled creativity session. | D | PE,PS |
| Recommendations might provide the user with suggestions on setting/requirements to be taken into account. For example the importance of the ideation phase and the time involved compared to the overall project time (constraints). |

| UR-1.11 | The system shall provide a method that helps the moderator of an ideation session to ensure that everyone understands and agrees with the topic and objective of the session. | O | PE,PS |
| Therefore, idSpace advice will provide recommendations for systematic articulation and mirroring ideas to gain feedback on shared understanding. Question to be answered: Does the system assume that idSpace sessions always have a coordinating person? Or, idSpace sessions (“can”) have a facilitator for the ideation session. The project has to decide which roles are when necessary. a) The session has a human moderator. b) The session has no dedicated moderator. c) The session has a system assistant that takes on the moderation/coordination. |

| UR-1.12 | The system shall provide context and additional material for the ideation session. | D | CA,PS |
| Recommendations point to usefulness and use of activity awareness, process awareness and knowledge awareness. It is necessary for building a shared understanding and the recognition of prior ideas, etc. |
UR-1.13 The system shall implement techniques like the Prime Objective (PO) technique to achieve goal clarity.

Goal clarity in a wider sense is crucial to contribute to a common understanding and for an efficient way of collaborating. Necessary are PS suggestions on usage/implementation of PO and of critical factors for the Prime Objective and tips for facilitator.

The Prime Objective is one sentence of a maximum of three lines long, which captures the vision and can be understood with a unique interpretation. The goal of the Prime Objective is to define, refine and concise the vision, helping to ensure that all participants share the same vision.

- Why at all the Prime Objective is needed:
  - At the beginning of a new project, different participants tend to have different opinions of what the project is or should be.
  - During the project, targets tend to “move around” with time.

The Prime Objective is used during the project period and between project members as an agreed goal.

- Why one sentence and not two or more – from the long experience in Space Applications Services, it was found that when the Prime Objective cannot be stated as one sentence, it means that the project has more than one goal, and therefore the risk of not achieving the right goal, by dissipating in several directions is increased.

- Why only three lines – the Prime Objective must have a unique interpretation that can be understood immediately. Long descriptions tend to open the door for additional interpretation and broaden the scope.

The Prime Objective is defined/negotiated in an iterative manner.

UR-1.14 The system shall help the team in establishing a coherent scope.

Pedagogical advice to build a shared an coherent scope and discussing individual input, sense making and negotiation of meanings.

In addition to the Prime Objective, the scope can be written. The Scope also defines the exact boundaries of the project by telling (like the Prime Objective) what the project is, and in addition to that, telling what the project is not. Usually during the iterative work on the Prime Objective a clear agreement on the scope can be achieved. This understanding can be documented in a table as in the following example:
### 3.2. Ideation Event / Creativity Session

<table>
<thead>
<tr>
<th>Idea</th>
<th>Included</th>
<th>Excluded</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-ground personnel are end-users</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Astronauts are end-users</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Astronaut instructors are end-users</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**UR-2.1** The system shall assist the user in choosing a useful method for the ideation procedure.

The system assists the user in the choice of appropriate methods for the ideation. It provides the unique feature of the technique when appropriate and how to apply. Specific pedagogical issue is when one of the techniques provided is too complex for the user to apply immediately and requires prior training/exercise by the user(s). Then the system has to link to a piece of training or provide adequate “playground of exercise” space plus feedback to coach the idSpace user to a competence level that he can use it in the project.

PS: Additional dedicated action and reflection propositions on 1,2,3,4,5, below.

A method or systematic for an ideation event is more than choosing a creativity technique. An example method could be:

1. Situation analysis (this is beyond the problem definition)
2. Problem mapping and decomposing
3. Using a creativity technique to generate ideas
4. Building ideas portfolio
5. Scoring and selection of best candidates

This example method correlates with the elements of our abstract use case. However, there may be situations where a different method is useful. It will be the responsibility of the research work packages 1, 2 and 3 to analyze this topic.

**UR-2.2** The system shall offer different innovation rooms.

An innovation room is a closed workspace, where the participants of an ideation session are working together.

**UR-2.3** The system shall support different roles: moderator and participants.

The moderator of the ideation process is the person who organizes the session, presents the problem and evaluates the suggested solutions. The role of the moderator is to organize the meeting, to present the problem, and to manage the session. The participants will be invited to the ideation session in order to contribute ideas.

The system can provide pedagogical suggestions for generic facilitation in this context and present ideation specific recommendations. Question is whether the facilitator only
manages and organizes an ideation session or whether this role is applicable to all project phases that take place in idSpace.

**UR-2.4** The system shall offer a number of appropriate creativity techniques.  
About 200 creativity techniques are known in the current state of the art. It will be the responsibility of the research packages WP1, WP2 and WP3, in consultation with WP4 and the present WP on what is feasible and required to choose appropriate techniques. In the section "Creativity Techniques" some examples are listed that were favoured by some of our end users.

**UR-2.5** The system shall support the generation of innovative ideas.  
The system shall implement techniques that drive the participants to have a "flow of associations". System will provide suggestions to enhance the chance to discover novel ideas and expand the flow of creative associations. It will propose affording actions to get as a person/team "into the flow".

**UR-2.6** The system shall support the participants in learning about the ideas of each other.  
For this purpose the system will provide alerts of input and activities of peer team members. The system will provide suggestions on how to profit by learning from ideas of peers and how to communicate ones own ideas.

**UR-2.7** The system shall support the user in clarifying the underlying rationale for their ideas.

**UR-2.8** The system shall support the contextualization of the generated ideas.

**UR-2.9** The platform should provide an easy method for sharing ideas.

**UR-2.10** The system shall support the commenting and critiquing of ideas.

**UR-2.11** Minimum restrictions shall be put on the users during the ideation session.  
During the ideation (the process of creating new ideas), it is very important to provide minimum restrictions on the process. Even the suggestion of providing information about ideas might be too restrictive. For example, naming the idea is a tough task that many times puts huge cognitive load on the users (any programmer face this problem when trying to find a good name for a variable, method or a class). Also the fact that the idea has to be written within a box is, at least conceptually, a disadvantage – as this implies certain order.

**UR-2.12** The system shall provide an efficient way to collect information about the ideation session and its outcome during the session.
### D5.1 idSpace User Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
<th>Priority</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR-2.13</td>
<td>The system shall provide the possibility for personal notes, annotations, structure and re-use elements of the creativity session.</td>
<td>D</td>
<td>PE</td>
</tr>
<tr>
<td>UR-2.14</td>
<td>The system shall provide an efficient way to organize the information about each ideation session and its outcome when the session is done.</td>
<td>D</td>
<td>PE, PS</td>
</tr>
<tr>
<td></td>
<td>System shall offer pedagogical suggestions for collecting/keeping team knowledge. E.g. tagging, individual notes, topic maps, etc. for possible reuse later. Suggestions to take a moment for evaluative reflection (after action reflection).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>It is very important that the ideation session is well documented. During the ideation, quite on purpose a ‘chaotic’ situation is created – many ideas are mentioned, and some are developed more than others. Due to the nature of the process, especially if minimum restrictions are put, the outcome of the session is not organized. Therefore, it is important to provide an efficient way to collect the information during the session as well as to organize and document the session and its outcome when the session is done. Using Topic Maps, one can document the conceptual path one follows through the associations in order to reach a certain idea. That is, not only we document the idea, but one also documents the conceptual effort to reach that idea.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UR-2.15</td>
<td>It shall be possible to integrate past ideation outcomes with future ones.</td>
<td>M</td>
<td>CA, PE</td>
</tr>
<tr>
<td></td>
<td>The outcome from one ideation session should be available for the next sessions. It is important that the outcome can be integrated with other outcomes. It is also important that it can be presented in a way that is easy to interpret and learn. The outcome of ideation sessions will be ideas and their explanations, comments, and ratings (from team members or experts).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UR-2.16</td>
<td>Emphasis shall be put on providing the ideation outcomes in a way that is easy to interpret and to learn.</td>
<td>D</td>
<td>PS</td>
</tr>
<tr>
<td>UR-2.17</td>
<td>The system shall be able to suggest on demand ideation techniques during the ideation session.</td>
<td>M</td>
<td>CA, CT</td>
</tr>
<tr>
<td></td>
<td>During the ideation session, it can be useful if different ideation techniques are suggested on demand by the system. This can be especially useful when there is a conceptual blockage and no ideas are coming.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UR-2.18</td>
<td>The system shall integrate scientific results related to the ideation session in order to ensure its efficiency.</td>
<td>D</td>
<td>CA, CT, PS</td>
</tr>
<tr>
<td></td>
<td>Proven facts related to the ideation session shall be integrated in the system. For example, if it was found that creativity processes should not last more than 30 minutes without a break, the system should suggest a break after 30 minutes. Additionally the system gives pedagogical suggestions, e.g. explains the rationale for the advice.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 3.3. Post processing of an Ideation Session

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
<th>Level</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UR-2.19</strong></td>
<td>During the ideation session the system shall provide contextually relevant associations.</td>
<td>M</td>
<td>CA, CT</td>
</tr>
<tr>
<td></td>
<td>When one is asked to provide a random list of words, usually the resulting list is built from</td>
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<tr>
<td></td>
<td>words that are somehow associated to each other. So the list is “almost” random. Practically we</td>
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<tr>
<td></td>
<td>“surf the associations” in order to produce new words. Unlike the generation of a random list of</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>words, when trying to produce a creative idea, we usually work in certain context. Following</td>
<td></td>
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<tr>
<td></td>
<td>associations for doing that is useful because it allows providing a stream of ideas that are all</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>connected (associated) to this certain context. Here Topic Maps can help: not always we see all</td>
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<td></td>
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<tr>
<td></td>
<td>the associations. However, a tool that can suggest associations related to the point we are in can</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>be very useful.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UR-2.20</strong></td>
<td>The system shall assist the user in identifying ideation design patterns.</td>
<td>O</td>
<td>CA, CT</td>
</tr>
<tr>
<td></td>
<td>It might be that during an ideation session, certain patterns are found – for example, techniques</td>
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<td></td>
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<tr>
<td></td>
<td>that support the process. It might be an advantage to add to the IdSpace platform a tool that</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>allows the identification of such patterns and the documentation of those techniques as “Ideation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design Patterns”, so the techniques can be re-used.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UR-2.21</strong></td>
<td>The system shall be able to trigger an artificial change of direction during ideation session</td>
<td>O</td>
<td>CA, PS</td>
</tr>
<tr>
<td></td>
<td>During ideation session, the moderator is entitled to stop a discussion thread when he feels</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>that this thread has reached its limits. This way, more ideas can be harvested in one meeting,</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>instead of developing only a few ideas. The moderator will have minimal interaction with the</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>system during the session, and therefore the system will be able to assess the situation and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>remind the moderator to change direction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UR-3.1</strong></td>
<td>The system shall support the integration of minutes of meeting from ideation sessions</td>
<td>O</td>
<td>PE</td>
</tr>
<tr>
<td></td>
<td>In some ideation session, the participants are asked to minute the session. Those minutes are</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>integrated when the session is done.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UR-3.2</strong></td>
<td>The system shall support the critical assessment of ideas, especially assessment of their</td>
<td>D</td>
<td>PE</td>
</tr>
<tr>
<td></td>
<td>innovative value, the analysis of design oddities, and contradictions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UR-3.3</strong></td>
<td>For the evaluation of ideas, the system shall support the rating and ranking of ideas.</td>
<td>M</td>
<td>PE, PS</td>
</tr>
<tr>
<td></td>
<td>Provision of instrumentation to weight ideas in order to discover the collective perception</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(e.g. discover the importance of respective ideas).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UR-3.4 The system shall be able to post-process the session by trying to analyze the overall result, indexing it and providing it for the other users of the platform. O PE

This should allow using these ideas further, to reuse them in order to find future ideas for other problems.

UR-3.5 The system shall support that generated ideas are showing a list of related resources, e.g. on mouse over event. O PE

During the ideation event it shall be possible to add related resources or link external material from web to the respective ideas, e.g. images, documents, or websites. At a later stage of the process it shall be possible to have an easy overview about this related resources, e.g. on mouse over event.

UR-3.6 The system shall assist the user in communicating a summary of the session result, e.g. to manager or customer. O PE

UR-3.7 If the objective of the session is not achieved, the system shall propose to start another iteration of the ideation process. D PE

This relates to the "incubation period" / "creative worrying" (see deliverable D2.1). From a pedagogical point of view, a time-out, might be of more value. The issues at hand can be left to creative worrying - "to wander through the subconscious". After some period, the session should be done again.

### 3.4. Accessibility

UR-4.1 The system shall be accessible using a web browser. M PE

The platform will work with standard browsers, i.e. Firefox (M) and Internet Explorer, Opera, Safari, etc. (D).

UR-4.2 Different participants shall be able to use the system in a collaborative way. M PE

UR-4.3 The system shall provide a sufficient degree of privacy (e.g.: in rating, criticizing, voting) M PE

UR-4.4 A mobile access to the workspace (via mobile phone / PDA / smart phone) should be possible. O PE

The system shall allow transforming available materials as much as possible to run not only on personal computer, but using mobile devices also.
### 3.5. Asynchronous/Synchronous Communication

<table>
<thead>
<tr>
<th>UR-5.1</th>
<th>The system shall support asynchronous communication possibilities, e.g. forum, private messages.</th>
<th>D</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR-5.2</td>
<td>The system shall support synchronous communication possibilities, e.g. chat.</td>
<td>O</td>
<td>PE</td>
</tr>
<tr>
<td>UR-5.3</td>
<td>The system shall provide a global forum for discussing general topics like tools for creativity or systematics. It shall allow the exchange of resources, opinions, and impressions.</td>
<td>M</td>
<td>PE,PS</td>
</tr>
</tbody>
</table>

This forum is meant to exchange experiences with the platform and creativity techniques beyond the scope of the users usual workspaces. It should have a community like setting, where users over time contribute and are connected to other users, outside their project team.

| UR-5.4 | The system shall allow users to upload material like video, animation or textual information. | D | PE |

### 3.6. Collaboration and Content Sharing

| UR-6.1 | The system shall foster collaboration between different workspaces. | M | PE |

Whether a user wants to use content from a private workspace or from another session, it should give an easy way to import/export content.

| UR-6.2 | The users shall be able to form temporary or long-term teams by inviting each other. | D | PE,PS |

The system shall inform users and provide guidance, with respect to known advantages and problems with team heterogeneity. Suggesting mixes, fruitful to the creativity design or inhibiting expansion of ideas.

| UR-6.3 | The system shall support the ability to assign groups, teams, or single users to projects. | D | PE |

| UR-6.4 | Users shall be allowed to contribute to the development of the support content (Ideas, knowledge/information, problem solving strategies). | R | PE |

WP1 and WP2 propose to support professionals to work and help them to “learn” embedded in their work. However, evidence is that they don’t perceive that as “learning” in the strict sense, nor that they like “explicit learning”. Hence, the approach is to develop learning enhancing recommendations and scenarios but don’t present them as explicit (e-)learning support. Learning will be more perceived as knowledge development/creation.
UR-6.5 The system shall offer "templates" for creating (pedagogical) scenarios (as a kind of guiding path to create instances of a pattern scenario choosing knowledge development model etc.).

UR-6.6 The system shall permit sharing of information space.

UR-6.7 Resources owned by every user shall be easily shared to public space. The sharing must be controlled by appropriate permissions.

UR-6.8 The system shall enable users to upload agendas (work plans).

This means that users will upload notes of what is going to be discussed, what their collaborators should study before they join the collaboration meeting, what they should prepare.

UR-6.9 The protection of ownership and copyright should be handled to the satisfaction of all users.

The system should support various types of copyright licenses and assignments. However, this is out of scope for idSpace.

UR-6.10 The system shall ensure the easy access to the shared contents. Therefore context awareness is necessary.

3.7. Content Dependent Functionality

UR-7.1 The platform shall support different types of objects: Knowledge creativity patterns/strategies, theory material, tasks, solutions, comments of experts, tests, case studies.

UR-7.2 The system shall support different formats: video, audio records, animation applets, PDF, Word, PowerPoint, HTML, Flash.

3.8. Creativity Techniques

UR-8.1 The system shall provide implementation of different creativity techniques

The list of creativity techniques will be formed in WP2 in consultation with WPs 1 and 3. The current favourite list from WP2 is as follows:
Evaluation
  • Brainstorming / Mindmapping

Questions-based Transformation / Combination
  • SCAMMPPER
  • 5W1H

Question-based Evaluation
  • OSbornes Checklist
  • Force-Field Analysis

Other methods worthwhile looking at:
  • 635-Method
  • Analogical Reasoning
  • Attribute Listing
  • Internal innovative proposals
  • Six Thinking Hats
  • TRIZ
  • TILMAG

The following techniques are special requests by our project partner SAS:

<table>
<thead>
<tr>
<th>UR-8.2</th>
<th>The system should provide communication blurring as a creativity technique.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>CT</td>
</tr>
</tbody>
</table>

It is argued that good and clear communication between team members during ideation can lead to more efficient process. This is correct when the ideas already exist, and can be clear explained. However, when trying to create new ideas, blurred and unclear explanations might lead to creative efforts by the team members in order to understand the new ideas. That is, the communicated idea can be understood as a totally different and new idea.

This can be demonstrated in the following example. When writing clearly a word on a white board, everybody can read that word. When writing a word in a blurred or unclear way, the others have to guess the word. We claim that this guessing is a creative activity – which can lead to other “new” words that match the same blurred criteria.

This means that sometimes, blurring the communication might be a useful technique in the ideation session.

<table>
<thead>
<tr>
<th>UR-8.3</th>
<th>The system shall implement the mixing technologies technique.</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>CT</td>
</tr>
</tbody>
</table>

In past ideation sessions in Space Applications Services, it was found that mixing technologies (for example, Topic Maps and Augmented Reality) led to new ideas for a problem. This technique guides to aim at ideas that mix different technologies that are practiced by the participants. For example, Space Applications Services expertise includes different technologies: ground segments, control centers, control systems for spacecraft and robots, human-machine and human-robot interaction systems and products, visualization systems, space system operation services: ground facility set up, operations preparation, planning, training and execution, knowledge management, simulations, etc.
It is very useful to mix those technologies in order to get ideas for new solutions, projects or products. Example for this is the SATOPI project that involves expertise in two different technologies: Topic Maps and Earth Observation (EO) products (satellite images). In order to promote the mixing of technologies, we organize every first Tuesday of the month a one hour meeting when one colleague presents certain technological aspect which is related to his work.

**UR-8.4** The system shall implement the mixing technologies with domains technique.

This technique guides to try to aim at ideas that mix different technologies for different domains which are practiced by the participants. For example, Space Applications Services is involved in different domains: Space and Aeronautics are the obvious ones, but other domains are also Technical Documentation, Environmental Monitoring or Crises Management. Mixing technologies with domains can also generate ideas for new solutions, projects or products. Example for this is ESNA which mixes a technology (namely wireless sensor networks) with a domain (namely space). The ESNA project targets the creation of a structure of Pico-satellites\(^1\) which builds a wireless sensor network.

**UR-8.5** The system shall implement the generalization technique.

This technique looks at how results from certain project can be generalized in order to provide a novel idea. Example for this can be two projects done by Space Applications Services: the LINDO project which generalizes the AIOBCT project: AIOBCT was a question answering over a specific topic map and which can answer to specific types of questions. LINDO extends this by aiming at a question answering over any given topic map.

### 3.9. Miscellaneous Functionality

**UR-9.1** User shall have the opportunity to add content and to comment on existing content.

**UR-9.2** The system shall provide a full text search over the content in the platform.

**UR-9.3** Each piece of content (i.e. ideas, materials) shall have a versioning option and document control.

**UR-9.4** RSS-feeds. The system shall provide the option to subscribe for proposals to get information (or news) about new projects or new aspects on ongoing projects.

---

\(^1\) Pico satellite is a small satellite with a mass of about 1 Kg.
**3.10. Pedagogical Issues**

The user requirements of this document contain already various pedagogical issues. Pedagogical aspects are inextricably embedded in the creative actions, the things already mentioned. (c.f. interview with David Boud (D1.1): learning is embedded in professional practice, explicit learning “hidden”).

<table>
<thead>
<tr>
<th>UR-10.1</th>
<th>The learning scenarios can be created not only by developers but also by users.</th>
<th>D</th>
<th>PS,PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>In idSpace users will learn about creativity techniques and other relevant aspects by using predefined content. However, learning scenarios will also be used during ideation sessions, when it is necessary to learn about the ideas of the other users or about the project background.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>UR-10.2</th>
<th>Pedagogical support: The platform shall contain a wide variety of learning material for creativity, provided by experts.</th>
<th>O</th>
<th>PS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UR-10.3</th>
<th>The system shall facilitate open learning environments, active learning and learning by doing.</th>
<th>O</th>
<th>PE, PS,CT</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UR-10.4</th>
<th>The system shall allow collaborative learning.</th>
<th>O</th>
<th>PS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UR-10.5</th>
<th>The system shall stimulate self-learning.</th>
<th>O</th>
<th>PS</th>
</tr>
</thead>
</table>

**3.11. Personalization**

<table>
<thead>
<tr>
<th>UR-11.1</th>
<th>The system shall offer the possibility to use some kind of avatar, not only nicknames.</th>
<th>O</th>
<th>PE</th>
</tr>
</thead>
</table>

Personalization requirements will be different for various idSpace org contexts. Options have to afford this ranging from working in persona - anonymously.

<table>
<thead>
<tr>
<th>UR-11.2</th>
<th>The system shall provide an editable user profile.</th>
<th>D</th>
<th>PE</th>
</tr>
</thead>
</table>

The user should be able to change its profile, additionally there should be space for expanding the profile with a picture and other information about themselves, like personal know-how. Suggestions for profile components in the light of trust building are
to provide some personal + context information dependent on already existing personal acquaintances.

**UR-11.3** The system shall be able to apply context by using the user profile.

For example, the system will be able to suggest certain ideation techniques that fit the user expertise or position in the organization.

### 3.12. Tools

<table>
<thead>
<tr>
<th>UR-12.1</th>
<th>The platform shall offer an idsSpace search engine that is able to find projects related to keyword.</th>
<th>O</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR-12.2</td>
<td>The system shall provide a name generation tool.</td>
<td>O</td>
<td>PE</td>
</tr>
</tbody>
</table>

Agreeing on terminology within a project is very important. Naming things – the project name, the different components and modules, and even the names of variables used in software – is important not only for understanding the project, but also for motivating the team working on the project. However, many times it is very hard to find good names. Moreover, the process of looking for a name is, quite often, conceptually blocking: we cannot continue until a satisfactory name is found. Therefore, it is suggested to provide a tool for generating names within certain context. The tool can use thesaurus, WordNet and other similar resources in order to suggest names that relates to key words the user provides.

| UR-12.3 | The system shall support the user in creating a terminology dictionary.                       | D | PE |

During the process of ideation, it is usually found that different terms are not understood by everybody, or they are understood in different manner. In order to avoid misunderstanding, a **Terminology Dictionary** will be prepared. This dictionary is augmented also in later phases.

| UR-12.4 | The system shall offer a presence, “Who is online” function (at least for integrated synchronous communication tools like chat). | D | PE |

| UR-12.5 | The system shall allow users to create pollings for the rating of ideas.                      | D | PE |

Generating the questionnaire and methods for statistics calculation and visualization. Users shall be able to create, edit and delete questions in electronic format in order to evaluate (gather data). Need to get results of polling in standard format (CVS) readable by for example Excel.

| UR-12.6 | The system shall support the global announcements for relevant events.                      | D | PE |
### 3.13. Tracking

<table>
<thead>
<tr>
<th>UR-13.1</th>
<th>The system shall offer an overview of what has happened after the last login (new postings, new messages, new tasks etc.) with direct link to the relevant part (for all user groups/roles).</th>
<th>D</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The platform shall provide the history of work (transparency - who has done what).</td>
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</tr>
</tbody>
</table>

| UR-13.2 | The system shall offer a tracking of contribution of users (last login, visited classes/pages, used materials, delivered tasks, no. of forum postings etc.). | O | PE |

### 3.14. Usability

<table>
<thead>
<tr>
<th>UR-14.1</th>
<th>The learning effort needed for using the system shall be minimal.</th>
<th>X</th>
<th>PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost effectiveness is a crucial point. It is very difficult to demonstrate cost effectiveness in relation to creativity process. Therefore the cost for using the system should be minimal. That is,</td>
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</tbody>
</table>

- The learning curve should be minimal. The system should be simple enough that it is obvious how the system can be used.
- The overhead time in using the system should be minimal. For example, after ideation session, the organization of the outcome should be done in extremely efficient way – so the users will actually engage in this activity. |

<table>
<thead>
<tr>
<th>UR-14.2</th>
<th>Emphasis shall be put on making the use of the system efficient.</th>
<th>X</th>
<th>PE</th>
</tr>
</thead>
</table>

| UR-14.3 | The system shall support Drag-and-Drop of content from one idea to another. | O | PE |

| UR-14.4 | The system shall offer step-by-step guidelines for the available tools. | D | PE |

| UR-14.5 | The system shall offer a user management system. E.g. the assignment of a user to a group or a workspace must be flexible and quickly to do. | D | PE |
### D5.1 idSpace User Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
<th>Priority</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>UR-14.6</td>
<td>Minimum clicks principle. The key options of the system shall be reachable with minimum clicks.</td>
<td>D</td>
<td>PE</td>
</tr>
<tr>
<td>UR-14.7</td>
<td>The system shall offer a task manager with reminder function.</td>
<td>O</td>
<td>PE</td>
</tr>
<tr>
<td>UR-14.8</td>
<td>The system shall be used without the help of a specialist and shall not require programming skills.</td>
<td>M</td>
<td>PE</td>
</tr>
<tr>
<td>UR-14.9</td>
<td>The platform shall be able to provide contextual help and FAQs on each step and throughout all possible situations the user can get into.</td>
<td>O</td>
<td>PE</td>
</tr>
<tr>
<td>UR-14.10</td>
<td>Data exchange shall be simple through common export formats.</td>
<td>O</td>
<td>PE</td>
</tr>
<tr>
<td>UR-14.11</td>
<td>The platform shall be user-friendly for inexperienced users.</td>
<td>M</td>
<td>PE</td>
</tr>
</tbody>
</table>
4. Appendix A - Usage Scenarios

4.1. Usage Scenarios of Space Applications Services

4.1.1. ESA Invitation to Tender

Task

An invitation to tender from the European Space Agency (ESA): concept for habitat of the crew traveling to Mars.

Problem

Ideas are needed – what can be suggested?

Action 1

Brainstorming session is organized with four colleagues – two software engineers and two operations engineers. The mixing technologies pattern is used:

Suggestions are, that in addition to HMI (Human Machine Interface) issues, psychological issues and architectural issues will be addressed in the proposal.

Action 2

The Prime Objective of the suggested project is defined.

Solution

The proposal is prepared.

The IdSpace tool allows documenting the needs.

Before the brainstorming the Moderator gets assistance of how to prepare the brainstorming (Brainstorming Wizard).

During the brainstorming the Moderator gets hints from the tool about which patterns might be useful. The mixing technology pattern is suggested.

After the brainstorming the tool allows to integrate the minutes of meeting.

The Prime Objective Wizard supports the Moderator and the other colleagues in defining the Prime Objective (this wizard has also email component allowing automatic distribution of suggestions related to the Prime Objective during the process).
### 4.1.2. Software Tools for the Columbus Operation Personnel

<table>
<thead>
<tr>
<th>Task</th>
<th>Demands for number of software tools to support operation personnel for the ISS Columbus laboratory.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem</td>
<td>Time to deliver is too soon and very critical</td>
</tr>
<tr>
<td><strong>Action 1</strong></td>
<td>Prime objective and Scope for each tool are defined.</td>
</tr>
<tr>
<td><strong>Action 2</strong></td>
<td>Plan B approach is exercised.</td>
</tr>
<tr>
<td><strong>Action 3 Solution</strong></td>
<td>The tools are prepared with the minimum requirements that make them useful, and are improved later.</td>
</tr>
<tr>
<td><strong>Prime Objective Wizard</strong></td>
<td>The Prime Objective Wizard supports the moderator and the other colleagues in defining the Prime Objective.</td>
</tr>
<tr>
<td><strong>Plan B</strong></td>
<td>The tool assists in identifying plan B and in keeping points for plan A.</td>
</tr>
</tbody>
</table>
4.1.3. LINDO Architecture

Task
Initial architecture for portable domain question answering system should be defined in the LINDO project.

Problem
In the LINDO research we have several different approaches for implementing such

Action 1
First session is organized where the requirements are defined.

Action 2
All colleagues who are working on the project are asked to provide suggestions for the architecture.

Action 3
Second session is organized to discuss the different suggestions.

Solution
Candidate architecture is defined.

Problem
The "devil in the details" effect: a certain step in the architecture proves to be problematic.

Action 4
All colleagues are asked to look into this issue.

Action 5
A brainstorming session is organized to solve this specific issue.

Solution
Ideas collected from all colleagues are merged to provide a solution.

The tool allows documenting the needs in a collaborative way.

The tool allows collecting suggestions in a collaborative way.

The tool presents the different suggestions and allows comparing them.

Before the brainstorming the Moderator gets assistance of how to prepare the brainstorming (Brainstorming Wizard).

During the brainstorming the Moderator gets hints from the tool about which patterns might be useful.

After the brainstorming the tool allows to integrate the minutes of meeting.
4.2. Usage Scenario by OUNL

This is the first draft of a use case from a WP1 perspective. It provides the setting of Geny Smart embedded in an innovation design team Energy2Move at M@eco looking for (pedagogical) support during the design process for new eco-mobile power cells.

We have the idea that it would be a good idea to construct and improve during the project a number of use cases. We propose to construct them modularly, starting from a core use case and elaborating per phase or type of use.

In our first straightforward example we describe Geny Smart as a person working in a, more or less, traditional enterprise. At a later stage, for example, we can elaborate on what it means when Geny is working in a distributed team in a context of a loosely coupled setting of autonomous entrepreneurs brought together around a project initiated by the government.

Yet other elaborations can explore the effects on user requirements with a different team composition (novice / expert) etc.

[Introduction]
Geny Smart just finished his studies ‘Environmental Sciences’ at the OUNL and ‘Design’ at the Eindhoven Design Academy. Last month he joined M@eco as an eco-designer. He has been added to the new Energy2Move project aiming to find new eco-friendly ways to the battery needs of equipment like laptops, PDAs and mobile phones etc. The team further consists of three senior engineers highly specialized in respectively mobile technology, chemistry of batteries and ICT. In addition two team members with a somewhat longer working history, have a marketing and manufacturing background. The official head of the team Sam Oldy (what’s in a name) has to take care of project management and communication with the division’s top management and other stakeholders.

Sam Oldy is proud to collaborate in idSpace. idSpace is a suite especially developed to support innovative design. The suite can be used in a distributed way. Team members log in from there workplace (their desktop at the office home or elsewhere). Today Sam decided to use the team room at the head office. He has experienced that even when people will not meet later on in the project, it works well and team members appreciate to get together, socialize and have a beer or meal together.

[Entering idSpace]
Each idSpace session starts by logging in into one of the idSpace project workspaces.

[Individual brainstorming session]
Once logged in to the *Energy2Move* workspace in *idSpace* each team member starts with an individual “jot down” session writing and drawing, sketching and telling what comes up concerning the new project. Before starting the session *IdSpace* offers the opportunity for each team member to adjust the help and instruction function at his personal level of expertise. Geny chooses the “newbies” recommendation mode. No boundaries are set except an end time for this individual brainstorming session.

*IdSpace* provides easy to use tools to express ideas and more importantly one already can tag these; creating new tags or use existing tags. Tagging is functional in order to find one’s way in one’s own notes in the collaborative brainstorming session. Personal notes are kept and annotated in one’s own workspace.

The awareness widget indicates that other team members are active as well and depending on what the timeslot which has been set in the team *idSpace* alerts when the end of the individual session is nearby.

**[Individual problem exploration session]**

In the second section of the individual session, individual team members are invited to zoom in and ‘jot down’ their view on the problem to be solved. This session generates an overview of all the relevant aspects of the ‘problem space’ as seen by each individual. The final alert when time is over asks individual team members to end and save their work in this session and join the others in the team space. It is the individual team member who transfers and integrates the ideas and ‘problem space’ in the team space (drags/sends).

**[Collective brainstorming and problem exploration session]**

Next a collective brainstorm takes place in the team’s workspace. Facilitation, i.e. preventing that the team jumps to conclusions and already scrutinizes and criticizes ideas brought forward before that phase arrives is supported by recommendations available in *idSpace*. The team of professionals can consult these suggestions or ask to have alerts on possibilities at set moments in time.

Geny likes the fact that especially in these early phases *IdSpace* offers maximum freedom of expression. He uses the possibility to sketch and describe how he sees the problem and what type of product he sees in his mind. He uploads an animation of a prototype and attaches an audio annotation via a podcast to it. The great thing is that while having the freedom to use the best method of expression it doesn’t end up in a terrible mess that makes it impossible to re-member and re-find ideas generated. *IdSpace* enables during all the stages of the process to give meaning to ideas, associations and relations between them using the ToplQ tags.

**[idSpace user system relation]**

As Geny explains: “As team and team member you can enrich ideas brought to table by annotations and link them with relations that might express how you associate these ideas. When during the process your ideas change you can also change the way you organized your projects maps.”
And in a separate modus you can look back into the history so that you can come and return to earlier team ideas, when the new road you entered proved to be a dead end.

So actually the organization of your design ideas in idSpace grows with you. It follows your needs to express loosely coupled ideas, connect them and structure them formally according to certain (design) conventions and give them new meaning as a team by defining terms and relations and actions for this design. In one of the representation modes a tag cloud is generated so that we can see which tags/terms we use and how important they are. Additional options idSpace offers are for visualizing similarities and differences. The timeline option gives you insight in the lifecycle of an idea. I find this option especially interesting since I noticed I tend to narrow down my focus rather early in the design process leaving out important ideas. IdSpace with this function offers a “re-minder” system.

Initially I tended to use default settings of the display which suggests screen components that are relevant for that design phase. I used these settings for about a week, to feel comfortable since the system offers so many options. But like my colleagues I composed my work appearance, according to my preferences and needs already customizing it from the first day onwards. In this way I have my personal combination like everybody else. And the nice thing is we have all different idSpace looks according to our personal likings.

For sure you can imagine that after the individual brainstorm and the “team-idea-storm” session our batteries were empty. It’s amazing the number of ideas you generate in a short period of time. And how the interaction generates new ideas and associations!

Then when the first stream ends idSpace offers additional suggestions. Design patterns are suggested: for example a name giving exercise, the suggestion to apply views and conventions from a totally different domain on your problem, and the idea to let someone play the devil’s advocate etc, etc

The TopIQ tagging mode is also used to articulate the rationale for design ideas. My senior colleagues state that this really helps the team to recall why certain options were presented earlier. Luckily it has a really light-weighted format which adds crucial information, unlike the rather formal design rationale procedures that I came across during my studies.

It is up to the team to apply a certain design pattern, which IdSpace suggests and for which it offers the enabling tooling. Suggested actions are not automatically executed, advices are not prescriptive. That’s fine with me since you want to be approached as a professional, an expert in your own field, capable of self-organization in projects and knowledgeable. However always open to new opportunities for advancement of learning and invention.

I feel respected as a professional team member. Thus we feel the IdSpace recommends suitable options and it offers services to our needs instead of imposing methods on us".

idSpace - 2008 - 216199
[Design of the collective solution]
The richness of ideas generated in the early phases has to converge to feasible options for the new product design. For this purpose IdSpace has an option to assign weights to ideas brought forward. For this purpose IdSpace offers a variety of weighting and voting options one can use to decide on the collective design. The voting system can be used to rank the relative importance of ideas.

[idSpace memory]
In the meantime idSpace collects and archives ideas in the Energy2Move project’s memory. Apart from the tags attached to the information, idSpace adds additional tags to enable adequate responses to queries at a later stage. Sometimes IdSpace therefore requests some additional information to make the project’s “memory” sustainable over time.

[idSpace planning for action]
After an incubation period of one week the team finally went through all their ideas. Retaining the ones that were viable and discarding the ones that were not. For this they used the idSpace ‘viability of ideas’ toolset. This toolset uses the criteria generated in the problem exploration phase. They reviewed all ideas using those criteria. The team ended with three viable ideas that were handed over to their management for further decision-making.

[idSpace Evaluation]
In order to improve on future ideation sessions IdSpace finally evaluates the process and the outcomes using the ‘Evaluation’ toolset.
Example of innovation process using different creative thinking techniques

<table>
<thead>
<tr>
<th>Task</th>
<th>Identified potentials to improve innovation process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of new eco-mobile power cells</td>
<td>1. <em>Multiple representation</em> formats to represent and eventually update the design assignment. Ability to include graphical representations.</td>
</tr>
<tr>
<td>Individual brainstorming session</td>
<td>2. Easy to use tool to express ideas in words and graphics, relate these and tag these.</td>
</tr>
<tr>
<td>Action 1</td>
<td>3. Possibility for personal notes, annotations, structure and re-use elements of brainstorm.</td>
</tr>
<tr>
<td>Action 2</td>
<td>4. Advice/evt training per phase on applicable techniques (learning/creativity).</td>
</tr>
<tr>
<td>Individual problem exploration session</td>
<td>5. &quot;overview&quot; and &quot;association&quot; options for top level view of all relevant aspects (problem space + associations between topics)</td>
</tr>
<tr>
<td>Action 3</td>
<td>6. Transfer of individual (views) of problem analysis to the integrated team view</td>
</tr>
<tr>
<td>Collective brainstorming and problem exploration session</td>
<td>7. Recommendations for creative and effective ideation. Suggestions to prevent problems like jumping to conclusions and judgment of input during brainstorming phase (instead of postponement)</td>
</tr>
<tr>
<td>Action 4</td>
<td>8. Provision of instrumentation to weight ideas to discover the collective perception (i.e., discovering the relative importance of respective ideas).</td>
</tr>
<tr>
<td>Design of the collective solution</td>
<td>9. Support for co-construction of the collective solution, using techniques to create common ground. Support for systematic evaluation/verification of the proposed solution.</td>
</tr>
<tr>
<td>Action 5</td>
<td>10. Advi  ces addressing options to improve learning from teammates, feedback on peer input etc.</td>
</tr>
<tr>
<td>Planning for action</td>
<td>11. Evaluation toolset to assess the design action (plan) concurrent ideation and criticizes ideas brought forward before that phase 4 arrives.</td>
</tr>
<tr>
<td>Solution</td>
<td></td>
</tr>
<tr>
<td>Three viable ideas</td>
<td></td>
</tr>
<tr>
<td>Action 6</td>
<td></td>
</tr>
</tbody>
</table>
4.3. **Scenario's by UCY**

The user is entering his account. In the main page of his account he sees the list with all the workspaces that he is a member, and he gets a list of notifications with the recent news, the last actions and the recently added ideas in these spaces. He checks if there are any requests-invitations from other workspaces or individual persons. He has one invitation from a group-space and 2 invitations automatically generated by the system. He checks the automatic invitations. He is checking the rationale of the invitations. The first invitation is explaining that his profile interests are related with a new idea of this work-space. The second automatic invitation is explaining that his input data in the workspace “Ideas for the new Health Center in my city” that he belongs, is related with the new work-space “New Sport Center in my city”. He accepts the second invitation and in the screen he sees the screen divided in two parts, each one includes the input data of all the group members of each workspace. A pop up window is opening in the screen. This window includes all the ideas that he entered in the “health center” workgroup and there is an option to transfer these ideas to the “sport center” workgroup. He accepts for all the ideas the page is refreshing and redirecting to the new workgroup. In the new workgroup environment he sees a virtual presentation of the brainstorming and each idea that is placed there is a link. He passes the mouse over a link and a pop-up is presented which includes a list:

- Related Uris
- Related Publications
- Videos
- Audios
- Images etc.

At the bottom of the main screen there is a section with the same list but the title has the word “Filtered”. In this section the user sees the content that is related with this workgroup, extracted from all the ideas, filtered with the rules that the author of the group has set.

The user closes this workgroup and he wants now to set up a new idea and create a new workspace. He wants to start a project with general subject “ecological transportation means” but he wants to find a more specific subject. Before he set up the new subject he checks for other subjects and workgroups close to his general subject. He is entering the keywords of the subject in the search machine and he finds the existing subjects alike his own. He also receives from the search machine an amount of sources (links, audios, videos, images) that contain the keywords and some title proposals that is a combination of the keywords that they are not used in other workgroups. Now he has a clearer image of what he wants to create. He wants to create a project for a “new high speed airplane”. He returns to the set up environment and he is entering the new subject. After the submission of the new subject he receives a list of people that probably have relation with the subject, a list of similar workgroups of other ideas, and a new list of urls, publications, videos, etc. He sends invitation to some of the people of the list to join the workgroup. He selects some of the proposed workgroups and he selects ideas from the other workgroups to be transferred to his own project. The list of content (links, audios, videos, images) is automatically filtered and updated.
The new idea’s environment now is set up and the user thinks that he needs a specialist’s opinion. He clicks on the button, “Find specialists” and he gets a list of specialist on the subject. He invites the specialists that he wants, and he has the option to open a chat room where the specialist can discuss with the members of the workgroup and the specialist is coaching the brainstorming procedure.
Scenario 2 by UCY

The expert creates a new project for the "ecological transportation means" but he wants a more specific subject to work on.

He searches in idSpace's search machine to find projects related to the keywords of the subject. The system returns list of similar projects and resources.

He decides the final project title: "High speed ecological airplane."

He opens a new whiteboard for the project.

He selects the participants of the project. Some of the participants are proposed by the system.

He sends invitations to the selected participants.

He chooses the communication methods that will be used during the collaboration. There are multiple methods of communication like chat, email, file transfer, real time idea exchange etc.
4.4. Usage Scenario by UNIHILDESHEIM

This usage scenario presents a requirements engineer in a software company who wants to create an innovative web 2.0 platform. We focus here on the part of the work of the requirements engineer that focuses on coming up with a suitable idea. The presented creativity session consists of three parts, where each emphasizes a different stage in the creative process:

1. **Exploration**: In this stage the user will create a large number of possible ideas.
2. **Transformation**: In this stage, the ideas created in the first stage will be transformed, structured and modified in different ways using different creativity techniques which support modifying ideas in various ways.
3. **Validation**: In this stage creativity techniques will be used to analyse the ideas and choose a suitable solution for the given problem.

We split the scenario because it is possible to categorize the creativity techniques according to their applicability in a certain stage. This categorization allows us to reduce the number of techniques needed to be analyzed and also helps to limit the number of choices in each stage. A detailed description of the operation types and other characterizations is included in the deliverable D2.1.

The Scenario

The three columns contain the following information.

- **Actor**: who performs the action. This can either be the user (U) or the system (S)
- **Action**: the action performed by the used or the system
- **Type**: this column is used to annotate actions where we think that input from the different R&D work packages is needed to make them work. The three possible values are
  - C: The action will require the system to be aware of the user and its actions. It somehow needs to interpret them and react accordingly (WP3)
  - S: The system needs to perform a semantic transformation of the data the user is currently providing (WP2)
  - L: The user needs to be taught how to properly use creativity techniques. The system should somehow provide context sensitive feedback to support the user in mastering the techniques proposed by the system.
**D5.1 idSpace User Requirements**

<table>
<thead>
<tr>
<th>Actor</th>
<th>Action</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Session 1. Initial data input – User A’s explorative creativity session</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>open web browser</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>log on to platform</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>start the creativity session to create an innovative product</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>proposes a personalized list of exploration techniques and preselects brainstorming based on the profile of user A</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>accepts the suggestion</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>launch the brainstorming view of the platform</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>starts typing in his ideas</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>while ideas flow unconscious starts sorting them in groups</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>becomes aware that the users adds the topics in a structured form by analysing the layout of the topics on the screen</td>
<td>C</td>
</tr>
<tr>
<td>S</td>
<td>suggests to change the input mode from brainstorming to mind mapping since they are similar techniques, but inserting relations allows to structure the data</td>
<td>C/L</td>
</tr>
<tr>
<td>U</td>
<td>accepts to change the input mode</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>pops up a dialog asking if it should try to automatically draw connections</td>
<td>S</td>
</tr>
<tr>
<td>U</td>
<td>doesn’t want to get interrupted while his ideas flow. He just ignores the pop up box and continues to work</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>while inserting more topics for a while</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>realizes that the user stops inserting new topics</td>
<td>C</td>
</tr>
<tr>
<td>S</td>
<td>suggests to stop the mind mapping session and focus on something different</td>
<td>L</td>
</tr>
<tr>
<td>S</td>
<td>proposes further steps</td>
<td>L</td>
</tr>
<tr>
<td>U</td>
<td>accepts this suggestion</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>pops up another dialog asking the user whether he would like to complete his mind map as there are still topics floating around without any relation to the main topic</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>accepts this suggestion</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>highlights the unconnected elements</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>detects that some of the topics are grouped together. It shows a suggestion which ones it would connect automatically</td>
<td>S</td>
</tr>
<tr>
<td>U</td>
<td>approves the suggestion by clicking on the grouped topics</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>concludes that he has worked enough for now and ends this session</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2. Data transformation – Users A and B’s cooperative creativity session applying transformation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>A and B decided that they need to transform the initial thoughts of users A into something more structured</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>both log onto the platform from different locations</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>A opens his old creativity session and invites B</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>knows that the meta model of data generated with mind mapping is a general graph. Selects a checklist based method since it is an appropriate method to enhance a general graph.</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>knows that B has successfully applied the CATWOE technique in several projects before</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>A and B both agree on using this method to enhance the graph.</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>the user interface shows a window containing the mind map created by user A</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>a second window shows the questions asked by the CATWOE technique</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>presents the first question: Customers?</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>searches its database for former transformations of mind maps with CATWOE</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>uses the retrieved information to show a preselection of possible customers</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>A selects some of the proposed customers</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>B accepts the suggestion of the system</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>stores the overlapping customers</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>both start to select the topics in the mind map that are customers and add new ones in the process</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>provides a chat between the users allowing B to ask A questions about unclear topics</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>their chat and questions helps them to generate new ideas which are inserted by both users into the mind map or the text fields for the questions</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>inserts the newly created ideas into the mind map</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>depending on the question and the selected topics it suggests a connection to other topics on the mind map. E.g. A inserts a new customer in his list between two existing ones and then connects the new one to same parent as the existing ones. The system could try to realize this after some time,</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>following this scheme, they continue with the other five questions of the checklist, always being able to jump back and forth between question and change and also to switch seamlessly among techniques</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>finally they decide that they added enough information for now and close this session</td>
<td></td>
</tr>
</tbody>
</table>

**Step 3: Idea Validation - User A’s creativity session applying verification**

<table>
<thead>
<tr>
<th>U</th>
<th>logs onto the platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>the workspace shows that he has a couple of ongoing sessions, sorting them by the activities done previously</td>
</tr>
<tr>
<td>U</td>
<td>He decides to validate the session: innovative web 2.0 product</td>
</tr>
<tr>
<td>S</td>
<td>suggests bullet proofing as validation method</td>
</tr>
<tr>
<td>U</td>
<td>accepts the suggestion</td>
</tr>
<tr>
<td>S</td>
<td>presents a screen comprised of the mind map with the additional information inserted by CATWOE</td>
</tr>
<tr>
<td>S</td>
<td>presents the first question: what might go wrong?</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>U</td>
<td>starts selecting items from the mind map that might go wrong.</td>
</tr>
<tr>
<td>U</td>
<td>clicks on an item to open the context menu and adds additional information like a more detailed description of what might go wrong</td>
</tr>
<tr>
<td>S</td>
<td>using its ability to process natural language it will try to identify words in the additional information which correspond to topics in the mind map and suggests the user to link them</td>
</tr>
<tr>
<td>U</td>
<td>regards one suggestion as useful and accepts it.</td>
</tr>
<tr>
<td>S</td>
<td>inserts an annotated link in the mind map</td>
</tr>
<tr>
<td>U</td>
<td>selects a guided mode where the system presents him one topic after the other to add additional information about what might go wrong</td>
</tr>
<tr>
<td>U</td>
<td>after enhancing all topics on the list he concludes that he has finished this session</td>
</tr>
<tr>
<td>U</td>
<td>logs of the platform,</td>
</tr>
<tr>
<td>S</td>
<td>post processes the session by trying to analyse the overall result, indexing it and providing it for the other users of the platform</td>
</tr>
</tbody>
</table>
4.5. **Usage Scenario by MORPH**

- **Occured Problem**: Customer order for an eLearning system, based on MAIUS, which is the customers' thematic, multi-course and project-based educational concept.
  - Customer and a consultant from Morpheus analyse the wish of the client to create an eLearning environment which suits the new educational concept. Identifies the problem to choose an concept for the elearning environment that fits the MAIUS-concept.

- **Action**: Brainstorming session with the customers' project owner, the customers' education expert and Morpheus' consultant. (time: 60 minutes)

- **Action**: Analysis of the generated concept by consultant and the development team leads to the choice for a semantic approach using Topic Maps.

- **Occured Problem**: The customers' usability test shows that the GUI is not intuitive enough for inexperienced users. Identifies the problem of finding a GUI which enables people not experienced in creating knowledge models to use the elearning environment smoothly.

- **Action**: Brainstorming session with consultant and the entire development team. (time: 60 minutes)

- **Action**: Analysis of the generated concept by consultant and the chief technology officer.

- **Solution**: Use the ontology itself (the knowledge map) to drive the user interface.

Existing ideas for using semantics to capture knowledge (also by non-present Morpheus-people) were used as well as knowledge about existing elearning environments.

Input about GUI techniques from a (non-present) third party was used.
### 4.6. Example of innovation process by LiNK MV

#### 4.6.1. Usage Scenario: 'Bullet Trap'

<table>
<thead>
<tr>
<th>Individual operation</th>
<th>Creativity Techniques</th>
<th>Results of the tasks</th>
<th>Potential to improve innovation process</th>
</tr>
</thead>
</table>
| Task description     | Demands by contractor | • Absorption of high kinetic projectile energy  
• Minimal danger to periphery  
• Minimal environmental burden  
• Solid energy absorption with long lifetime |  |
| Problem description  | Brainstorming by principal and agent | • For static targets, a bullet trap effects the absorption of the kinetic energy of the bullet  
• Available solutions, like sand-panels or rubber-bricks are hazardous waste  
• Contamination by bullets of different substances  
• The separation of the bullets is too costly | Principals experiences |
| Analyses of the task description | Brainstorming by principal and agent to define the minimal requirements and ideal solution | • Minimal requirement: Simplified separation of projectile and energy absorber  
• Ideal Solution: Automatic separation | Experiences of principal and agent |
| Problem analysis     | Function- or process analysis | Determination of function structures and conflict pair description | Support through software tools |
| Known solutions      | Patent-, Internet-, and Literature research | Patents for existing solutions:  
• Sinkhole model for dynamic dead run  
• Sand wall bullet capture | Support through Patent Information Centers and external commission |
<table>
<thead>
<tr>
<th>Conflicts</th>
<th>Description of conflict</th>
<th>Conflict pair: Bullet &lt;&gt; Energy absorber</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Changeable component: Energy absorber</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conflict:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High kinetic energy leads to wastage of absorber and to environmental burden</td>
</tr>
</tbody>
</table>

**Conflict solution employing "Technical Contradiction"**

- **Application of TRIZ by expert:**
  - Description of the "Technical Contradiction" with Technical Parameters (TP)
  - Abstract solutions with Contradiction Matrix, defined by Innovative Principles (IP)

**Contradictions:**
- "High velocity (TP9)" of the bullet requires a "Reliability (TP27)" of the absorber.
- "Power (TP10)" and "Energy consumption of the moving object (TP19)" requires the prevention of "Exterior negative influence to the object (TP30)".

**Solution through Innovative Principals (IP):**
- (IP18) > Utilization of mechanical vibrations
- (IP35) > Change of aggregate state
- (IP28) > Substitution of mechanical principles
- (IP11) > prior interception / prevention
- (IP01) > Segmentation / partition
- (IP27) > cheap short life cycle instead expensive long life

**TRIZ-Software:** Collection of example solutions based on innovative principles; Experiences of method use

**Substantiation of the abstract solution**

- **Brainstorming for solution finding through application of innovative principals at the concrete example**

**Polymer damping:**
- Polymer brick acquires damping and bullet trap
- Polymer is a low melting thermoplastic
- On saturation of the plastic it will be replaced
- Bullets are separated by melting of the damper

**Spiral damping**
- Spiral with high viscid bio-oil
- Oil acquires damping
- Spiral geometry provides kinetic energy loss of the bullet

**Dry ice damping ...**
Usage of databases

<table>
<thead>
<tr>
<th>Effects data base with search items, e.g. &quot;absorb energy&quot;</th>
<th>Broadening of the solution variants</th>
<th>TRIZ software tools</th>
</tr>
</thead>
</table>

Collection of the solutions, Solution assessment and solution selection

| Systematic of the solution concepts | Systematization in accordance with criteria: Geometry, spatial structure Material usage, change of state Mechanical principles Usage of electrical fields in conjunction with magnetic liquids | Assessment techniques (Criteria, Rating modes, weighting) |

4.6.2. Usage Scenario: 'NAWARO'

German acronym for "Nachwachsende Rohstoffe" / "Regrowing Commodities"

<table>
<thead>
<tr>
<th>Individual operation</th>
<th>Creativity Techniques</th>
<th>Results of the tasks</th>
<th>Potential to improve innovation process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task description</td>
<td>Demands by contractor</td>
<td>Application of straw (NAWARO - German acronym for regrowing commodity) as insulator in different areas, particularly shipbuilding</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problem description</th>
<th>Brainstorming by principal and agent</th>
<th>Observance or surpassing of SOLARES-standards: • Inhibit passage of flames for 30 min • Temperature at reverse site of wall &lt; 140°C</th>
<th>Principals experiences</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Analyses of the task description</th>
<th>Brainstorming by principal and agent to define the minimal requirements and ideal solution</th>
<th>• Minimal requirement: Reduction of inflammability of slabs with limited NAWARO application • Ideal Solution: Noncombustible slab with maximum NAWARO application With the given material (straw) it are to fabricate insulating slabs with this requirements: homogeneous body, self-supporting, without cover</th>
<th>Experiences of principal and agent</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Problem analysis</th>
<th>Function- or process analysis</th>
<th>Determination of function structures and conflict pair description</th>
<th>Support through software tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known solutions</td>
<td>Patent-, Internet-, and Literature recherche</td>
<td>Patents for existing solutions:</td>
<td>Support through Patent Information Centers and external commission</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------</td>
<td>-------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Natural Fiber insulator</td>
<td>Insulating material from biogenic commodities</td>
<td>Insulating material out of seaweed</td>
<td>No solutions for straw usage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflict</td>
<td>Description of conflict</td>
<td>Conflict pair: Source of fire &lt;&gt; NAWARO</td>
<td>Changeable component: NAWARO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conflict: Despite high temperature, stability and solidness of the insulating material must be guaranteed.</td>
<td></td>
</tr>
<tr>
<td>Conflict solution employing &quot;Technical Contradiction&quot;</td>
<td>Application of TRIZ by expert: Description of the &quot;Technical Contradiction&quot; with Technical Parameters (TP) Abstract solutions with Contradiction Matrix, defined by Innovative Principles (IP)</td>
<td>High stability (TP13) and solidness (TP14) are to be guaranteed despite of very high temperature (TP17) Solution through Innovative Principals (IP): (IP35) &gt; Change of aggregate state (usage of additives) (IP01) &gt; Segmentation / partition</td>
<td></td>
</tr>
<tr>
<td>TRIZ - conflict solution via &quot;Material-Field-Model&quot;</td>
<td>Application of TRIZ by experts: Description of &quot;Material-Field-Model&quot; and the solution</td>
<td>Receiver: NAWARO-structure Perpetrator: source of fire Field with harmful impact at receiver: temperature-field Problem solving: Adding additional material to the NAWARO structure, to damp the temperature impact, to shield the NAWARI structure or to delay gas escape</td>
<td></td>
</tr>
<tr>
<td>TRIZ - conflict solution via &quot;Talented Thinking&quot;</td>
<td>Application of TRIZ by experts: &quot;system of small figures&quot;</td>
<td>A system of small impersonal beings take on business to accomplish the given tasks: Reflect temperature Enclosing NAWARO-elements to absorb escaping gas</td>
<td></td>
</tr>
</tbody>
</table>
## D5.1 idSpace User Requirements

| Substantiation of the abstract solutions | Brainstorming for solution finding through application of innovative principals at the concrete example | Idea 1: Additives, supplements shield the commodity and acquire active fire control  
Idea 2: Pre-treatment of commodities inhibits gas escape at heating  
Idea 3: Supplements inhibit gas escape by absorption  
Idea 4: Structural modification: Supplements, | Consultation of material experts |
|----------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------|
| Usage of databases                      | Effects data base with search items, e.g. “fire resistance”                                    | Polymerization as problem solving:  
Copolymer increases the fire-resistance of batting  
Fire-resistance improvement in polymer materials  
Bromating increases the fire resistance of polydiphenylenptalide; the bromine molecules strengthen the intermolecular bonds in the polydiphenylenptalide molecules  
Compression of organic material minimizes oxygen access and inflammableness | TRIZ- software tools |
| Collection of the solutions, Solution assessment and solution selection | Systematic of the solution concepts | Systematization of solutions, assessment, choosing for realization | Assessment techniques (Criteria, Rating modes, weighting) |
5. Appendix B - Short State of the Art

This State of the Art (STAR) is not directly part of D5.1, but is necessary to create a list of realistic user requirements. We need an understanding of state of the art creativity techniques, systematics, knowledge management, etc. to be able to demand realistic user requirements from the developers. The content of this document is therefore restricted to aspects that could be relevant for the implementation of the idSpace platform and the execution of the idSpace use cases.

5.1. Creativity Tools

5.1.1. TRIZ

TRIZ is a Russian acronym and could be translated with "The theory of inventor's problem solving". It was developed by the Soviet engineer and researcher Genrich Altshuller and his colleagues starting in 1946.

TRIZ is a methodology, tool set, knowledge base, and model-based approach for generating innovative ideas and solutions for problem solving. TRIZ, in contrast to techniques such as brainstorming (which is based on random idea generation), aims to create an algorithmic approach to the invention of new systems, and the refinement of old systems (see e.g. Souchkov (2007) for more information).

TRIZ was developed by inspection of a huge number of patents, whereby those were selected that seemed to be a technological breakthrough. By analyzing this patents three major regularities were found:

1. A big number of inventions are based on a small number of solutions principals.
2. We need to overcome contradictions to allow for innovative developments.
3. The evolution of technical systems follows certain patterns and rules.

The methods and tools include:

- Effects Database
- 40 Inventive Principles
- Contradiction Matrix
- 6 Inventive Standards
- Trends of Evolution of Technical Systems
- 9-Windows Method (or System Operator Method)
- Su-Field Modeling
- Technical Contradiction Method
- Physical Contradiction Method
- Smart Little People's Modeling
- Cause-Effect Analysis
- Function Analysis; Function and Attribute Analysis
What of TRIZ could be useful for idSpace?

Some of TRIZ is open source, some - especially knowledge databases - is owned by commercial organizations. Some of the procedures and maybe some of the algorithms of TRIZ are worth to be considered for idSpace. The most interesting features are the mechanisms that help to transform a problem to a solution by processing the problem at an abstract level and the techniques for solving inventive problems based on systematic approach.

According to Souchkov (2007) TRIZ methods and techniques can be used in four situations:

1. To solve a specific problem, which is formulated as a negative or undesired effect (a product degrades too fast, engine breaks, projects fails, sales drop, and so forth).
2. To explore a system (business or technological), and find existing bottlenecks and undesired effects which can be further improved with TRIZ tools and techniques.
3. To analyze evolutionary potential of technological or a business system and propose next generations of the system.
4. To predict potential failures in new products and processes and help with their prevention.

"Although originally created for engineering applications, today TRIZ gradually develops to a meta-theory, which is based on a heuristic approach to explain how we solve problems and generate breakthrough ideas." (URL, 2008a)

However, engineering creativity is not always applicable for real world problems - typically business problems, artistic creativity and so on. Here a more open style is probably more effective. Note that this isn't a criticism of TRIZ. The system itself works excellent for what it is designed to do. TRIZ was original designed for engineers, to be used by engineers. We have to analyze for which kind of problems it really is the optimal choice and where we need more open techniques for creative thinking.

Figure 1. Source. Valeri Souchkov, www.xtriz.com

In Fig. 1 we see a useful systematic that could be used as an inspiration for a procedure within the idSpace platform.

5.1.2. www.triz40.com

This website offers an online overview of the 40 Principles for Innovative Problem Solving. These 40 TRIZ principles are known solutions to solve contradictions. Using these known solutions in new problems can bring innovative solutions! They also offer a full TRIZ Matrix, a database of known solutions (principles) able to overcome contradictions. It consists of the worsening features and the improving features.
This website also offers the access to a patent database. As TRIZ is based on patents analysis, it is one method of TRIZ to consider existing patents and to adapt them to solve the current problems in an innovative way. Patent databases are therefore a good opening to find inspiration if you need to overcome a technical problem.

5.1.3. ASIT

ASIT (Advanced Systematic Inventive Thinking) is a creative thinking method derived from TRIZ, developed by Dr. Roni Horowitz. It is not available as a software product to support creativity, but as an online training course in using ASIT (URL, 2008b)

5.1.4. Goldfire Innovator

Goldfire Innovator [4] integrates a problem analysis workbench with a patented semantic knowledgebase, helps engineers and scientists build structure around the innovation process, including such steps as organizing ideas, researching prior patents, exploring potential new markets and competition and evaluating risk so the most lucrative ideas are capitalized on.

With a base pricing for Goldfire Innovator of about $100,000 it is not suited for the intended user group of idSpace. However, it gives a good overview of state of the art feature set of software for innovation and creativity.

The software consists of three major tools and three major sources of knowledge (source: Invention Machine software (URL, 2008c)):

**Innovator Workbench**

- Customizable wizards help users to precisely define problems and opportunities, then formulate creative solution strategies.
- Provides a common language for analyzing design intent and prioritizing solutions.
- Embeds proven methods such as Theory of Inventive Problem Solving (TRIZ), Value Engineering, Root Cause Analysis, and Failure Mode and Effects Analysis (FMEA).

**Researcher**

- Answer questions, identify solutions, and generate ideas with precision access to relevant internal and external data.
- Intuitive natural language query interface supports English, German, French, and Japanese queries.
- Automatic summaries and visual topic browsing enable fast, efficient document review.

**Trend Analysis**

- Packaged set of analytic tools examines patent activity for a technology, company, or inventor to validate ideas, research evolving markets, and track competitive directions.
Goldfire Intelligence

- Invention Machine’s proprietary content houses thousands of scientific concepts - uniquely organized for engineers.
- Stimulates thinking outside one’s core discipline or area of expertise.

Personal, Corporate and External Knowledge

- Semantic indexing of internal corporate documents and knowledge banks lets users leverage corporate wisdom.
- Accommodates more than 250 document types, personal data, private and shared drives, e-mail, Internet content, and deep web links.

Collaboration Repository

- Facility to collect, manage, and automatically re-use the analyses, research, and solutions generated by innovation projects.
- Ensures critical design and problem-solving rationale remains visible across product lifecycle.

5.1.5. Topic Maps

An Example of how to use Topic Maps in idSpace (MORPH)

Topic Maps is in essence a way to represent knowledge and ideas are nothing more or less than bits of knowledge concerning a specific question or problem. In a creativity session people create ideas in an interactive setting. Thus they are generating knowledge. Ideas (and thus knowledge) can be inspired (or based) on ideas generated earlier in the same creativity session or it can be inspired (or based) on ideas generated from previous sessions of that same group or by other groups.

Topic Maps can capture this knowledge while it is being generated or after is has been generated, whatever the wish of the user might be. It can also capture the associations that people make. Furthermore it can even point out similar topics or associations to the user, which he can use merge ideas or expand on them.

Example

In the schema below there is an example of the usage. There are two creativity sessions, the current creativity session in which several users are participating and a previous creativity session which resulted in two ideas. Beforehand the director of the creativity session has selected existing knowledge, relevant for the current session.

In the current session two ideas are brought forward. Each idea has 3 properties. In that same session a user has pointed out a similarity between two properties. The system can then merge these two. So, when someone looks at idea A he can see that there is a relation with idea B.

In that same session the system has detected similarities (Sim-2 & Sim-3) between two existing ideas and the two newly generated ideas. The system can present the similarities to the group as a new angle of discussion and might lead to a new idea C. The group can then decide that property-5 and property-10 are indeed similar and will be merged into new combined property.
In short:

- It provides a close-to-natural way of structuring and representing ideas and knowledge (topics, their associations and their properties); thus, writing down an idea will take less time and effort.
- Users can build on existing knowledge to generate new ideas; the system can even point out similarities between the new knowledge and the existing knowledge.
- The ‘director’ of a creativity session can locate usable existing knowledge and instruct participants beforehand about the domain of the session. By doing this, the participants don’t have to dig through large amounts of information during the session. Instead they can suffice with only the knowledge that is relevant for this specific session and this specific domain.
- It is easy to share knowledge as well as context and scope between users separated in space (or time). Besides capturing knowledge, Topic Maps also captures scope and context of an idea.
- Because the creativity techniques are part of the topic map, the way an idea is generated, can be recreated, which enriches the evaluation afterwards.

After processing the generated ideas, the proposed similarities and the information about the creative process, the new knowledge map would look as follows.
5.2. **Systematics**

5.2.1. **VDI 2221**

System-technical problem solving cycles. Systematic from VDI2221 that could be used as a systematic for idSpace.

```
Problem
Confrontation with state of information and know-how,
Recognition of essential requirements

Problem analysis
State the problem more precisely in the "language" of the customer

System statement
Actual problem solving and searching for solutions, possible solutions and corresponding alternatives

System analysis
Gathering information + analysing the qualities of the "solution pool"

Rating
Assessment (poss. weighting) of solution qualities

Decision
Continuing system development or abortion of system

Next life period of the system
```
6. References


Microcosmos (2008) - collaboration and communication environment, (c.f. deliverable D4.1)


