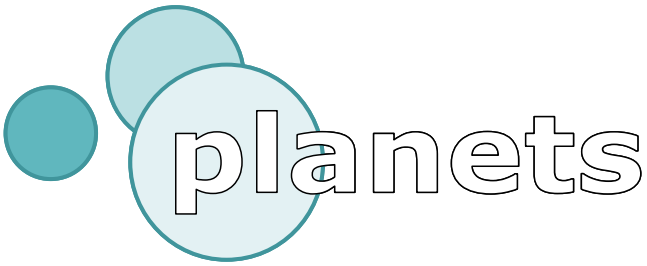

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Abstract

The selection of preservation strategy is one of the core areas in digital preservation endeavours. Heterogeneous content, complex preservation requirements and goals, and untested tools make the selection of a preservation strategy very difficult. The Planets Preservation Planning Approach provides a way to make informed and accountable decisions on which preservation strategy to implement in order to most suitably preserve digital objects for a given preservation context. It allows the explicit definition of requirements and goals and offers a systematic way to evaluate preservation strategies. The applicability of this approach was explored in a series of case studies with various institutions, the case studies are presented in this report.
We are developing tool support for the Planets Preservation Planning approach. The tool supports the individual steps in the workflow and will integrate various services from other workpackages in the Planets project. In this report, use cases are defined that are guiding the development of the software.

Keyword list:

Digital Preservation, Preservation Planning, Evaluation

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1.2	TUWIEN	08/08/07	revised
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1.7	TUWIEN	31/08/07	revised
1.8	TUWIEN	27/09/07	revised and final version

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Ref	Document	Date	Details and Version
1	Stephan Strodl, Christoph Becker, Robert Neumayer, Andreas Rauber: How to Choose a Digital Preservation Strategy: Evaluating a Preservation Planning Procedure	June 2007	Proceedings of the ACM IEEE Joint Conference on Digital Libraries (JCDL'07), Vancouver, British Columbia, Canada, June 18-23, 2007. pp 29-38
2	Christoph Becker, Stephan Strodl, Robert Neumayer, Andreas Rauber, Eleonora Nicchiarelli Bettelli, Max Kaiser: Long-Term Preservation of Electronic Theses and Dissertations: A Case Study in Preservation Planning	October 2007	Proceedings of the Ninth Russian National Research Conference on Digital Libraries: Advanced Methods and Technologies, Digital Collections (RCDL'07), Pereslavl, Russia, October 15-18, 2007 (accepted for publication)
3	Stephan Strodl, Carl Rauch, Andreas Rauber, Hans Hofman, Franca Debole, Giuseppe Amato: The DELOS Testbed for Choosing a Digital Preservation Strategy	November 2006	Proceedings of the 9th International Conference on Asian Digital Libraries, November 27-30, 2006, Kyoto, Japan, pp 323-332
4	Alistair Cockburn: Writing Effective Use Cases	2001	Addison-Wesley
5	Eng U. Choo, Bertram Schoner and William C. Wedley: Interpretation of criteria weights in multicriteria decision making	1999	Computers and Industrial Engineering, Volume 37, Number 3, 1 November 1999 , pp. 527-541(15)
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EXECUTIVE SUMMARY

This report, a result of the workpackage PP/4 in the Planets project, presents Planets' approach to defining and evaluating preservation strategies.

The selection of preservation strategy is one of the core areas in digital preservation. Heterogeneous content, complex preservation requirements and goals, and untested tool make the decision very difficult. The Planets Preservation Planning approach provides a way to make informed and accountable decisions on which solution to implement in order to most suitably preserve digital objects for a given purpose. It is based on Utility Analysis (7) to evaluate the performance of various solutions against well-defined requirements and goals.

Figure 1 presents the workflow, followed by a brief description.

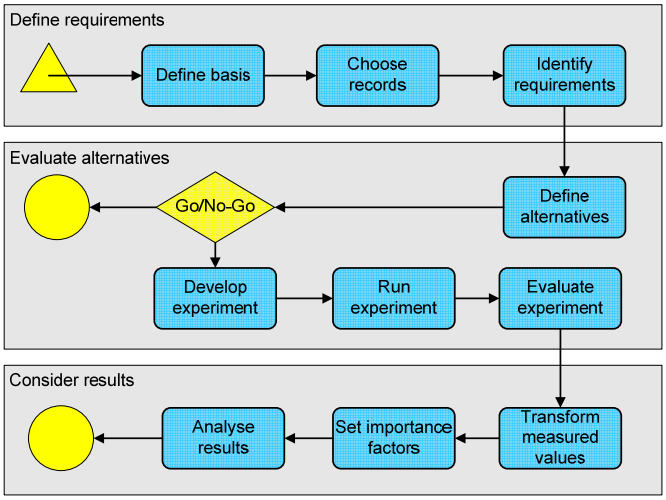

Figure 1 Planets Preservation Planning workflow

The 3-phase process, consisting of 11 steps, starts with defining the preservation scenario, choosing sample records for experiments, and identifying the requirements and goals for the preservation scenario. The second part of the process consists of the definition and evaluation of potential preservation alternatives. Therefore, alternatives are identified, including technical settings and required resources for running experiments. The Go/No-Go-Decision enforce a review of the work in the previous steps. The experiments are set up and run. The last step of the second phase is the evaluation of the experimental outcomes against the requirements and goals defined in the first phase.

In the third part of the workflow, the results of the experiments are aggregated to make them comparable, the importance factors are set and the alternatives are ranked. The stability of the final ranking is analysed with respect to minor changes in the weighting and performance of the individual objectives using Sensitivity Analysis. After this consideration, a clear and well justified recommendation for one of the alternatives can be made. The viability of this approach is shown in a range of case studies for different preservation contexts. In this work we present its application to two scenarios of web archives, two collections of electronic publications, and a collection of multimedia art. This work focuses on the different requirements and goals in the various preservation contexts.

We are developing tool support for the Planets Preservation Planning approach. The tool supports the individual steps in the workflow and will integrate various services from other workpackages in the Planets project. In this report, use cases are defined that will guide the development of the software.

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1 Introduction

Digital Preservation is an emerging cross-disciplinary research area that requires involvement of computer scientists, archivists, librarians, curators, as well as researchers from the humanities. Within Digital Preservation, many areas can be identified and are well reflected within the Planets project. Planets workpackages comprise Preservation Action, Preservation Characterisation, and Preservation Planning.

Identifying, evaluating and selecting a preservation strategy that meets an institution's needs is a core Digital Preservation task. Wide ranges of factors are relevant, including technical, procedural, and financial. Preservation Planning tools therefore need to provide decision support components as well as experimentation, documentation and logging facilities. In addition to providing support for users' data acquisition, accountable documentation is a vital aspect and therefore a crucial success factor.

The Planets Preservation Planning approach is based on the previous work of the DELOS Preservation Testbed (3). The DELOS Testbed combines the Utility Analysis approach developed at the Vienna University of Technology and the Dutch Testbed from the National Archive of the Netherlands. A prototype tool was developed for the Testbed in the DELOS project. In the PLANETS project, the workflow was refined based on practical experience and feedback from the user community.

This document describes the Planets Preservation Planning approach in detail. It allows the explicit definition of requirements and goals and offers a systematic way to identify and evaluate preservation strategies. A numeric evaluation of the results based on Utility Analysis (7) enables a repeatable, accountable and documented decision on which preservation strategy to implement. The applicability of this approach was explored in a series of case studies with various institutions. The Planets Preservation Planning Approach was presented at (1) (2).

In order to support the Planets Preservation Planning approach we are developing a software tool, called Plato (planning tool). The tool implements the planning approach and it will use Planets services and registries to assist the workflow and provide semi-automated steps. The first version of Plato will be available in November 2007.

The remainder of the report is organised as follow: Chapter 2 describes the methodology of the Planets Preservation Planning approach; Chapter 3 presents the Case Studies; Chapter 4 lists a set of use cases that will guide the development of a software tool to support the workflow.

2 Workflow

An overview of the Planets Preservation Planning workflow is presented in Figure 2.

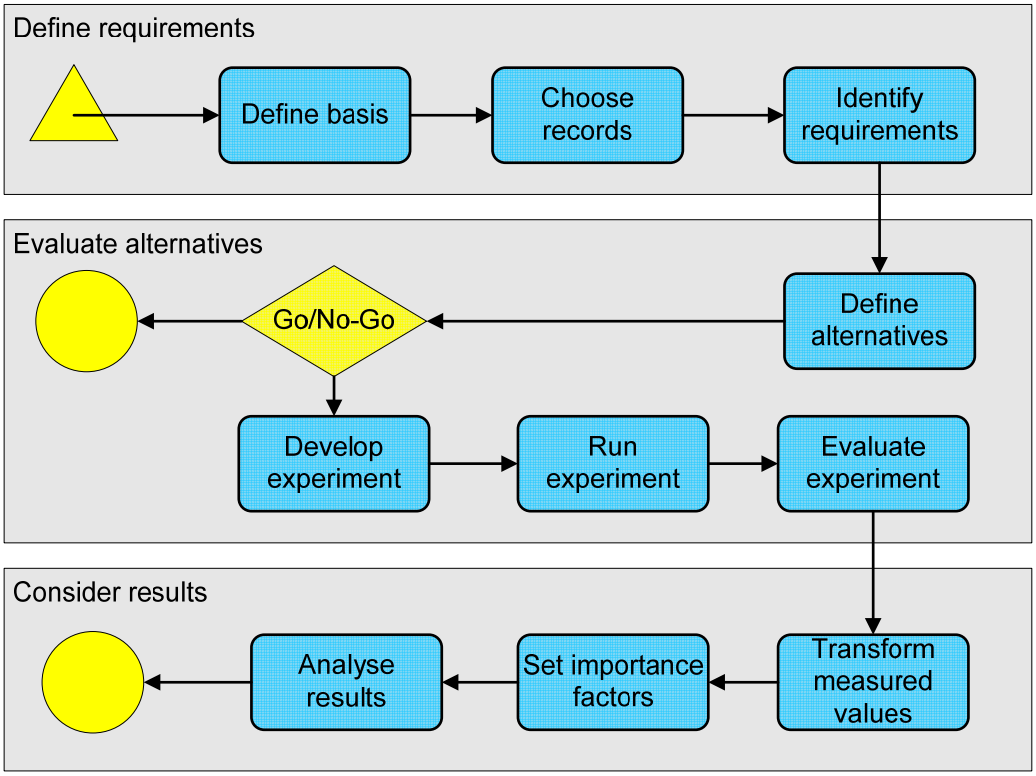

Figure 2 Overview of Planets Preservation Planning workflow

The 3-phase process consists of 11 steps. It starts with defining the preservation scenario, choosing sample records for experiments, and identifying the requirements and goals.

The second part of the process consists of the definition and evaluation of potential preservation alternatives. Alternatives are therefore identified, including technical settings and required resources for running the experiments. The Go/No-Go-Decision enforces a review of the work in the previous steps. In the experiments the preservation alternatives are applied to the sample records. The final step of the second phase is the evaluation of the experimental outcomes against the requirements and goals defined in the first phase.

In the third phase results of the experiments are aggregated to make them comparable, importance factors are set and the alternatives are ranked. The stability of the final ranking is analysed with respect to minor changes in the weighting and performance of the individual objectives using Sensitivity Analysis. After this consideration a clear and accountable recommendation can be made for one of the alternatives.

The workflow shown in Figure 2 is described below in detail.

1. Define basis

In the first step, the preservation scenario is described in a semi-structured way including the collection to be considered. Information about the collection includes details about the objects, number of objects in the collection, and legal requirements for handling the records. Moreover, the environment is described in which the preservation process takes place including institutional policies for preservation.

2. Choose records

In this step, a representative sample of records from the collection. The samples, usually between 5 and 10 objects, are later used on for evaluating the preservation alternatives.

3. Identify requirements

The goal of this step is to define clearly the requirements and goals (objectives) for a preservation solution in a given domain. High-level goals are specified, collect detailed requirements, and organise them into a tree structure, referred to as the tree of objectives or shortly, 'objective tree'.

While the resulting trees usually differ according to specific preservation context, some general principles can be observed. At the top level, the objectives can usually be organised into four main categories:

- *Object characteristics* - describe the visual and contextual experience a user has when dealing with a digital object. Subdivisions may be 'Appearance', 'Content', 'Structure' and 'Behaviour', with lowest level characteristics being colour depth, image resolution, forms of interactivity, macro support, or embedded metadata.
- *Record characteristics* - denote the technical foundations of a digital record, the context, interrelationships among records and metadata. A record can include one or more objects.
- *Process characteristics* - refer to the preservation process. These include usability, complexity, or scalability.
- *Costs* - have a significant influence on the choice of a preservation strategy. Usually and may usually be divided into technical and personnel costs-as or start-up and operational expenditures.

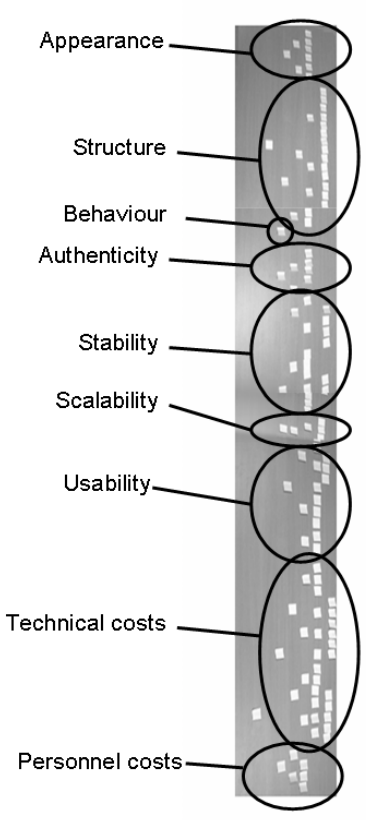

Figure 3 Objective tree created with post-it notes

The objective tree is usually created in a workshop with experts from different domains contributing to the requirements gathering process. The tree is independent from the preservation actions that are considered. It models the requirements, not the actions to be taken. The tree documents the individual preservation requirements of an institution for a given collection of objects. Typical trees may contain from 50 up to several hundred objectives, usually organised in four to six hierarchy levels.

Objective trees were initially created with post-it notes on a flip chart. Figure 3 shows an objective tree constructed with post-it notes.

While this is convenient for certain environments, an alternative way has been introduced and the feedback on it has been very positive. This involves the use of mind-mapping software, usually projected onto a large screen to provide an overview, to allow multiple stakeholders working on the tree.

Figure 4 shows a screenshot of an objective tree using mind-mapping software, which was edited during a preservation planning workshop.

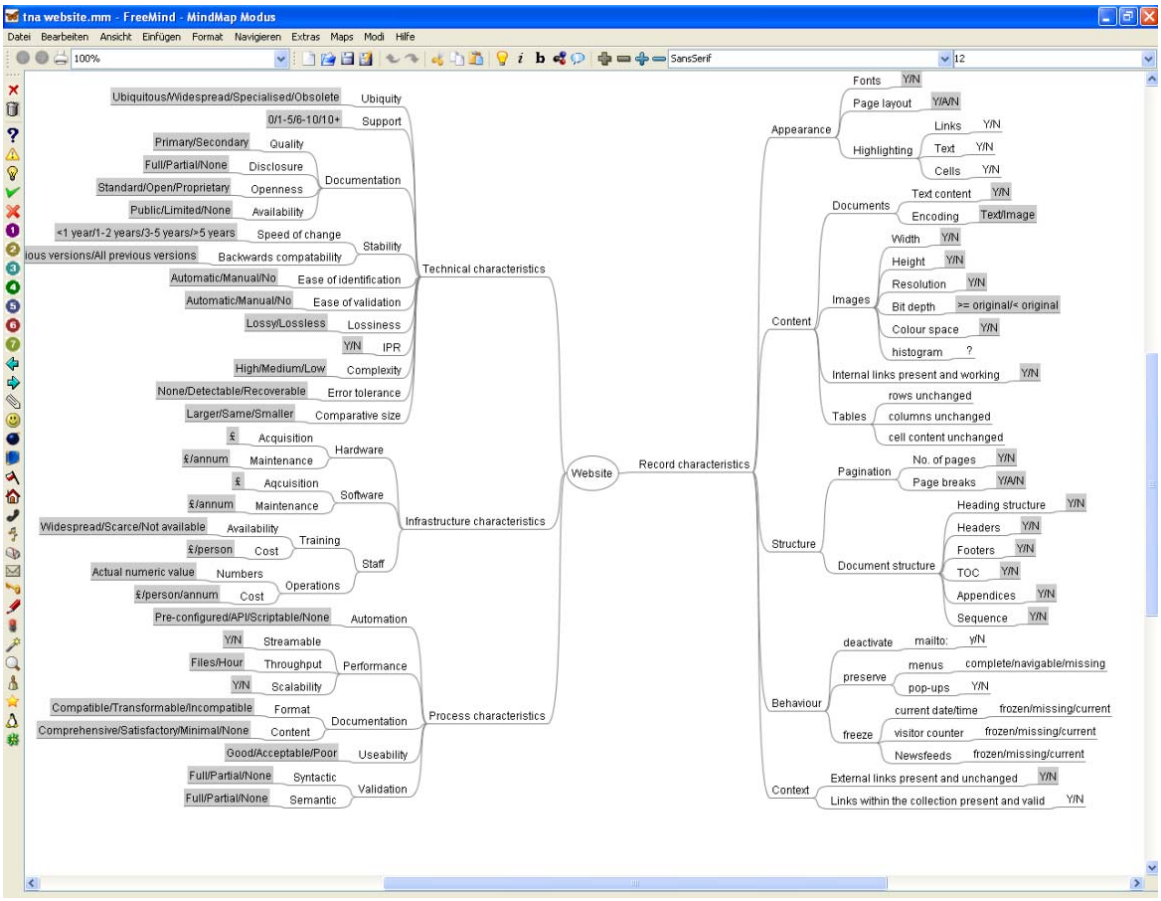

Figure 4 Use of a mind-mapping software for building objective trees

Having defined the objectives, the next step is to assign measures to each of the objectives in the tree, which provides metrics to determine how successful a requirement is met. Wherever possible, the metrics should be objectively quantifiable (e.g. € per year, frames per second). In some cases, (semi-) subjective scales are necessary, for example degrees of openness and stability, support of a standard, degree of file format acceptance within different communities.

4. Define alternatives

Different preservation strategies, using for example migrations tools or emulators, are selected. A detailed description of each preservation alternative is provided. The description includes the software environment and parameters settings of the tool, in order to ensure a clear understanding of the alternative and allow a later re-evaluation of the planning process. For each defined alternative, the amount of work, time, and money required for running experiments is estimated.

5. Go/No-Go

Some experiments need a considerable amount of effort and required resources to run the experiments, for example experiment with great number of alternatives or high cost of hardware and software to run the experiments. Feasibility of the proposed alternatives are determined in this step by considering the defined requirements, the selected preservation alternatives, and estimated resources. The result is a decision for continuing the evaluation process or a justification of the abandonment or postponement of certain alternatives.

6. Develop experiment

In the experiments, the preservation alternatives are applied to the previous defined sample records. The results of the experiments are later evaluated against the goals and requirements of the objective tree. In order to run repeatable tests, it is important to document all relevant experiment settings. This stage produces a specific development plan for each experiment, which includes the workflow, the software and hardware systems used for the experiments, and the mechanisms to capture the results. All items needed for the experiment will be developed and/or installed and tested, including copies of the sample objects, software packages and programs, and mechanisms for capturing the results.

7. Run experiment

Experiments are designed to test one or more aspects of a specific preservation alternative when applied to the previously defined sample records. Running an experiment produces results, for example converted computer files, revised metadata, and measured workload of the hardware. The results are evaluated in the next step.

8. Evaluate experiments

The results of the experiments are evaluated to determine the degree to which the requirements defined in the objective tree were met. Therefore, the leaf objectives defined in the objective tree are evaluated with the defined measurement unit. For each alternative, the outcomes of this stage are measured performance values for each leaf in the objective tree.

9. Transform measured values

The measurements taken in the experiments might all be measured on different scales. In order to make these comparable, they are transformed to a uniform scale using transformation functions. These transformation functions can define thresholds or injective mathematic functions to map the measured values to the uniform scale. The resulting scale ranges from zero to five. A value of zero denotes an unacceptable result and thus serves as a dropout criterion for the whole preservation alternative.

10. Set importance factors

Not all of the identified objectives are equally important and different degrees of conformance of a solution are accepted in different objectives. This step assigns importance factors to each objective depending on the specific preferences and requirements in the scenario.

11. Analyse results

In this step, the performance measures for the individual objectives are aggregated to one single comparable value for each alternative. Currently the following methods are available:

- Sum – The measured performance values, as transformed by the transformation functions, are multiplied by the weighting factor. These values are summed up to a single comparable value per alternative. Leaf values that score zero (measured performance under required minimum threshold) have no decisive effect on the final root value.
- Multiplication – The first step here is to multiply the comparable value per leaf by the weight of that leaf. The results are then multiplied throughout the tree for the whole alternative. The multiplication method highlights alternatives with drop out values, as these alternatives with leaf values zero have a final root value of zero.
- Sum of Advantages – This aggregation allows the comparison of two alternatives against each other, it is a comparative comparison of two alternatives. The DELOS Testbed (6)

has implemented the aggregation function Sum of Priority, which is based on integer numbers. Because we introduced real numbers for the uniform scale in the Planets approach, this aggregation is not feasible.
The newly introduced Sum of Advantage function supports the comparison of real numbers. Each alternative's leaf value is compared to the leaf values of the other alternative. The final value for the alternative with the higher leave value is the difference, the final value for other alternative is zero. These values are summed up over the tree and form a final value for each alternative. The final values of an alternative show the difference of the performance compared to the other alternative.

We thus obtain aggregated performance values for every part of the objective tree for each alternative, including an overall performance value at the root level.

A first ranking of the alternatives can be done based on the final root values associated with each alternative. This ranking is based on the specific requirements of the preservation context. It forms the basis for a documented and accountable selection of a specific preservation alternative. Furthermore, an analysis of all parts of the objective tree can identify the strengths and weakness of an alternative.

In addition to ranking, Sensitivity Analysis may be performed by analysing, for example, the stability of the ranking with respect to minor changes in the weighting of the individual objectives, or to minor changes in the performance. This will result in a stability value for each alternative and each objective, which may further influence the final decision.

The result of the preservation planning process described above is a concise, objective, and well-documented ranked list of preservation alternatives for a given preservation context, considering institution-specific requirements. By providing both overall and detailed performance measures, based on the standardised and repeatable experiments, it allows the selection of most suitable preservation strategy.

3 Case Studies

To evaluate the viability and the benefits of the presented approach, we performed a series of case studies with several partner institutions within the Planets project and one institution outside the Planets consortium.

Here we report details of five case studies involving

- two web archives, one in a library and the other in an archival institution
- two collections of electronic publications with scientific provenance
- a large collection of born-digital multimedia art

3.1 Web Archive Collections

As part of the preservation activities in Preservation Planning sub project of Planets, we held a workshop with the British Library (BL) and The National Archive of the UK (TNA) to define the preservation requirements for both organisations' web archiving collections. The two-day workshop took place in December 2006 in London, the TNA was represented by the head of Digital Preservation. Web curators and preservation experts from the British Library attended the workshop. In the workshop, the requirements for the whole web archiving collection were defined. A web archiving collection consists of hundreds of file formats. Potential preservation strategies would only deal with parts of the collection. The strategies can be evaluated against the defined requirements in the workshop.

The resulting objective trees showed the different focus and background the two institutions have. A strong emphasis is placed on the user experience with the website in a library context while the archives concentrate on the risk assessment and technical aspects. The objective trees form a valuable input for other workpackages in the Planets project. For example, the workpackage

'Organisational Policy and Strategy Model' might draw conclusion regarding organisational policy for archives and libraries.

Figure 5 shows the objective tree as created and later refined by the workshop participant from TNA for a collection of web pages, archived in 2001, with no search facility or other programmatic facilities. Figure 6 shows a sub-branch of the tree, describing requirements for technical characteristics of a preservation strategy. The outermost leaves describe the measurement units assigned to the leaf objectives. In this case, the measurement units are described on ordinal scales.

The measurements from the experiments come in different scales. In order to make these comparable, they are transformed to a uniform scale using transformation functions, which happens in Step 9 of the workflow. For example a transformation of *openness of documentation* on ordinal scale: Standard, Open, and Proprietary, respectively can be mapped to 5, 3, and 1. Alternatively, if open documentation is an essential criterion, the institution can manifest this by assigning a 'not-acceptable' value of zero to the value *proprietary*.

The objectives in the depicted sub-tree primarily deal with technical risks the collection is facing. For example, tool support for a file format is quantified by the number of tools that currently available. If the number is low, then the risk of the file format obsolesce will likely be high. Similarly the backwards compatibility of file formats can be seen as an indicator of stability.

The objective tree approach allows the modelling of potential risks of preservation strategies and makes these quantifiable through the measurement scales. Although measurement values had to be assigned manually, participants agreed that the rating provided by the scales is far more useful and objective than an undocumented, intuitive decision.

Figure 7 shows the objective tree defined by workshop participants from the British Library. The fact that the appearance branch is much more elaborated clearly shows the different perspective and content. Moreover, while the objective tree from TNA concentrates on limiting interactive behaviour, the tree from the BL wants to preserve dynamic and interactive behaviour as far as possible in order to retain the original look-and-feel the user had experienced when interacting with the website. An example is the dynamics feature such as tooltips and drop-down menus in the objective tree from the BL.

In all figures, the leaves specify the measurement scale to be used for evaluation. While many leaves are measured in Boolean or ordinal scales, they will still be measurable in an automatic way in the future, when object characterisation tools and registries of Planets become available.

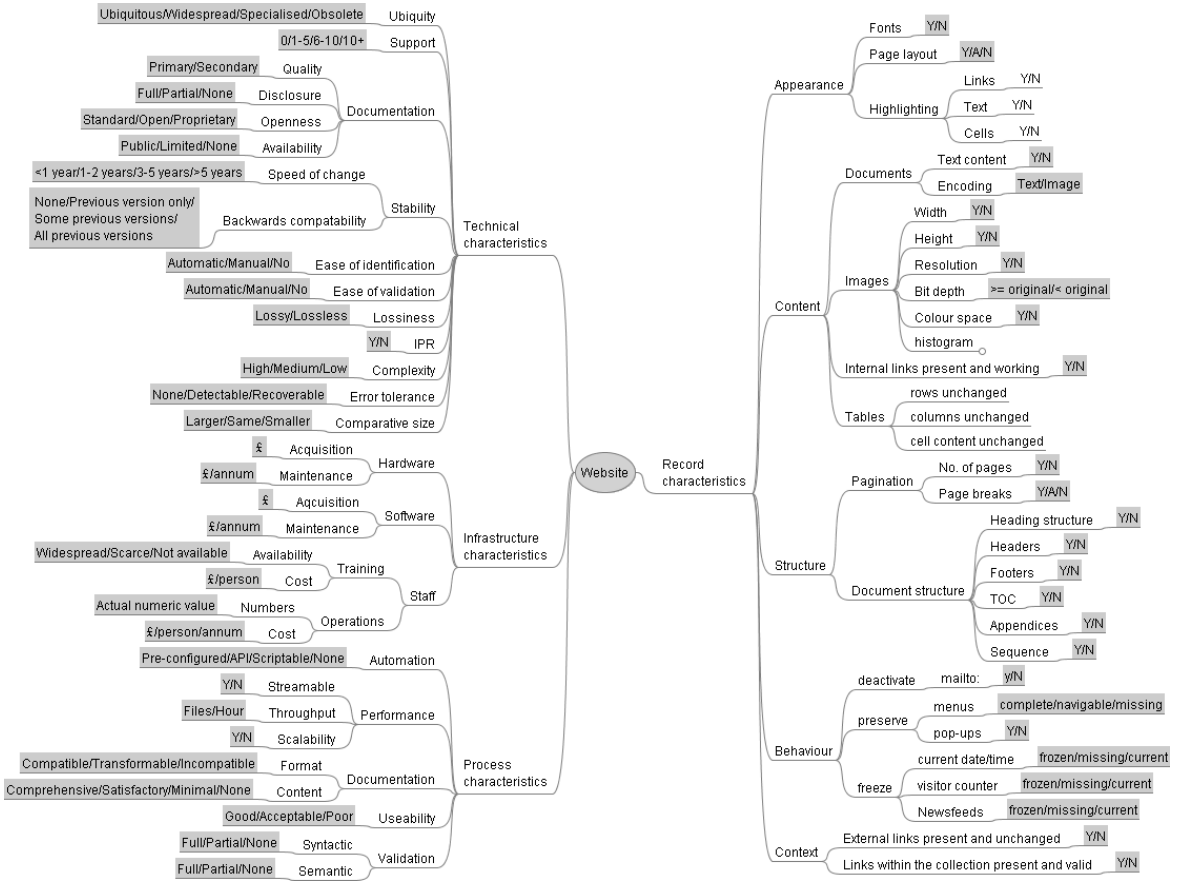

Figure 5 Objective tree for a sub-collection of the TNA web archive

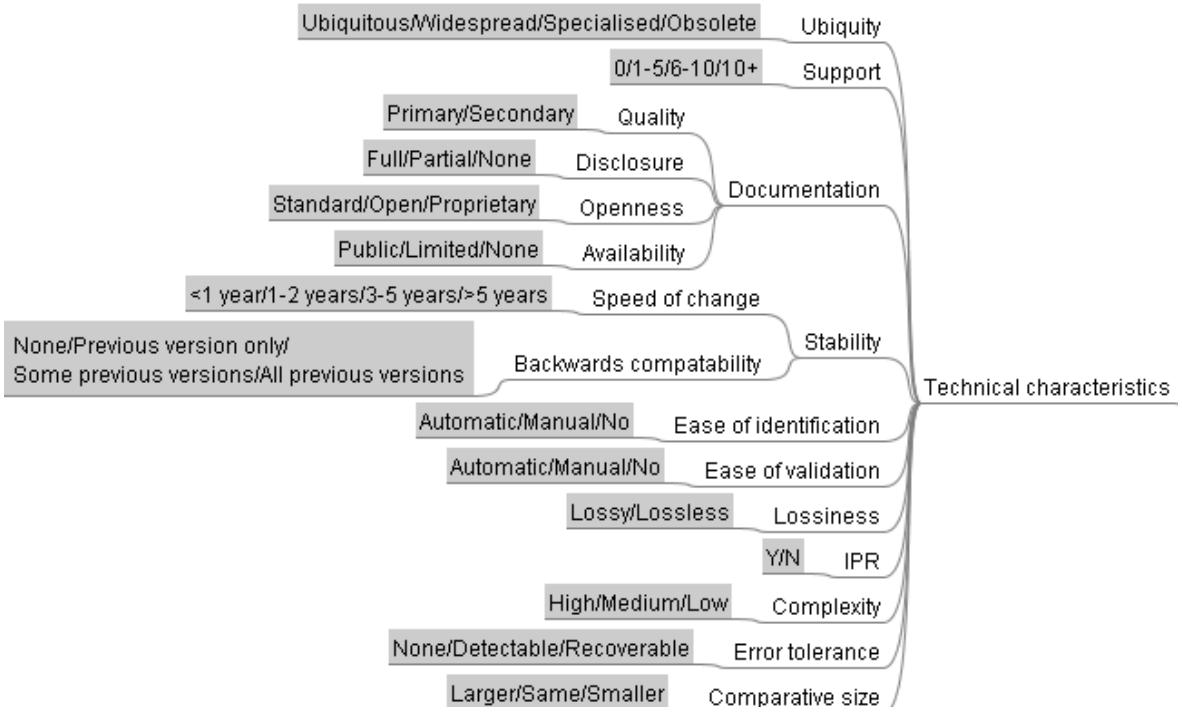

Figure 6 Technical characteristics regarding a sub-collection of the TNA web archive

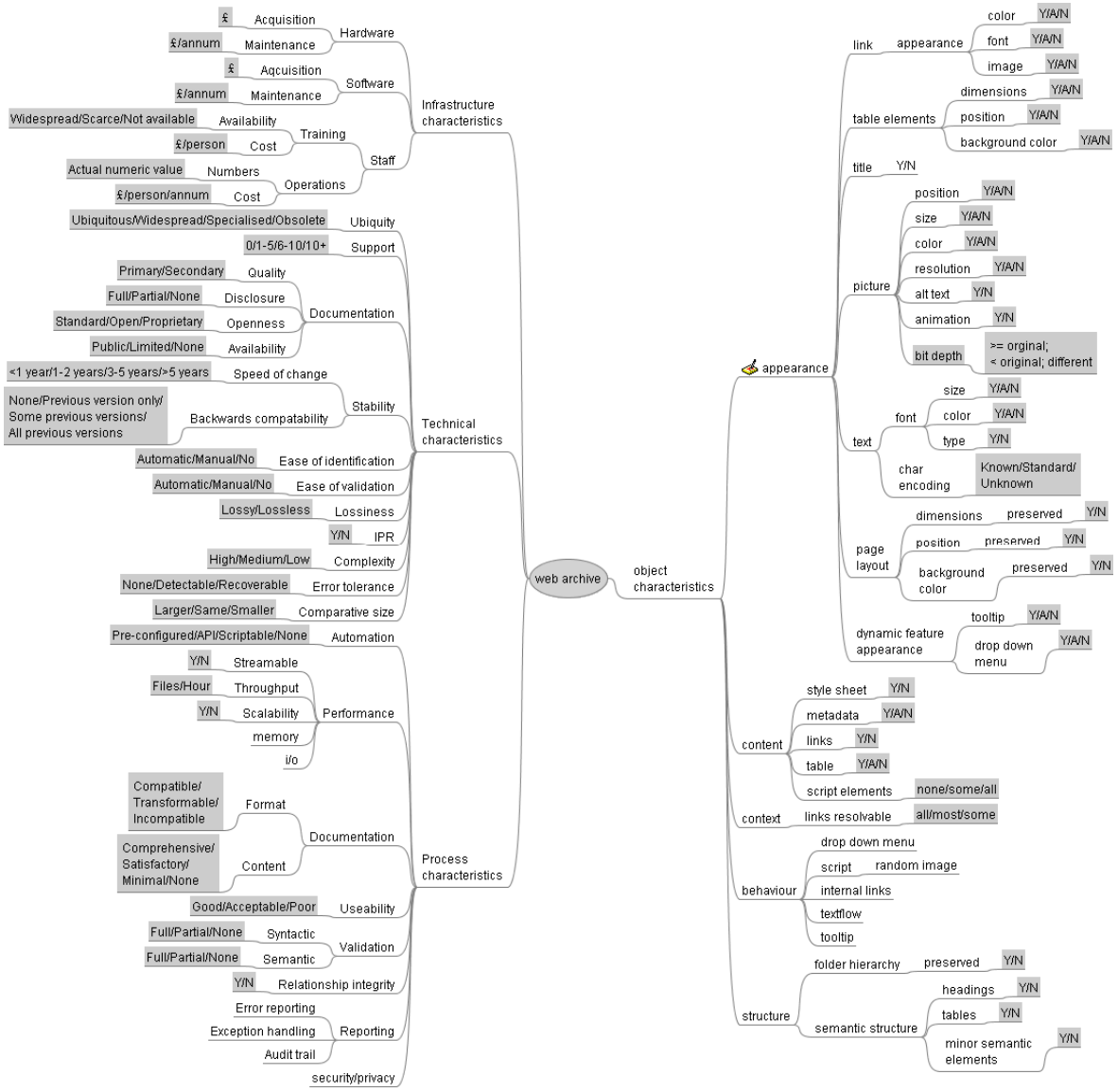

Figure 7 Objective tree for a subcollection of the BL web archive

3.2 Collections of Scientific Publications

This series of two case studies was conducted with the Austrian National Library (ONB) and the Royal Library of the Netherlands (KB). Both have to preserve scientific publications provided in formats ranging from MSWord and older word processing formats to current PDF files. The ONB will have the obligation to collect and preserve electronic theses and dissertations from Austrian Universities provided in PDF. To fulfil its obligation, the ONB need to evaluate possible preservation strategies for these documents. The KB is responsible for preserving scientific documents from 18 scientific institutions in the Netherlands within the DARE project[1].

The resulting objective trees showed many similarities, but also differed in some aspects that are specific to individual institutions. An example is the requirements coming from the technical environment specific to the KB, where an automated migration process has to run on a central server in parallel with other processes. It therefore needs to be configurable for load balancing to limit the workload the process consumes.

[1] www.darenet.nl

Another example is metadata of the objects. In the ONB the metadata of documents are held by a document management system. It is therefore more important to document changes to an object for the document management system, than to preserve the metadata embedded in an object. This is different with KB where the metadata are partly contained in the object. In this case, the embedded metadata have to be preserved and enriched.

Table 1 provides the ranking of alternative migration strategies considered by the ONB. Only the root values of the Sum and Multiplication aggregations are shown. All experiments were executed on Windows XP Professional OS using a sample of five master's theses. The results show that the migration to PDF/A using Adobe Acrobat 7 Professional ranks at the top, followed by migration to TIFF, EPS and JPEG2000; far behind are migration to RTF and plain text. The alternative PDF/A preserves core document characteristics in a widely used file format with good migration process performance.

Note that while the option of leaving the documents in their original PDF format(s) seems to show good performance when looking at the overall weighted sum aggregation, but weighted multiplication reveals that some essential requirements are not met. These are the deactivation of scripting and security mechanisms, which are regarded a knockout criterion that must be fulfilled

The migration to TIFF, EPS and JPEG2000 show very good appearance but exhibit weaknesses regarding criteria such as ‘content machine readable’.

The aggregation method ’Multiplication’ shows that RTF (Adobe), RTF (ConvertDoc) and TXT alternatives failed to preserve essential characteristics and fulfil the minimum requirements in at least one objective.

Both RTF solutions exhibit major weaknesses in appearance and structure of the documents, especially with respect to tables and equations, character encoding and line breaks. Object characteristics show a clear advantage for ConvertDoc, which was able to preserve the layout of headers and footers, in contrast to Adobe Acrobat. Still, costs and the technical advantages of the Acrobat tool such as macro support and customisation compensate for this difference and lead to an almost equal score. The migration to plain text format fails to preserve important artefacts like tables and figures as well as appearance characteristics like font types and sizes.

The migration to PDF/A by Adobe Acrobat 7 Professional reaches the highest score and provides a feasible solution for the long term storage of theses and dissertations. Migration to TIFF, EPS and JPEG perform very well at appearance objectives, but have some substantial technical weaknesses. Further work will evaluate different tools for converting PDF to PDF/A with a focus on process objectives such as duration, capacity, and automation support.

Alternative	Total Score	
	Sum	Multiplication
PDF/A (Adobe Acrobate 7 prof.)	4.52	4.31
PDF (unchanged)	4.53	0.00
TIFF (ConvertDoc 4.1)	4.26	3.93
EPS (Adobe Acrobate 7 prof.)	4.22	3.99
JPEG2000 (Adobe Acrobate 7 prof.)	4.17	3.77
RTF (Adobe Acrobate 7 prof.)	3.43	0.00
RTF (ConvertDoc 4.1)	3.38	0.00
TXT (Adobe Acrobate 7 prof.)	3.28	0.00

Table 1 Overall scores of the alternative strategies considered in the ONB case study

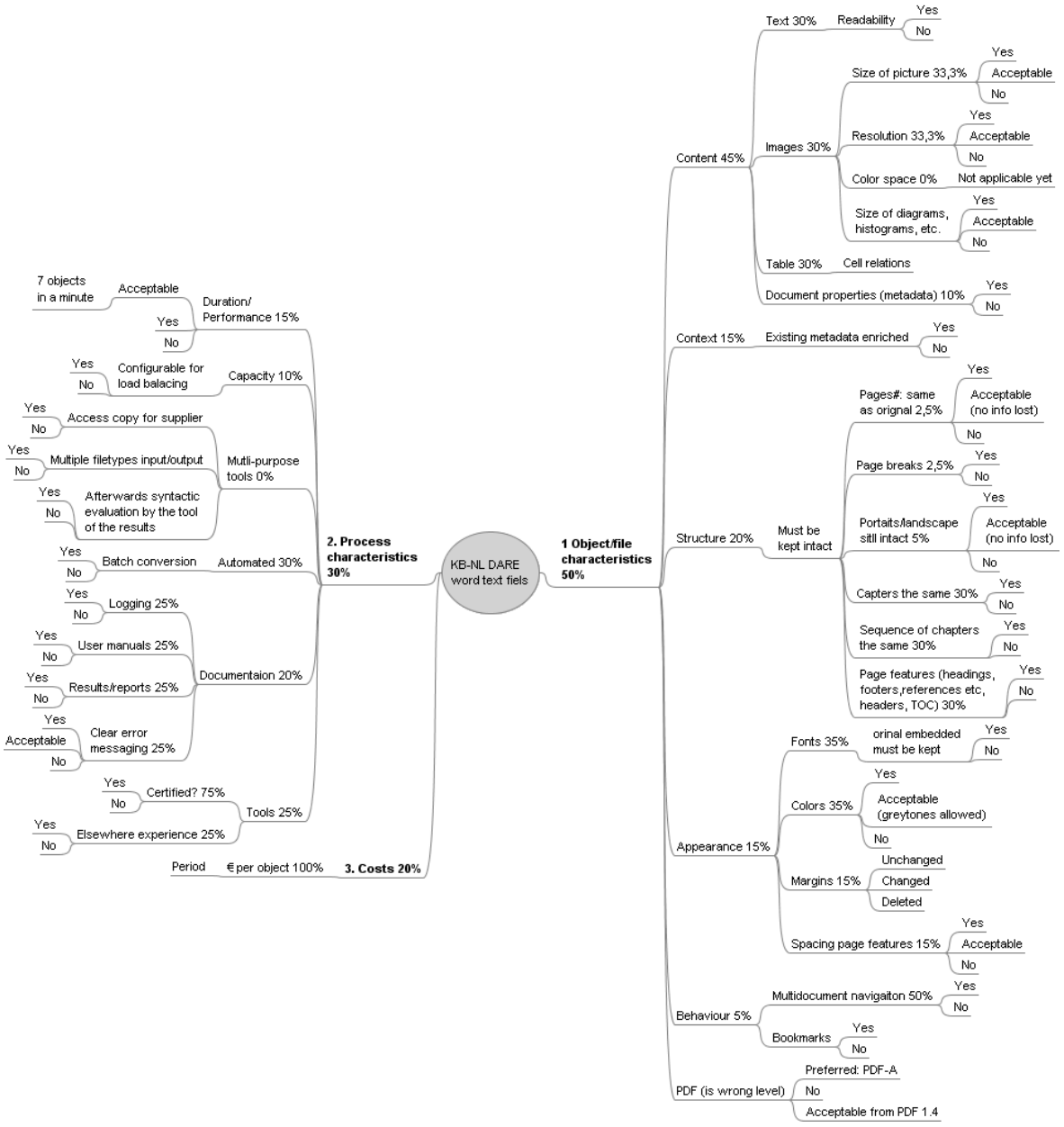

Figure 8 Objective tree for the DARE collection of electronic publications

3.3 Electronic Multimedia Art

The Ars Electronica[2] in Linz, Austria has been collecting electronic art in digital form since the early nineties. The Ars Electronica holds more than 25.000 CDs containing multimedia and interactive art in different formats, including long obsolete presentation file formats with interactive visuals, audio and video content. The Ludwig Boltzmann Institute[3] is currently evaluating alternative strategies not only to preserve these pieces of art over the long term but also to make them accessible in a satisfying form on the web.

[2] www.aec.at/en

[3] http://media.lbg.ac.at/en/index.php

The case study focused on the requirements for preserving a sub-collection that contains interactive presentations in the file formats such as Asymetrix Compel. More specifically, we concentrated on the requirements for the 'documentation' of the art objects which has to be created in order to enable long-term preservation and interactive access over the web. In a series of workshops with curators, art historians, computer scientists, preservation specialists, and management, the first phase of the planning process was completed.

The resulting objective tree is strikingly different from those constructed by library and archival institutions. Figure 9 provides an overview of the essential object characteristics that were identified, and documents the weights that have been assigned to the upper levels of the tree hierarchy. The primary focus lies on the content of the artworks, such as the contained text, images, and sounds. The second most important criterion is the completeness of the navigational structure that constitutes each interactive artwork.

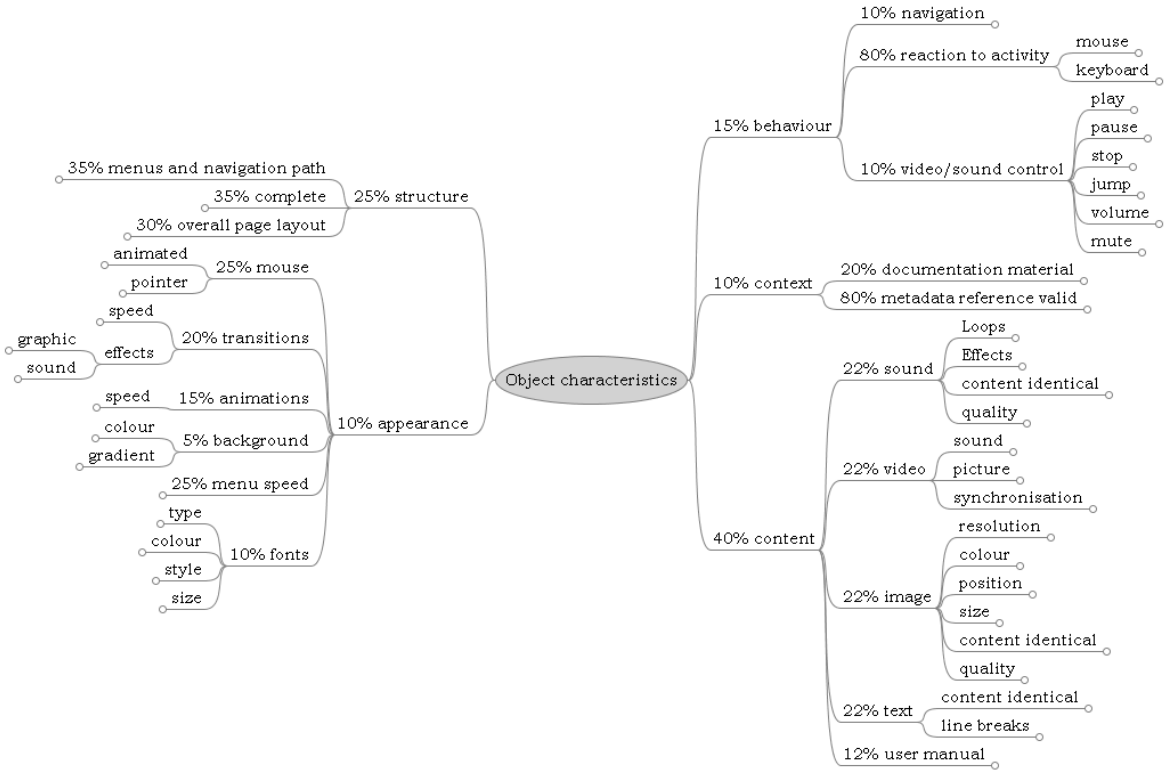

Figure 9 High-level view of the essential object characteristics for electronic multimedia art

3.4 Workshops

Workshops were held to define the requirements of the preservation activities. Participants with different backgrounds (usually technical, managerial and curatorial) formed a group of three to seven people. For the planning process, it is essential that the group include people that are responsible for the collection, technical experts and those are allowed to take a preservation decisions. In the workshop, the participants engaged in brainstorming to elicit as many different requirements and goals as possible. These were then reduced and structured, to arrive at a basic objective tree. During this process, numerous further objectives were identified. Especially with regard to technical characteristics, discussions sometimes drift into creating a comprehensive list of all metadata embedded in a digital object, or highly specialised characteristics inherent in a specific file format, instead of simply document the requirement that all of these to be kept intact. It is of vital importance to maintain the balance between the necessary level of detail and the overall requirements, focusing on the crucial needs of the preservation process and the intended use of

the objects. Practical examples were very helpful in this stage, for example metadata objectives from other planning projects.

The assignment of measurable units to each of the leaf objectives is a very important step. Wherever possible, objective measures should be used, these can be automatically measured during the experiment phase. In some case subjective scales are necessary. Apart from the fact that these require manual evaluation, detailed definition of the subjective scales is required to guarantee an accountable evaluation of the experiments.

This sometimes requires a revision of the objectives identified, either re-formulation or further refinement. Participants sometimes have difficulty in quantifying characteristics that are at first perceived as too elusive for objective measurements. Our experience performing the case studies showed that a moderation and guidance of the group discussion from an outside expert is very helpful in reaching useful measurement scales. The expert should have practical expertise on the Planets Preservation Planning workflow. Illustrative examples were in addition helpful to reach agreement on practicable measurement units and therefore best practices examples are an important requirement input for the tool support.

Furthermore, precise definition and labelling of the objectives are crucial to avoid ambiguities, redundancies, or misunderstandings.

Another issue is the assignment of importance factors. The weight setting for group decisions process is a research discipline itself and analysed in (5). In principle the weights can be keep equal to reach a decision. In some cases, sub-branches are explicit more important than other, in this case the weighting can be adjusted.
The influence of the weighting on the final ranking can be analysed using a Sensitivity Analysis. It evaluates the variation by a certain percentage for each of the weights has on the overall outcome. This, however, was in most cases minimal. Sometimes the order of consecutive pairs of alternatives switched.

The feedback from the participants was very positive - particularly the elicitation of the preservation requirements, which required a structured view on the problem and the needs, was highly welcomed. The definition and elicitation of requirements during the brainstorming session, as well as the subsequent structuring to form an objective tree, was initially performed in a traditional manner, using staples of post-it notes on a whiteboard. During the course of the Planets project, this situation improved greatly by the usage mind-mapping software to construct the tree and importing the resulting XML definition into the planning software.

In most cases, the experts had a good feeling of the strengths and weaknesses of the preservation alternatives based on their experience. In some cases, they were able to predict the ranking of the alternatives. They highly valued the evaluation setting, as this provided a means to document the facts, providing a basis for an accountable decision.

3.5 Summary and Outlook

The DELOS project developed and validated the methodology of specifying preservation plans. In the first year of Planets, emphasis was put on refining and further evaluating the methodology, specifically with respect to its potential for automation and integration into a distributed landscape of preservation services. This was achieved through a series of workshops and case studies with project partners that substantiated the applicability and usefulness of the methodology and helped to identify future directions.

The Planets Preservation Planning described in this approach allows informed and accountable decisions on preservation strategy and enforces a clear definition of the requirements and goals. Furthermore, it provides consistent evaluation of various preservation strategies and a detailed comparison of their performance.

Experience of the conducted workshops shows that many participants had difficulty in quantifying requirements and goals that are at first perceived as too elusive for objective measurements. Moderation and guidance of the group discussion by an outside expert is very helpful in reaching useful measurement objectives and measurement scales. In order to facilitate the tree definition and offer increased support, we will provide a set of template trees/fragments next year. These

template trees come from best practice examples from the case studies. They provide fragments of the objective tree, for example technical characteristics of images or cost model for archives. Template trees support smaller institution and institutions with less expertise to build objective trees for their purpose. The templates provide illustrative examples and support the definition of practicable objectives and measurement units with less guidance from outside experts.

We will continue several of the case studies probably in cooperation with other workpackages of the Planets project, such as 'PP/2 - Organisational Policy and Strategy Model' and 'PP3 - Collection/Usage model'. Moreover, we have started an additional case study with the Austrian National Library on the image archive.

An external case study on the preservation of interactive multimedia art, in a joint effort with the Ludwig Boltzmann Institute, was initiated. The collection in question is part of the world-renowned collection of electronic art of the Ars Electronica.

At the moment we are focussed on developing software that supports the preservation planning process and will integrate the distributed Planets registries and services. The first version of this will be available in November 2007.

The next section outlines the tool support. After a brief introduction, we will provide the use case descriptions that model the behaviour of the software, and give a short overview of the release plan and the input from other Planets work packages that will be integrated into the planning tool.

4 Planets Preservation Planning Tool support

4.1 Introduction

In addition to conducting case studies on preservation planning, the main focus of our workpackage is the development of the preservation planning tool, called Plato. We are currently developing the tool and plan the first release in November 2007.

Figure 10 shows the imported objective tree from the case study with the TNA in a current version of the planning tool. The user can select measurement scales to be used for each leaf; depending on the scale chosen, the evaluation interface will behave accordingly. Figure 11 depicts a wider range of possible measurement scales.

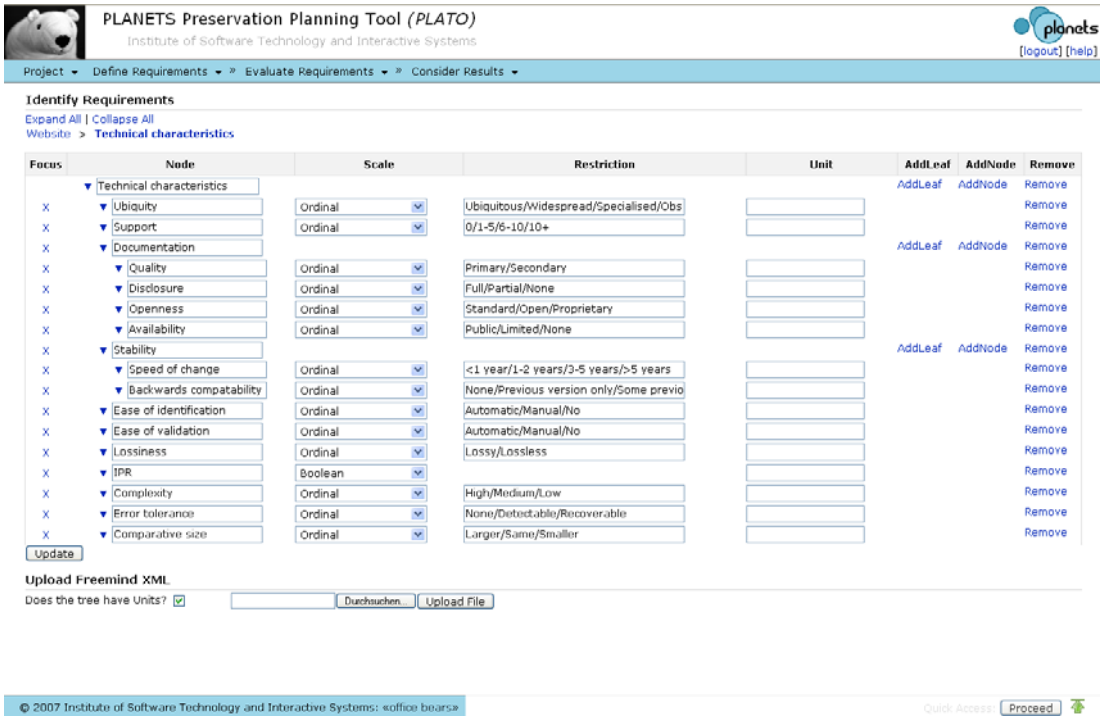

Figure 10 Editing an objective tree in the decision support software

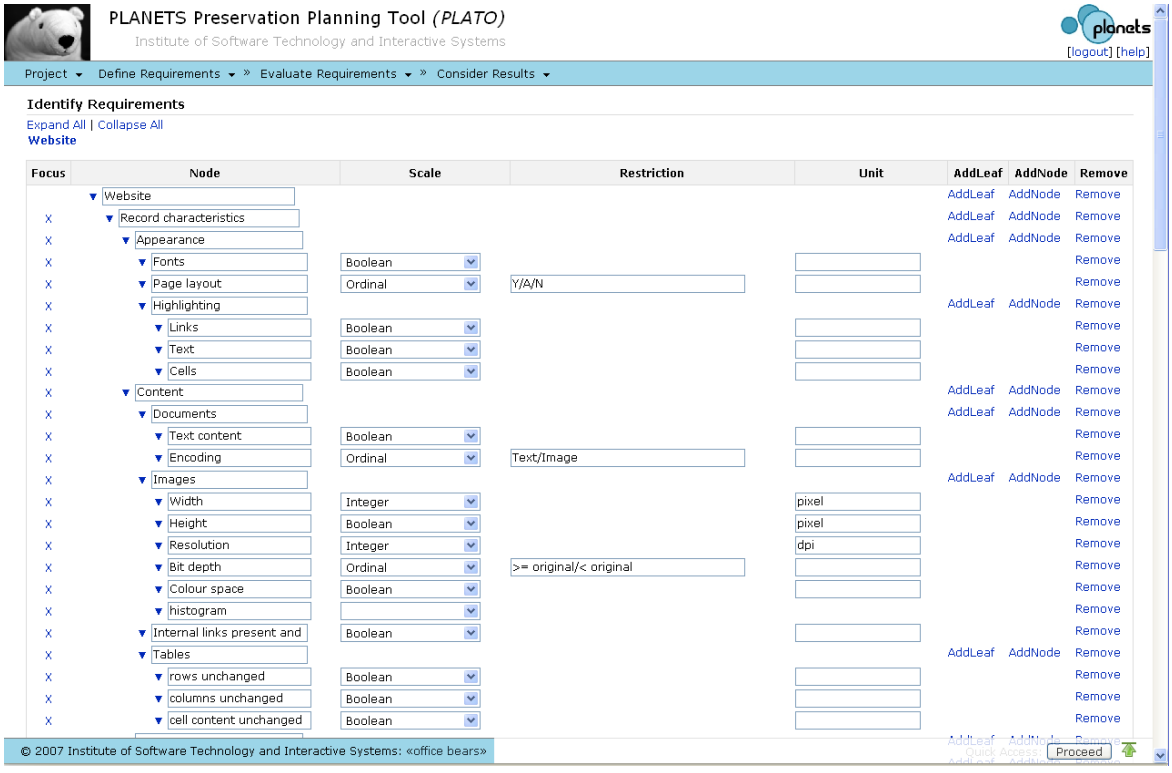

Figure 11 Various measurement scales in the objective tree editor

4.2 Use Cases

This section describes the use cases for a tool that would provide decision support during preservation planning. We refer to it as a 'planning tool' or Plato. The tool is being developed at TUWIEN as part of workpackage 'Preservation Plan Decision Support'.

Plato evaluates preservation plans against clearly defined requirements and goals. It allows us to compare different preservation plans and make informed and accountable decisions on which plan to implement in order to preserve digital objects for a given purpose.

We describe here a stand-alone deployment of the planning tool. When it is integrated into the Planets Test-bed, slight modifications will be made, such as omitting Login and Logout.

Figure 12 depicts an overview of the use cases. The main use case, 'Evaluate Preservation Plan', is a summary-level use case including the 11 user-goal-level use cases that form the main workflow. (Of course the planner executes all these steps. For the sake of readability of the diagram, the links between the planner and the user-goal use cases such as 'Define objective tree' or 'Transform values' have been omitted.)

The use cases primarily describe the first version of the Planning Tool. However, where appropriate, we also included functionality that will only be available in the second version after external services such as migration actions and preservation characterisation are included. More details about the iteration of developments are in the section summary and outlook of this section. The integration of preservation action and preservation characteristic web services is scheduled for release two, as are template tree fragments and the assignment of results from PC services to the objective tree.

Figure 12 Use case overview diagram

Category	Entry	
Use Case ID	***PP-1***	
Title	***Evaluate preservation plan***	
Level	*Summary*	
Actors	*Planner*	
Preconditions	Planner is logged in	
Trigger	Planner creates a project or loads an existing project	
Success guarantees	The preservation planning project is evaluated, the results are stored and known to the user.	
Main Success Scenario	1. Planner defines the basis of the preservation plan. 2. Planner chooses records. 3. Planner identifies the requirements by defining the objective tree and assigning measurement units. 4. Planner defines preservation alternatives and their resources. 5. Planner takes the Go-decision. 6. Planner develops the experiment. 7. Planner runs the experiment. 8. Planner evaluates the experiment. 9. Planner transforms values. 10. Planner sets importance factors. 11. Planner analyses the results.	
Exceptions	Step	Branching Action
	5	Planner decides not to continue (No-Go decision): The decision is recorded and stored together with the reasoning, execution of the following steps of the workflow is not possible. The planner can later resume the evaluation of the plan, e.g. if assumptions, preferences or environmental conditions have changed, by taking the Go-Decision.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-2***	
Title	***Create a preservation planning project***	
Level	*User Goal*	
Actors	*Planner*	
Preconditions	Planner is logged in	
Trigger	Planner selects 'Create project'	
Success guarantees	The preservation planning project is stored and opened, and the planner can define the basis of the project.	
Main Success Scenario	1. Planner enters main properties of the PP project 2. System verifies necessary information and stores the new project.	
Exceptions	Step	Branching Action
	2	Necessary information is missing: System notifies the planner who might provide missing information
	2	Project with the specified name exists: System notifies the planner who might change the project name
Issues/Comments		

<table>
<tr><th>Category</th><th>Entry</th></tr>
<tr><td>Use Case ID</td><td>PP-3</td></tr>
<tr><td>Title</td><td>Load a preservation planning project</td></tr>
<tr><td>Level</td><td>User Goal</td></tr>
<tr><td>Actors</td><td>Planner</td></tr>
<tr><td>Preconditions</td><td>Planner is logged in</td></tr>
<tr><td>Trigger</td><td>Planner selects ‘Load existing project’</td></tr>
<tr><td>Success guarantees</td><td>An existing preservation planning project is opened and the planner can continue with evaluating this project.</td></tr>
<tr><td>Main Success Scenario</td><td>1. System presents a list of existing projects, each with a short description.
2. Planner selects a project
3. System loads the project and presents the first step: Define basis</td></tr>
<tr><td>Exceptions</td><td><table><tr><td>Step</td><td>Branching Action</td></tr><tr><td>2</td><td>Planner cancels: System returns to the main menu</td></tr><tr><td></td><td></td></tr></table></td></tr>
<tr><td>Issues/Comments</td><td>A planner should not see the projects of other user groups. Role management will be provided in the Interoperability Framework.</td></tr>
</table>

Category	Entry	
Use Case ID	***PP-4***	
Title	***Define basis***	
Level	*Summary*	
Actors	*Planner*	
Preconditions	Planner is logged in	
Trigger	Planner successfully loads or creates a project	
Success guarantees	The basic properties of the project are defined and stored in the system.	
Main Success Scenario	1. System presents the main properties to edit. 2. Planner textually defines the basic properties of the preservation planning project: document types, environment, and amount of files. 3. System verifies the input and stores the project.	
Exceptions	Step	Branching Action
	2	Planner cancels: The system presents the main menu, no changes are saved.
	3	Input is not correct: System notifies user, continue with step 2.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-5***	
Title	***Define sample records***	
Level	*Summary*	
Actors	*Planner*	
Preconditions	Planner is logged in and working on a planning project which has at least completed the step '*Define basis*.'	
Trigger	Planner finishes the preceding step of defining the basis or directly selects 'Define sample records'.	
Success guarantees	Sample records for the planning project are uploaded and stored in the system.	
Main Success Scenario	1. System presents an interface including a list of uploaded files. 2. The planner textually defines the main properties of the sample records and may upload files to the system, remove files from the list, etc. 3. The planner asks the system to store the changes. 4. System stores the changes.	
Exceptions	Step	Branching Action
	2	Planner cancels without saving: The system asks for confirmation. If the planner confirms the cancelling, the system restores the previous state and continues with step 1.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-6***	
Title	***Identify requirements***	
Level	*User Goal*	
Actors	*Planner*	
Preconditions	Planner is working on a project that has at least completed the step 'Define sample records'	
Trigger	Planner finishes preceding step of defining sample records or selects 'Define objective tree'	
Success guarantees	The objective tree with assigned measurement units is defined and stored in the system.	
Main Success Scenario	1. System displays an interface for editing the objective tree and loads the existing objective tree. It also displays a list of predefined tree fragments, organised in categories. On selection of a category such as 'images', the system displays a list of tree fragments that belong to that category. The planner can insert these fragments into the objective tree. 2. a. The Planner iteratively adds/deletes nodes and leafs and specifies measurement units and descriptions b. The Planner adds predefined sub trees to the objective tree 3. The planner tells the system to save the tree. 4. The system verifies the tree and stores the data.	
Exceptions	Step	Branching Action
	3	Planner cancels: System restores the last stored objective tree
	4	Tree does not contain any leaves: The system notifies the user. The tree can be stored in the system, but to continue with the next step, the tree has to be completed first.
Issues/Comments	*This is the core functionality of the tool, thus usability is a primary issue here. The interface should be comfortable, probably without issuing a separate request for each user action such as adding a node.*	

Category	Entry	
Use Case ID	***PP-7***	
Title	***Define preservation alternatives***	
Level	*Summary*	
Actors	*Planner*	
Preconditions	Planner is working on a project that has at least completed the step 'Identify requirements'.	
Trigger	Planner selects 'Define alternatives' or finishes the preceding step of the workflow, 'identify requirements'.	
Success guarantees	At least one preservation alternative is defined and its resources are specified. The planner can proceed to the next step.	
Main Success Scenario	1. System presents a list of existing alternatives in a table. 2. The planner can iteratively delete an alternative from the list, add a new alternative or specify resources for an alternative. After defining at least one alternative including the resources, the planner saves and continues. 3. The system verifies the input and stores the data.	
Exceptions	Step	Branching Action
	3	Resource specifications or other data are missing: System notifies user, continue with 2.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-8***	
Title	***Add preservation alternative***	
Level	*User Goal*	
Actors	*Planner*	
Preconditions	Planner is editing preservation alternatives	
Trigger	Planner selects 'add new alternative'.	
Success guarantees	A new preservation alternative is added to the list of alternatives and the planner can specify its properties and resources	
Main Success Scenario	There are two kinds of alternatives in the planning tool: Preservation strategies that are carried out in an environment external to the planning tool, such as an external testbed environment, and strategies based on online service that are discovered through a service registry and executed by the planning tool in the step 'Run experiment'. Both kinds of alternatives are covered here. 1. The system creates a new alternative and presents an interface for editing its properties. 2. The planner enters the name and a short description. 3. The planner may set an online service to use for this alternative: a. System uses a service registry for discovering available services, and presents a list of these. b. The planner browses this list. On selecting a service, the system provides additional information such as input parameters. c. The planner selects one service to use. 4. The planner saves the alternative. 5. System verifies input and stores the data.	
Exceptions	Step	Branching Action
	3	Name for this alternative already exists in this project: System notifies user who might choose another name.
	3c	Planner cancels: Return to 2.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-9***	
Title	***Delete preservation alternative***	
Level	*Sub-function*	
Actors	*Planner*	
Preconditions	Planner is editing preservation alternatives	
Trigger	Planner selects ‘delete alternative’	
Success guarantees	The selected alternative is deleted, and the planner can continue with editing the alternatives.	
Main Success Scenario	1. System asks for confirmation 2. Planner confirms deletion 3. System deletes the alternative and presents the interface for editing alternatives again.	
Exceptions	Step	Branching Action
	2	Planner denies confirmation: Alternative is not deleted, planner can continue editing alternatives.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-10***	
Title	***Specify resources***	
Level	*User Goal*	
Actors	*Planner*	
Preconditions	Planner is editing preservation alternatives	
Trigger	Planner selects an alternative in the list	
Success guarantees	The resource definition of the selected alternative is updated.	
Main Success Scenario	1. System displays the resource definition fields for this alternative: mandatory items, desirable items, and enhancements. 2. The planner edits this data and saves the changes 3. System verifies input and stores the data.	
Exceptions	Step	Branching Action
	2	Planner cancels: System restores the previous resource definitions.
Issues/Comments	*When editing alternatives, the system displays both the table with the list of alternatives and the resource specification fields below, so that the planner can comfortably edit both in one interface.*	

Category	Entry	
Use Case ID	***PP-11***	
Title	***Take Go-decision***	
Level	*User Goal*	
Actors	*Planner*	
Preconditions	Planner is working on a project that has at least completed the step 'Define alternatives'.	
Trigger	Planner selects 'Go/No-go decision' or finishes the preceding step of the workflow, 'define alternatives'.	
Success guarantees	The decision to continue is recorded and the planner continues with developing the experiments. If the decision is not 'Go', execution of the later steps in the workflow is not possible.	
Main Success Scenario	1. System presents an interface with the decision options: a. Go b. Provisional Go c. Deferred Go d. No Go 2. Planner selects one of these, enters the reasoning and possibly actions to be taken and selects 'Take decision'. 3. System verifies input, stores the decision and the reasoning.	
Exceptions	Step	Branching Action
	3	Reasoning is missing: System notifies planner who can provide reasoning (continue with 1)
	3	Decision is not 'Go': System notifies the user that execution of the next steps of the workflow is not possible.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-12***	
Title	***Develop experiment***	
Level	*User Goal*	
Actors	*Planner*	
Preconditions	Planner is working on a project that has at least completed the step 'Go/No-Go' with a Go-decision.	
Trigger	Planner finishes the preceding step Take Go–Decision or selects 'Develop experiment'	
Success guarantees	An experiment plan for each alternative is defined and stored.	
Main Success Scenario	1. System presents the list of defined alternatives. 2. The user iteratively selects one alternative for editing. 3. System displays an interface for editing the corresponding experiment plan. If the alternative is based on online services, the system additionally presents a list of parameters that may be provided to the service, indicating which of them are mandatory and which are optional. The system also allows the user to add and configure characterisation services that should be applied on the output data. 4. The planner sets parameters and textually describes the plan and stores it. 5. The system verifies the parameter input and stores the data.	
Exceptions	Step	Branching Action
	5	Parameters are incorrect: The system notifies the planner and continues with 3.
Issues/Comments		

Category	Entry
Use Case ID	***PP-13***
Title	***Run experiment***
Level	*User Goal*
Actors	*Planner*
Preconditions	Planner is working on a project that has completed the step 'Develop experiment' and has taken the Go-decision.
Trigger	Planner finishes preceding step develop experiment or selects 'Run experiment'
Success guarantees	All online experiments are performed; the results of experiments run in an external environment are successfully uploaded and stored in the system. The planner can proceed to the next step of evaluating experiment.
Main Success Scenario	1. System presents a summary including a. Preservation actions to be executed online and externally, b. Characterisation services to be called on the input and output of these actions, c. Metadata to be recorded, if available. If there are services to be called by the planning tool, the system allows the user to start this execution. If not, it allows the user to go directly to step 5. 2. If there are services to be called, the planner initiates the execution. 3. The system performs the preservation actions that are based on online services. During running the online experiments, the system provides a simple kind of progress feedback to the user. 4. The system provides an interface to upload the outcome of experiments performed in an external environment. 5. The planner may upload any outcome of experiments. 6. The system stores the output in the registry.
Exceptions	Step: Branching Action
	1: Problems occur during experiment: System presents an error message (e.g. the one obtained from the service that failed) to the user. Proceed with 1. Probably the user may want to go to 'Develop experiment', for example to edit parameter settings for services to be called.
Issues/Comments	

Category	Entry
Use Case ID	***PP-14***
Title	***Evaluate Experiment***
Level	*User Goal*
Actors	*Planner*
Preconditions	Planner is working on a project that has at least completed the step 'Run experiment' and has taken the Go-Decision
Trigger	Planner finishes preceding step 'run experiment' or selects 'Evaluate experiment'
Success guarantees	The objective trees for all alternatives are evaluated.
Main Success Scenario	1. The system presents a list of the alternatives, if possible with status information (e.g. not evaluated, partly evaluated, evaluation completed). 2. The user selects one alternative for evaluation. If all evaluations are completed, the user may proceed to the next step: 'Transform values'. 3. The system presents an overview of the characterisation services that the user has defined in 'Develop experiment'. If there are none defined, continue with 6. 4. The user initiates characterisation. 5. The system calls the PC services, providing basic feedback on the progress to the user. 6. The system presents the results for each sample record side by side with the objective tree for the current alternative. 7. The user can manually input characteristics, and in parallel use the results of the PC tools for evaluation. The PC tools provide results for each sample record. The user can choose the aggregation mode for each objective in the tree. The system provides maximum, minimum and average aggregation of results from PC tools. 8. The user initiates saving of the objective tree. 9. System verifies input and stores the data, continue with 1.
Exceptions	Step: Branching Action *5*: Error occurs in PC call: System presents corresponding error message, continue with 3. *7*: Planner cancels: The changes are not stored, continue with 1
Issues/Comments	*Depending on the integration of PC services, the scenario of this use case may vary a bit to achieve optimal usability.*

Category	Entry	
Use Case ID	***PP-15***	
Title	***Transform values***	
Level	*Summary*	
Actors	*Planner*	
Preconditions	Planner is working on a project that has completed the step 'Evaluate experiment'	
Trigger	Planner finishes the preceding step run experiment or selects 'Transform values'	
Success guarantees	For each leaf of the objective tree a transformation table has been assigned.	
Main Success Scenario	1. The system provides input forms to assign transformation tables for each leaf. A transformation table defines thresholds for mapping the values of the measurement scale to the resulting scale of 1 to 5 (plus 0 as unacceptable value). 2. The planner edits these tables and initiates saving. 3. The system verifies the transformation tables and stores the data	
Exceptions	Step	Branching Action
	2	Planner cancels: The changes are not stored
	3	Entries are missing: System notifies the planner, continue with 1.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-16***	
Title	***Set importance factors***	
Level	*User Goal*	
Actors	*Planner*	
Preconditions	Planner is working on a project that has completed at least the step 'transform values'	
Trigger	Planner finishes preceding step transform values or selects 'set importance factors'	
Success guarantees	For each leaf and node of the objective tree a weight have been assigned.	
Main Success Scenario	1. The system provides input forms to assign a weight between 0 and 1 for each leaf, with a sum of 1 for each level in the tree. The interface includes commodity functions such as distributing remaining weights evenly on the remaining nodes. 2. The planner edits the weights. 3. The system verifies the weights and stores the data	
Exceptions	Step	Branching Action
	1	Planner cancels: The changes are not stored
	3	The weights are not consistent: System notifies user, continue with 1.
Issues/Comments		

Category	Entry
Use Case ID	***PP-17***
Title	***Analyse results***
Level	*User Goal*
Actors	*Planner*
Preconditions	Planner is working on a project that has completed at least the step 'Set importance factors' of the workflow
Trigger	Planner finishes preceding step 'Set importance factors' or selects 'Analyse results'
Success guarantees	The final results of each alternative of the project are presented by the system.
Main Success Scenario	1. System presents a list of possible result views such as a. simple ranking of all alternatives according to their total performance b. compare alternatives visually throughout the levels of the objective tree according to various aggregation functions: i. Sum ii. Multiplication iii. Minimum iv. Maximum v. Sum of advantage The user can also set the desired level of depth of the tree. c. Show sensitivity values of the objective tree with different variance settings. 2. The planner iteratively selects one of the views of the results 3. The system calculates the resulting view and displays the results to the user. 4. The user may interact with the view (e.g. the tree) and may return to the list of options
Exceptions	Step: Branching Action :
Issues/Comments	

Category	Entry	
Use Case ID	***PP-18***	
Title	***Login***	
Level	*User Goal*	
Actors	*User*	
Preconditions	Planning tool is running	
Trigger	The user starts the preservation planning tool.	
Success guarantees	The user gains access to a planning tool session.	
Main Success Scenario	1. The user enters username and password into the system login form. 2. The system submits the input data to the Planets IF User Management and calls for authentication. 3. The Planets IF User Management verifies the data, checks the user authorisation for the planning tool, and returns the result. 4. The system grants the user access to a preservation planning tool session	
Exceptions	Step	Branching Action
	3	User name or Password is incorrect. System informs user and provides the system login form.
	3	User has no authorisation for the planning tool. The system denies access.
Issues/Comments		

Category	Entry	
Use Case ID	***PP-19***	
Title	***Logout***	
Level	*User Goal*	
Actors	*User*	
Preconditions	The user is logged in.	
Trigger	User selects ‘Logout’.	
Success guarantees	The preservation planning session is closed and the IF user management notified.	
Main Success Scenario	1. The user selects ‘Logout’. 2. The system closes the preservation planning session. 3. The system notifies the Planets IF User Management of having ended the preservation planning tool session.	
Exceptions	Step	Branching Action
Issues/Comments		

4.3 Summary and Outlook

In order to support the Planets preservation planning workflow, we are currently developing a preservation planning tool, called Plato. It implements the workflow and supports the various stages of the workflow, specifically for documenting the individual steps. As Plato will be deployable within the Planets Testbed environment, the tool will be accessible through the experiment user interface of the Testbed.

Table 2 shows the first two releases as planned at the moment and the main features associated with each version. The plan is dependent of the timely availability of results from other strands of work within Plantes.

The second iteration of the software in August 2009 will include tree templates/fragments to support the definition of the objective tree. The templates provide best practice examples of parts of the objective tree. They support smaller institution and institutions with less expertise to define practicable objectives and measurement units.
The integration of preservation action and characterisation services is also planned in the second iteration. Preservation action services allow performing preservation experiments within the Plato software and the results of the experiments can be captured by the preservation characterization services. The results of the workpackage about 'Validation framework' will also be integrated in the Plato software. These developments should minimize the need for input from outside experts to run a preservation planning project.

Further development of Plato will be influenced by other workpackages from the Preservation Planning subproject. Figure 13 depicts the foreseen development cycles of the decision support software and other work packages, which might produce results that will feed into the software tool. The workpackage PP3 'Collection/Usage model' and PP6 'Proactive Planning' are currently working towards collection models and profiling services; PP2 'Organisational Policy and Strategy Model' is developing policy and strategy models that will be considered for integration into Plato. Further input might be provided by the workpackage 'Proactive Planning' which is analysing recommender systems and technology watch services.

Release	Month	Features expected to be delivered in this version
1	18	Complete workflow support Integration into the Interoperability Framework
2	27	Integration of • a sophisticated objective tree editor • PA registry and services (m18) • PC registry and services (m12) • PP5 GUI framework for evaluation (m24) • PP4 templates/fragments (m20)

Table 2 Release plan for the software tool

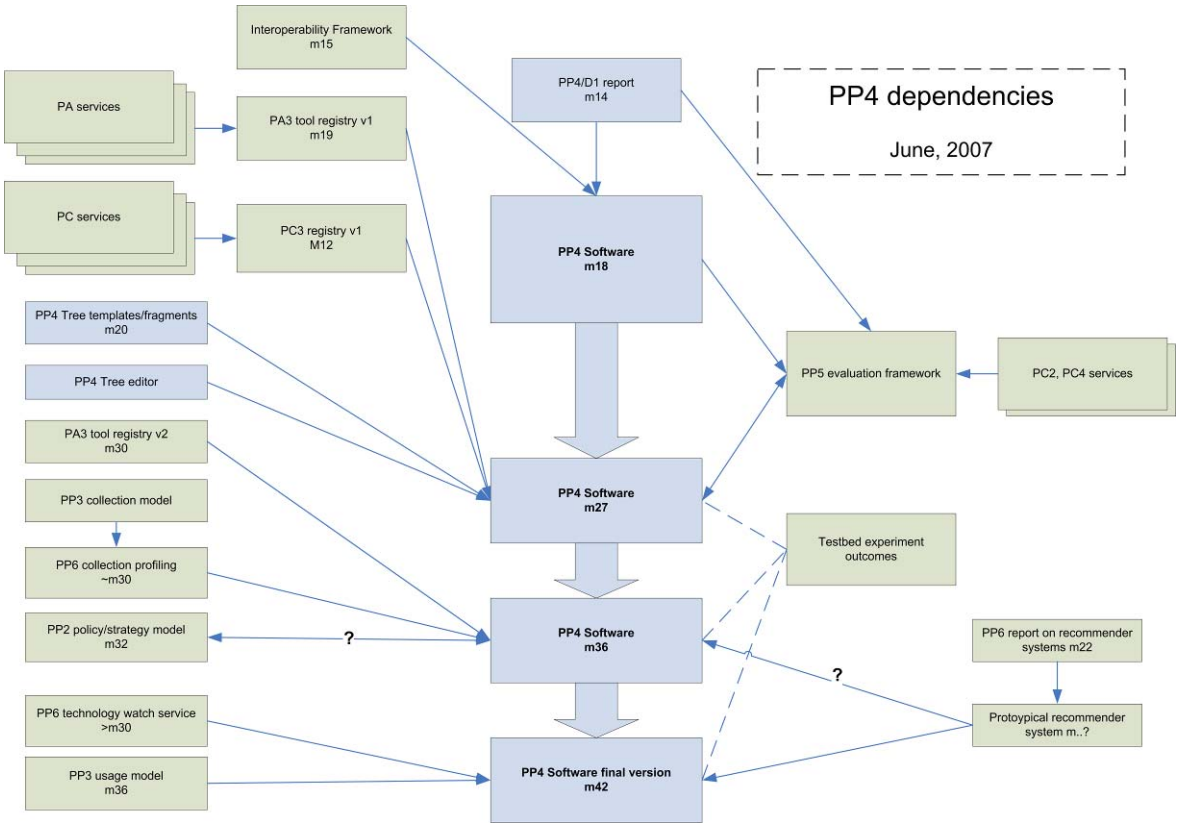

Figure 13 PP software dependencies

5 Glossary

5.1 Preservation Context

The preservation context describes the environment and the collection of the preservation endeavour. The context includes

- The collection in question,
- A description of the types of digital objects that are within the scope of the plan,
- The environment in which the preservation process takes place, and
- Requirements and goals of the preservation endeavours (including policies and obligations for the collection)

5.2 Preservation Strategy

The strategy is a procedure of preservation actions to preserve a collection of digital objects. It treats only technical aspects.

The preservation strategy thus contains a detailed description of the preservation action(s) to be taken, including

- used hardware and software,
- parameter settings for used tools and actions, and
- input and output file format, and
- available metadata about the action(s)

In a preservation strategy, different tools and parameter settings can be defined for different file formats. Appropriate characterisation tools allow even different tools and parameter setting for the same file format with different characteristics.

5.3 Preservation Alternative

Different preservation strategies, which are analysed for a specific collection, are called preservation alternatives.

5.4 Preservation Plan

A preservation plan is a plan to preserve a specific collection or a part of a collection of digital objects in consideration of preservation policies, legal obligation and preservation goals. A preservation plan, resulting form a preservation planning project, describes the preservation context and the selected preservation strategy including the reasoning for the decision.

The plan defines a well documented procedure of actions to ensure the long term access and usage of the collection. The plan treats organisational, technical and financial aspects of the specific preservation problem at hand.

The preservation plan includes

- Preservation context
- Selected preservation strategy
- The evaluation result of different preservation alternatives and the decision
- Roles and responsibilities for the preservation plan (and to monitor it)
- Triggers that initiate the execution of the plan
- (Estimated) Cost of realising the preservation plan.

Optional aspects to be included are

- Comparisons of different preservation alternatives for the specific collection.

Further inputs to the preservation plan are organisational aspects such as policies and strategies as well as collection and usage models. These aspects are analysed in other work packages within Planets. They will be taken into account in the decision making process; however, the exact relationship is not yet defined. However, discussion in the Preservation Planning subproject has let to the agreement that criteria from these aspects will be modelled in a tree structure that will fit into the objective tree structure described in this report.

5.5 Preservation Planner

The preservation planner is the person who performs the preservation planning process. This is also the main actor using the planning tool.

5.6 Preservation Planning experiments

Preservation Planning experiments constitute the core part of the evaluation of preservation strategies according to specified criteria as it is described in this document. They should be performed with the support of the planning tool to ensure proper documentation of the process and thus guarantee the quality of the Preservation Planning activities.