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Abstract

This report is deliverable 1 of PP/4 - Report on methodology for specifying preservation plans.

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References

Ref.	Document	Date	Details and Version
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

EXECUTIVE SUMMARY

This report, a result of the workpackage PP/4 in the Planets project, presents the Planets Preservation Planning approach to define and evaluate preservation plans.

The selection of preservation strategy is one of the core areas in digital preservation endeavours. Different preservation requirements and goals across institutions and settings make the decision on which solution to implement very difficult.

The herein presented 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 to evaluate the performance of various solutions against well-defined requirements and goals.

The workflow is presented in Figure1, followed by a brief description.

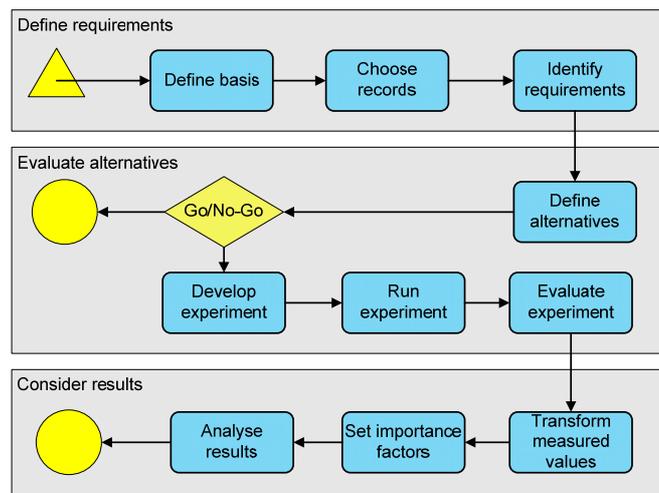


Figure 1 Planets Preservation Planning workflow

The 3-phase process, consisting of a total 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 enforces 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 settings. 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 settings.

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, the requirements for the planned tool support are defined as use cases.

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Introduction

Digital Preservation is an emerging cross-disciplinary research area that requires involvement by 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.

Identifying and selecting a preservation plan that meets an institution's needs is a core Digital Preservation task. A wide range of factors are relevant, including technical, procedural, and financial. Preservation Planning tools therefore need to provide decision support components as well as documentation and logging facilities. On top of providing support for the users' data acquisition needs they might have in their preservation plans, accountable documentation is a vital aspect and therefore also a crucial success factor in preservation ventures.

This document describes the initial Planets Preservation Planning Approach. It allows the explicit definition of requirements and goals and offers a systematic way to plan and evaluate preservation plans. A numeric evaluation of the results based on the Utility Analysis enables a repeatable, accountable and documented decision on which preservation plan 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).

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. The workflow of the DELOS Testbed was refined based on practical experience and feedback from the user community. The result of this process is the herein presented Planets Preservation Planning approach.

The remainder of the report is organized as follows: Chapter 2 describes the Planets Preservation Planning workflow; 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.

What is a Preservation Plan?

A preservation plan contains a well documented procedure for preserving a given collection of digital objects. The plan treats organisational, technical and financial aspects of the specific preservation problem at hand.

The preservation plan thus contains a detailed description of the following elements.

- The collection in question
- Description of types of digital objects under the scope of the plan
- The environment in which the preservation process takes place
- Requirements and goals of the preservation endeavours (including policies and obligations for the collection)
- Roles and responsibilities for the plan (and to monitor it)
- The preservation action(s) to be taken, including
 - used hardware and software,
 - parameter settings for used tools and actions, and
 - responsibilities in the preservation action workflow
 - metadata to capture about the action(s)
 - triggers that initiate the execution of the plan
- (Estimated) Cost of realising the preservation plan.
- The evaluation result of different preservation alternatives and the decision

Optional aspects to be included are

- Comparisons with alternative preservation plans 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, it is clear that criteria from these aspects will be modelled in a tree structure that will fit into the objective tree structure described in this report.

Workflow

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

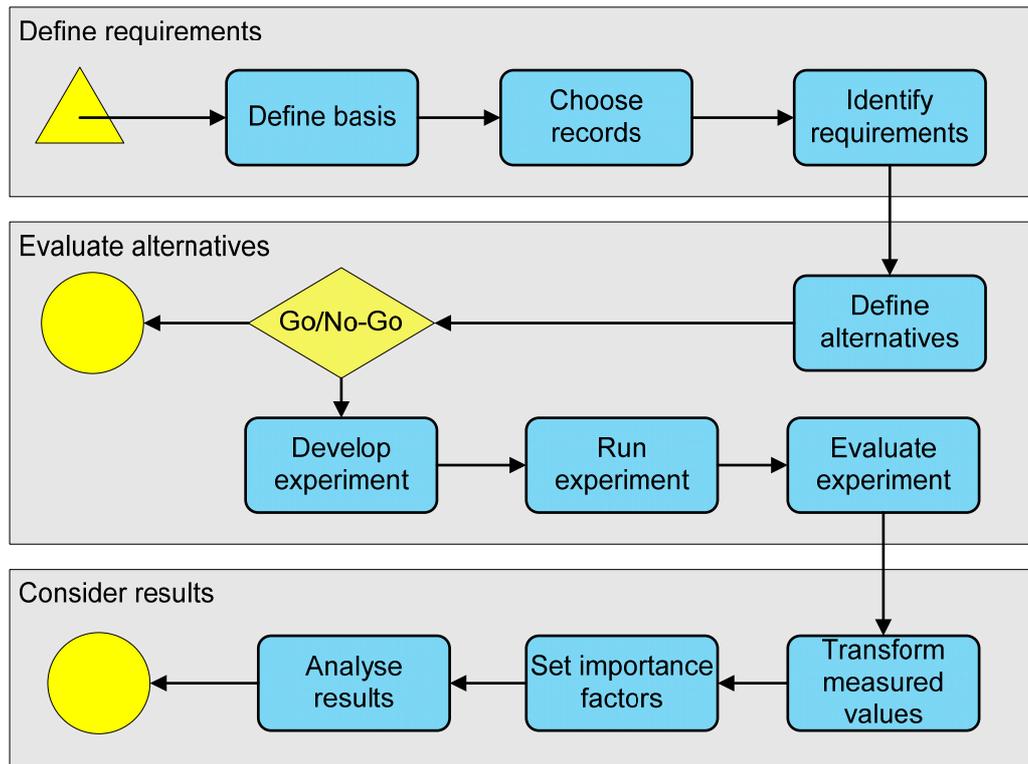


Figure 2 Overview of Planets Preservation Planning workflow

The 3-phase process consists of a total of 11 steps. It 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 the experiments. The Go/No-Go-Decision enforces 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 founded, accountable recommendation for one of the alternatives can be made.

The workflow as shown in Figure 2 is described below.

1. Define basis

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

2. Choose records

In this step we select a sample of records that is representative of the objects present in the collection. Such samples are later used for evaluating the preservation alternatives.

3. Identify requirements

The goal of this step is to clearly define the requirements and goals for a preservation solution in a given application domain. We specify high-level goals, 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 settings, some general principles can be observed. At the top level, the objectives can usually be organised into four main categories:

- *File characteristics* - describe the visual and contextual experience a user has when dealing with a digital record. 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.
- *Process characteristics* - refer to the preservation process. These include usability, complexity, or scalability.
- *Cost issues* - have a significant influence on the choice of a preservation solution. Usually, they may be divided into technical and personnel costs-as well as start-up and operational expenditures.

The objective tree is usually created in a workshop setting 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.

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

While this is still convenient for certain settings, an alternative way has been introduced and feedback has been very positive. This approach relies on mind-mapping software, usually used in conjunction with projection on a large screen to allow multiple stakeholders to have an overview while working on the tree.

Figure 4 shows a screenshot of a mind-mapping software while editing an objective tree during a preservation planning workshop.

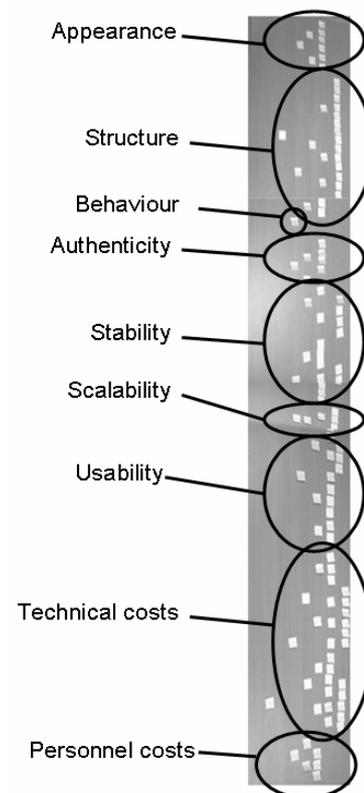


Figure 3 Objective tree created with post-it notes

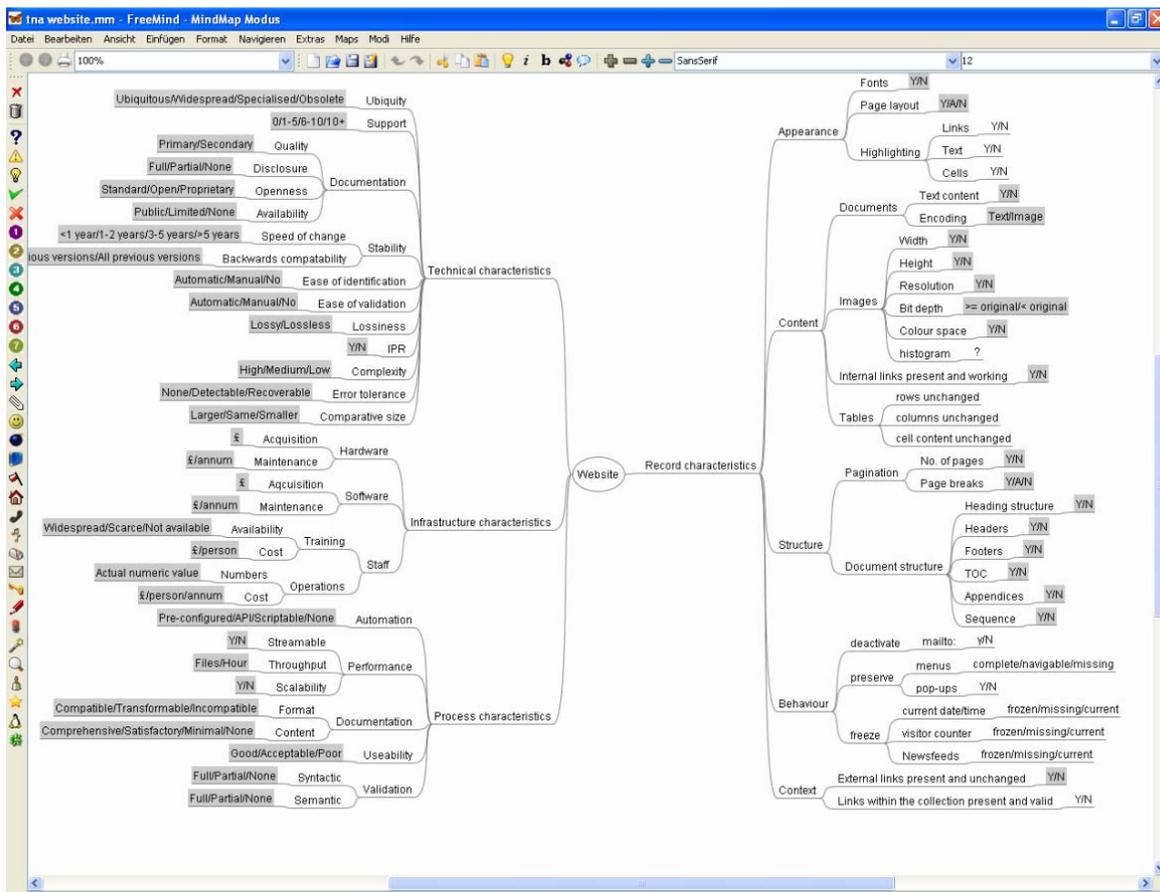


Figure 4 Use of mind-mapping software for building of objective trees

Having defined the objectives, the next step is to assign measurable units to each of the objectives in the tree. The measurable unit defines metric to measure how successful a requirement is met. Wherever possible, these effects should be objectively measurable (e.g. € per year, frames per second). In some cases, (semi-) subjective scales will need to be employed (e.g. degrees of openness and stability, support of a standard, degree of file format acceptance within different communities, etc.).

4. Define alternatives

Different preservation solutions, such as different migration tools or emulators, are selected. We provide a detailed description of each alternative solution, including the software environment and parameters, in order to ensure a clear understanding. For each defined alternative, we estimate the amount of work, time, and money required for running experiments.

5. Go/No-Go

In this step we consider the defined requirements, the selected preservation alternatives, and estimated resources to determine the feasibility of proposed alternatives. 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 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 of the experiment, software and hardware system of the experiment environment, and the mechanism to capture the results.

7. Run experiment

We design experiments to test one or more aspects of a specific preservation alternative when applied to the previously defined sample records.

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.

9. Transform measured values

The measurements taken in the experiments might all be scaled differently. In order to make these comparable, they are transformed to a uniform scale using transformation functions. These transformation tables can define thresholds or injective mathematic functions to map the measured values to the uniform scale. The resulting scale might e. g. range from 0 to 5. A value of 0 would in this case denote an unacceptable result and thus serve as a dropout criterion for the whole preservation alternative.

10. Set importance factors

Not all of the objectives of the tree are equally important. 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. A range of other aggregation techniques have been implemented in the tool support, resulting in slightly more pronounced final ranking values for the alternatives. 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** – Here, the first step 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 Differences** – This aggregation allows the comparison of two alternatives against each other, it is a comparative comparison of two alternatives. Each alternative's leaf value is compared to the leaf values of the other alternatives. The difference is the final value for each leaf. 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.

In the DELOS Testbed, two other aggregation functions were implemented, namely Sum of Priority and Austin Slight. These methods were based on integer numbers. In the Planets Project we introduced real numbers for the uniform scale, where these two aggregations were not feasible. The new introduced Sum of Differences function supports the comparison of real numbers and provides a detailed comparison of two preservation alternatives.

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 setting. It forms the basis for a documented and accountable decision for the selection of a specific preservation alternative.

In addition to the 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 Sensitivity Analysis results in a stability value for each alternative and each objective, which may further influence the final decision.

The result of this preservation planning process is a concise, objective, and well-documented ranked list of various alternative solutions for a given preservation task, considering institution-specific requirements. By providing both overall and detailed performance measures, based on the standardised and repeatable experiments, it forms the basis for sound and accountable decisions on which solution to implement.

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

Web Archive Collections

As part of the preservation activities in PP4 we held a workshop with the British Library and The National Archive of the UK (TNA) to define the preservation requirements for the collections resulting from their web archiving activities.

The resulting objective trees show the different focus and background the two institutions have. In a library context strong emphasis is placed on the user experience with the website while the archives concentrate on the risk assessment and technical aspects. The resulting objective trees form a valuable input for other workpackages in the Planets project. For example PP2 might draw conclusion regarding organisational policy for archives and libraries.

Figure 5 shows the objective tree as created and later refined by TNA. The collection for which it was created is a static website, dating from 2001, with no search facility or other programmatic facilities. Figure 6 shows a sub-branch of the tree constructed by TNA, 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. Therefore the measured values from the experiments have to be assigned manually by an expert. For ordinal scale we do not have tool support for automatic measurement and assignment of the measured results from the experiments.

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. In step 9 of the workflow, these units are transformed to a uniform scale. 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 an 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 are currently supporting it. If this number is low, the risk of the file format becoming obsolete will probably be high. Related to this, the backwards compatibility of file formats can be seen as an indicator of stability.

These criteria and scales support the risk assessment for each potential preservation strategy by modelling the risks in a quantifiable way. Despite the manual assignment of measurement values, participants agreed that the rating these scales provide is far more useful and objective than an undocumented, intuitive decision.

Figure 7 shows the objective tree as defined by the British Library. The fact that the appearance branch is much more elaborated clearly shows the different perspective and content. Moreover, while TNA concentrates on freezing interactive behaviour, the BL wants to preserve dynamic and interactive behaviour as far as possible to retain the original look-and-feel the user had when interacting with the website. One example is the objective of dynamic feature appearance of 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.

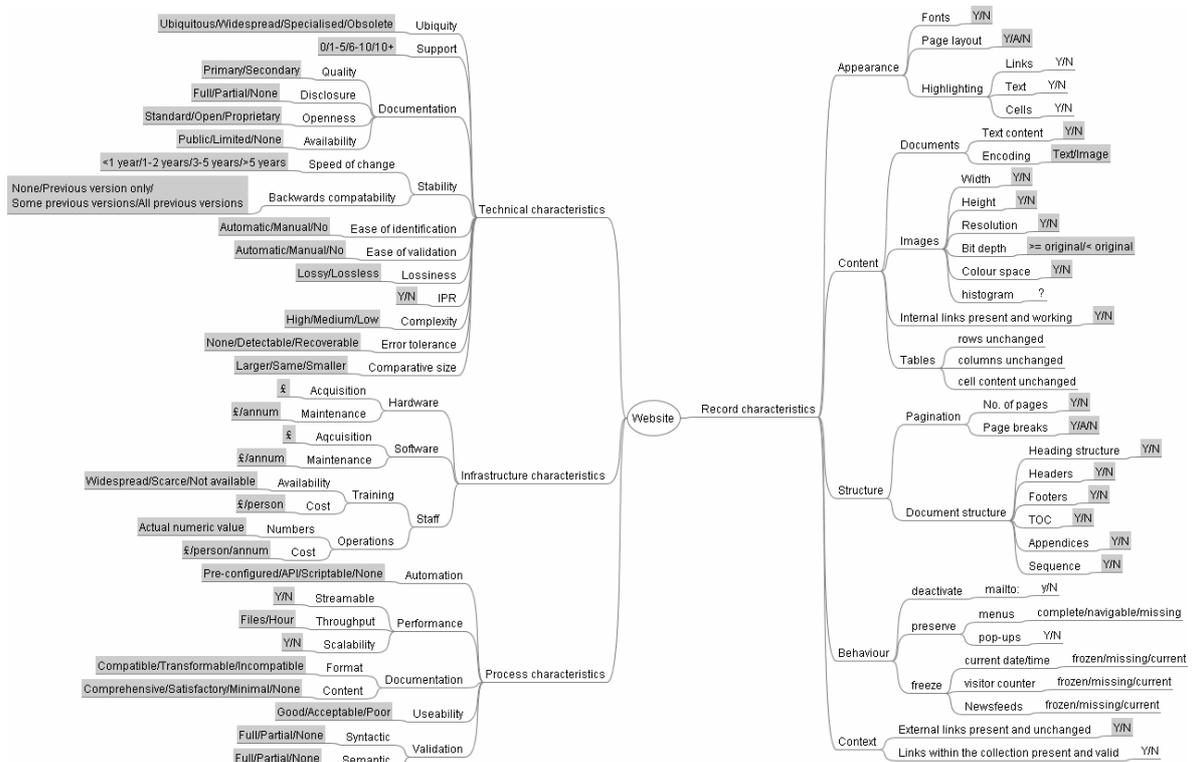


Figure 5 Objective tree for a public website as identified by TNA

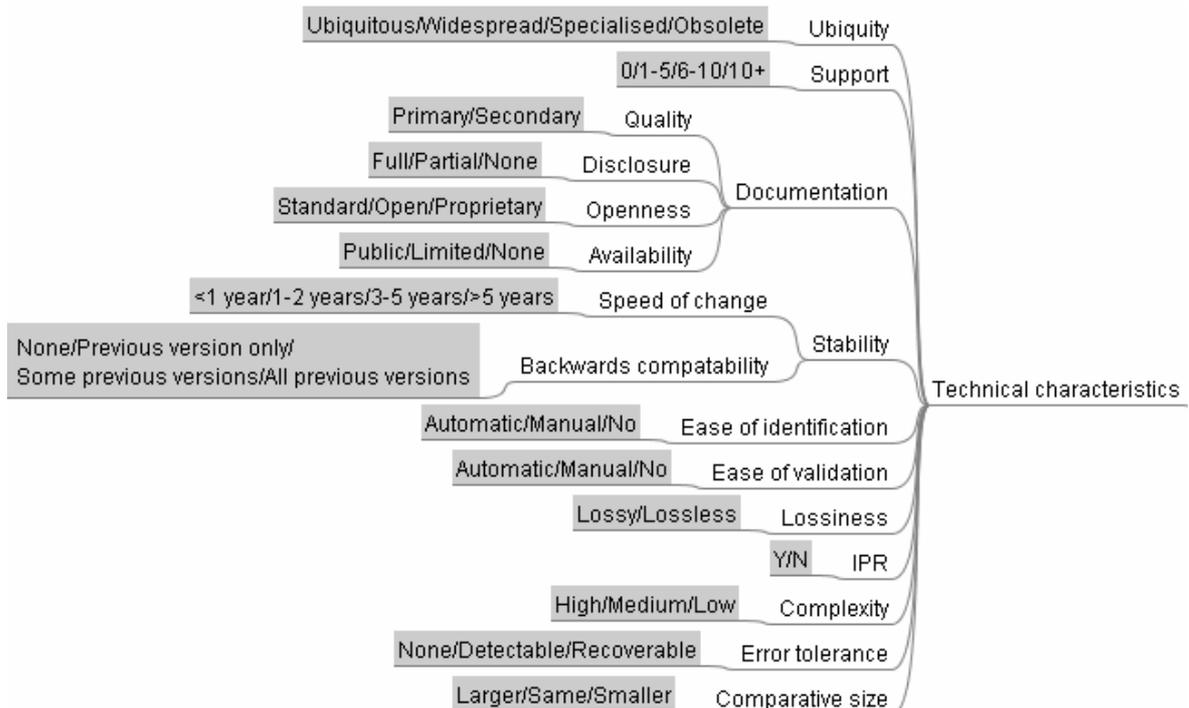


Figure 6 Technical characteristics for preserving a web archive as identified by TNA

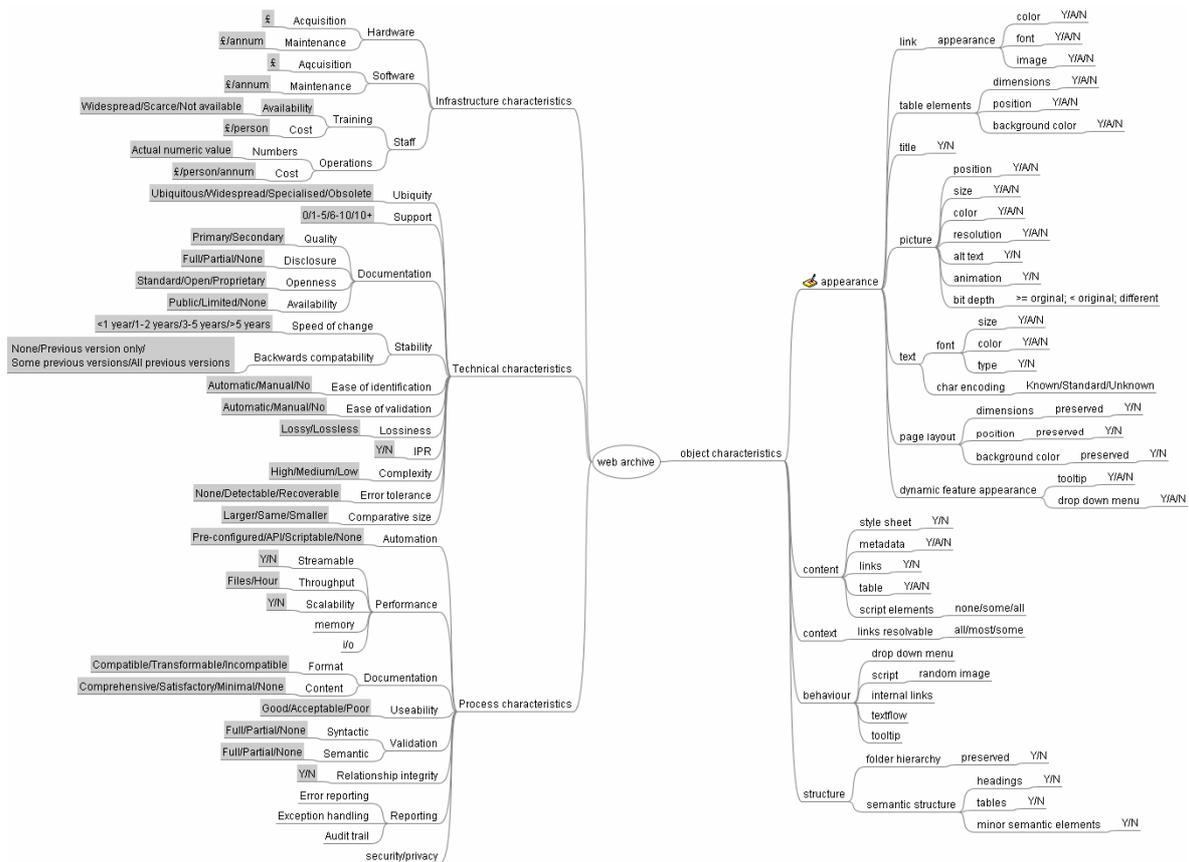


Figure 7 Objective tree for a public website as identified by BL

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 needed to evaluate possible preservation strategies for these documents. The KB is responsible for preserving scientific documents from 18 scientific institutions in the Netherlands.

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

Another example are metadata of the objects. In the ONB the metadata of documents are held by a document management system. So it is less important to preserve the embedded metadata of an object than to provide documentation about changes to an object for the document management system. 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, weighted multiplication reveals that some essential requirements are not met. These are the deactivation of scripting and security mechanisms, which are regarded a knock-out 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, specifically 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.

Nr.	Alternative	Total Score	
		Sum	Multiplication
1	PDF/A (Adobe Acrobat 7 prof.)	4.52	4.31
2	PDF (unchanged)	4.53	0.00
3	TIFF (Document Converter 4.1)	4.26	3.93
4	EPS (Adobe Acrobat 7 prof.)	4.22	3.99
5	JPEG2000 (Adobe Acrobat 7 prof.)	4.17	3.77
6	RTF (Adobe Acrobat 7 prof.)	3.43	0.00
7	RTF (ConvertDoc 4.1)	3.38	0.00
8	TXT (Adobe Acrobat 7 prof.)	3.28	0.00

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

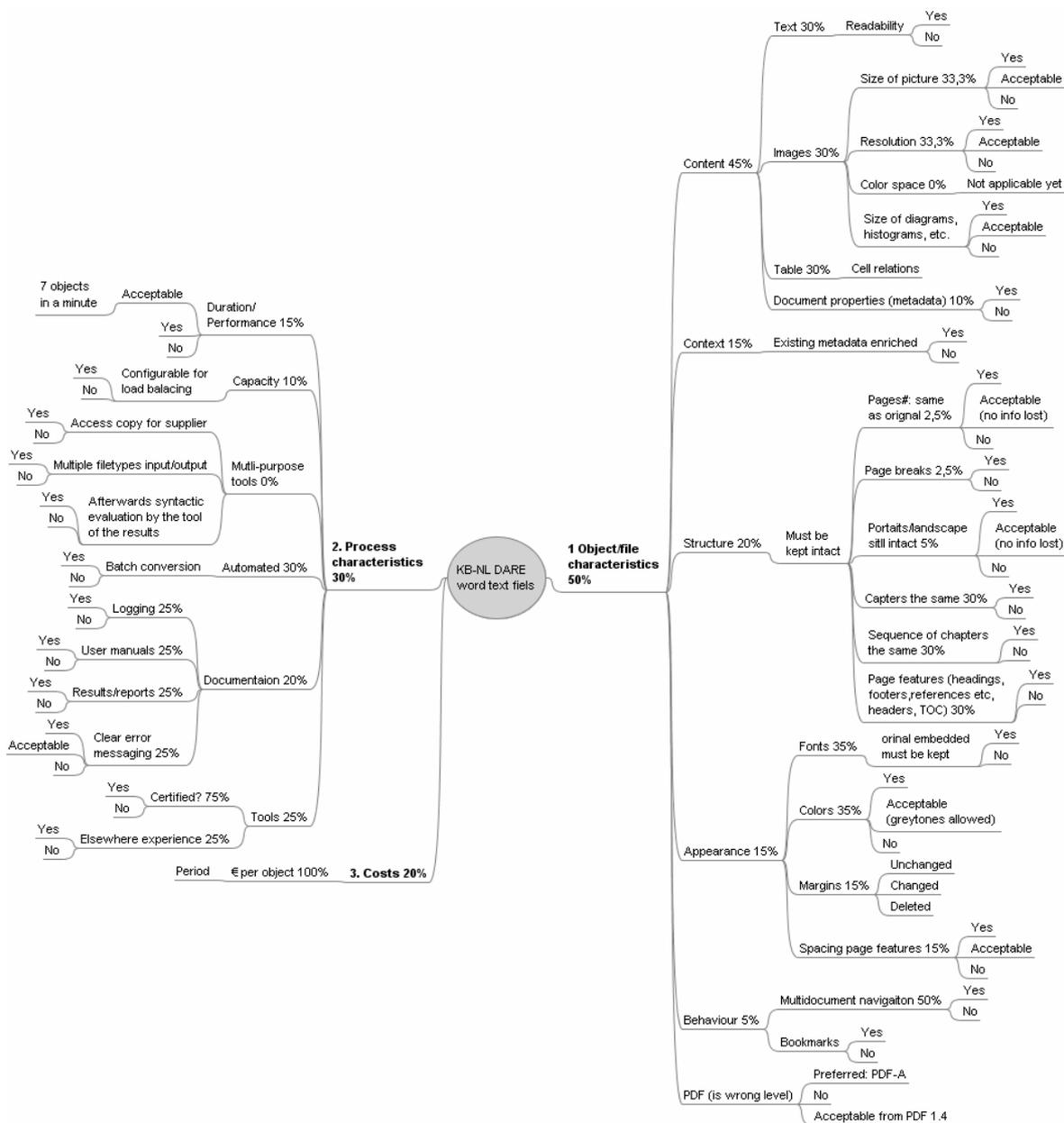


Figure 8 Objective tree for the DARE collection of electronic publications as identified by KB-NL

Electronic Multimedia Art

The Ars Electronica¹ 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 Institute² 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.

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.

¹ www.aec.at/en

² http://media.lbg.ac.at/en/index.php

The resulting objective tree is strikingly different from those that arose in other settings such as library and archival institutions. It shows a strong focus on the navigation behaviour of the artwork and the appearance of animations. An example for a specific characteristic of multimedia art is the speed of execution. Migrating a piece of art to a different format or emulating the original platform for which it was created may alter this speed.

Workshops

The workshops held to define the requirements of the preservation activity had a similar format. 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. After defining the basic settings, they 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. Specifically with regard to technical characteristics, the discussions sometimes derailed into creating a comprehensive list of all metadata embedded in a digital object, or highly specialised characteristics inherent in a specific file format. Thus, it was 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.

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. 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. Also illustrative examples turned out very helpful to reach practicable measurement units.

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

Another critical issue is the assignment of the importance factors. Standard Utility Analysis would require these to be defined immediately after identifying the objectives. However, experience showed that in many cases the various tools performed virtually identical for a range of requirements. Thus, specifying the importance values after running the experiments, although not formally correct due to possibly biased decisions for or against a certain solution, turned out to be more efficient, preventing avoidable discussions at the outset. Institutions were not looking for external certification, but for the best solution for the problems they are facing. If this approach is used for external vendor certification or a bidding process, it might be advisable to assign importance factors before evaluation. The support software tools allow for a flexible redesign of the process in this case.

In some cases there were concerns relating to the influence of the weighting on the final rankings of the alternatives. This led to the development of an automated Sensitivity Analysis evaluating the impact that a variation by a certain percentage for each of the weights would have on the overall outcome. This, however, was in most cases minimal. Sometimes the order of consecutive pairs of alternatives was switched.

In general, participants were very satisfied with the process - particularly with the elicitation of the preservation requirements, which required a structured view on the problem and the needs. The experiments to actually evaluate the various tools were considered to be of minor importance. 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 has been greatly improved by using mind-mapping software to construct the tree and importing the resulting XML definition into the planning software.

In most cases the experts had a pretty good feeling on the performance of the preservation alternatives and were able to predict the outcome. They highly valued the evaluation setting, as this provided a means to document the facts, providing a basis for an accountable decision.

Summary and Outlook

The first year of Planets refined and validated the methodology for preservation planning. We conducted a series of case studies with project partners to gather experiences in applying the presented methodology.

The here presented Planets Preservation Planning approach allows to make informed and accountable decisions on which preservation solution to follow. Thereby is enforce a clearly definition of the requirements and goals for the preservation strategy for a given propose. Further it provides a consistent evaluation of various preservation strategies and a detailed comparison of their performance, enabling informed and well-documented decisions.

Experiences 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 from an outside expert is very helpful in reaching useful measurement objectives and measurement scales. In order to further support the tree definition we will provide a set of template trees/fragments next year. These template trees are built on 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.

PP/4 will continue several of the case studies probably in cooperation with PP/2 and PP/3. Moreover, we have started an additional case study with ONB on the image archive.

Also 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 month 18 of the project. The functional requirements of the software are developed as part of work package PP/4.

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.

Planets Preservation Planning Tool support

Introduction

Apart from conducting case studies on preservation planning, the main focus of PP4 is the development of the preservation planning tool, called Plato. We are currently developing the tool and plan the first release in month 18.

Figure 9 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 10 depicts a wider range of possible measurement scales.

Focus	Node	Scale	Restriction	Unit	AddLeaf	AddNode	Remove
	Technical characteristics				AddLeaf	AddNode	Remove
X	Ubiquity	Ordinal	Ubiquitous/Widespread/Specialised/Obs				Remove
X	Support	Ordinal	0/1-5/6-10/10+				Remove
X	Documentation				AddLeaf	AddNode	Remove
X	Quality	Ordinal	Primary/Secondary				Remove
X	Disclosure	Ordinal	Full/Partial/None				Remove
X	Openness	Ordinal	Standard/Open/Proprietary				Remove
X	Availability	Ordinal	Public/Limited/None				Remove
X	Stability				AddLeaf	AddNode	Remove
X	Speed of change	Ordinal	<1 year/1-2 years/3-5 years/>5 years				Remove
X	Backwards compatability	Ordinal	None/Previous version only/Some previo				Remove
X	Ease of identification	Ordinal	Automatic/Manual/No				Remove
X	Ease of validation	Ordinal	Automatic/Manual/No				Remove
X	Lossiness	Ordinal	Lossy/Lossless				Remove
X	IPR	Boolean					Remove
X	Complexity	Ordinal	High/Medium/Low				Remove
X	Error tolerance	Ordinal	None/Detectable/Recoverable				Remove
X	Comparative size	Ordinal	Larger/Same/Smaller				Remove

Does the tree have Units?

Figure 9 Editing an objective tree in the decision support software

Focus	Node	Scale	Restriction	Unit	AddLeaf	AddNode	Remove
	Website				AddLeaf	AddNode	Remove
X	Record characteristics				AddLeaf	AddNode	Remove
X	Appearance				AddLeaf	AddNode	Remove
X	Fonts	Boolean					Remove
X	Page layout	Ordinal	Y/A/N				Remove
X	Highlighting				AddLeaf	AddNode	Remove
X	Links	Boolean					Remove
X	Text	Boolean					Remove
X	Cells	Boolean					Remove
X	Content				AddLeaf	AddNode	Remove
X	Documents				AddLeaf	AddNode	Remove
X	Text content	Boolean					Remove
X	Encoding	Ordinal	Text/Image				Remove
X	Images				AddLeaf	AddNode	Remove
X	Width	Integer		pixel			Remove
X	Height	Boolean		pixel			Remove
X	Resolution	Integer		dpi			Remove
X	Bit depth	Ordinal	>= original/< original				Remove
X	Colour space	Boolean					Remove
X	histogram						Remove
X	Internal links present and	Boolean					Remove
X	Tables				AddLeaf	AddNode	Remove
X	rows unchanged	Boolean					Remove
X	columns unchanged	Boolean					Remove
X	cell content unchanged	Boolean					Remove

Figure 10 Various measurement scales in the objective tree editor

Use Cases

This section describes the use cases for a tool that would support the decision making during preservation planning. We refer to it as a 'planning tool' or Plato. The tool is being developed at TUWIEN as part of PP4 – Decision support for preservation planning.

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 11 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 describe the first and the second version of the software tool. More details about the iteration of developments are in the section summary and outlook of this section. The integration of PA and PC services is scheduled for release two, as are template tree fragments and the assignment of results from PC services to the objective tree.

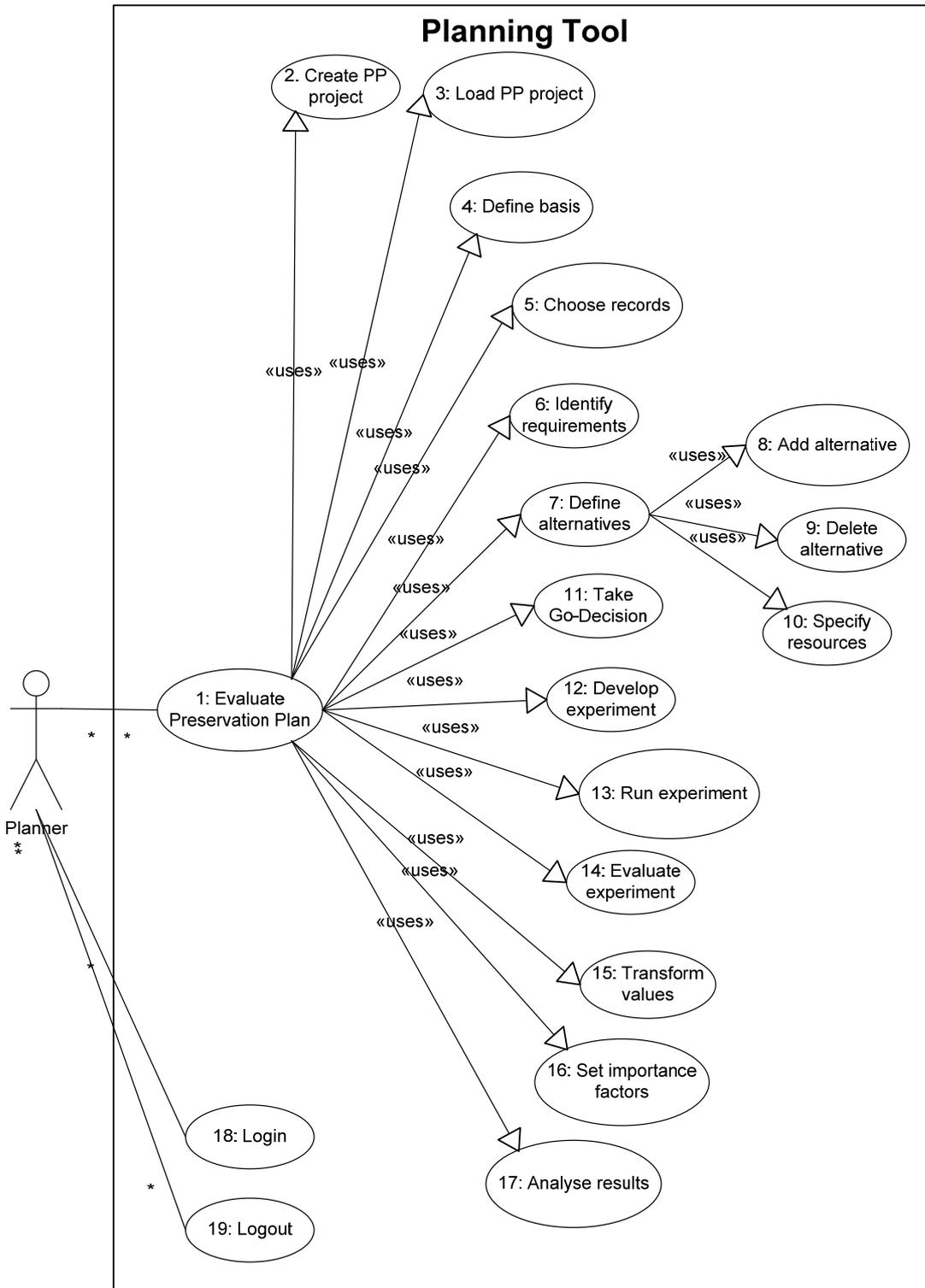


Figure 11 Use case overview diagram

Category	Entry	
Use Case ID	PP-1	
Title	<i>Evaluate preservation plan</i>	
Level	<i>Summary</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is logged in	
Trigger	Planner <u>creates a project</u> or <u>loads an existing project</u>	
Success guarantees	The preservation planning project is evaluated, the results are stored and known to the user.	
Main Success Scenario	<ol style="list-style-type: none"> 1. Planner <u>defines the basis</u> of the preservation plan. 2. Planner <u>chooses records</u>. 3. Planner <u>identifies the requirements</u> by defining the objective tree and assigning measurement units. 4. Planner <u>defines preservation alternatives</u> and their resources. 5. Planner <u>takes the Go-decision</u>. 6. Planner <u>develops the experiment</u>. 7. Planner <u>runs the experiment</u>. 8. Planner <u>evaluates the experiment</u>. 9. Planner <u>transforms values</u>. 10. Planner <u>sets importance factors</u>. 11. Planner <u>analyses the results</u>. 	
Exceptions	Step	Branching Action
	5	<p>Planner decides not to continue (No-Go decision):</p> <p>The decision is recorded and stored together with the reasoning, execution of the following steps of the workflow is not possible.</p> <p>The planner can later resume the evaluation of the plan, e.g. if assumptions, preferences or environmental conditions have changed, by <u>taking the Go-Decision</u>.</p>
Issues/Comments		

Category	Entry	
Use Case ID	PP-2	
Title	Create a preservation planning project	
Level	<i>User Goal</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is logged in	
Trigger	Planner selects 'Create project'	
Success guarantees	The preservation planning project is stored and opened, and the planner can <u>define the basis</u> of the project.	
Main Success Scenario	<ol style="list-style-type: none"> 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		

Category	Entry	
Use Case ID	PP-3	
Title	Load a preservation planning project	
Level	<i>User Goal</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is logged in	
Trigger	Planner selects 'Load existing project'	
Success guarantees	An existing preservation planning project is opened and the planner can continue with evaluating this project.	
Main Success Scenario	<ol style="list-style-type: none"> 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: <u>Define basis</u> 	
Exceptions	Step	Branching Action
	2	Planner cancels: System returns to the main menu
Issues/Comments	<i>A planner should not see the projects of other user groups. Role management will be provided in the Interoperability Framework.</i>	

Category	Entry	
Use Case ID	PP-4	
Title	Define basis	
Level	Summary	
Actors	Planner	
Preconditions	Planner is logged in	
Trigger	Planner successfully <u>loads</u> or <u>creates a project</u>	
Success guarantees	The basic properties of the project are defined and stored in the system.	
Main Success Scenario	<ol style="list-style-type: none"> 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 ' <u>Define basis.</u> '	
Trigger	Planner finishes the preceding step of <u>defining the basis</u> or directly selects 'Define sample records'.	
Success guarantees	Sample records for the planning project are uploaded and stored in the system.	
Main Success Scenario	<ol style="list-style-type: none"> 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	<i>User Goal</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is working on a project that has at least completed the step ' <u>Define sample records</u> '	
Trigger	Planner finishes preceding step of <u>defining sample records</u> or selects 'Define objective tree'	
Success guarantees	The objective tree with assigned measurement units is defined and stored in the system.	
Main Success Scenario	<ol style="list-style-type: none"> 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. <ol style="list-style-type: none"> 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	<i>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.</i>	

Category	Entry	
Use Case ID	PP-7	
Title	<i>Define preservation alternatives</i>	
Level	<i>Summary</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is working on a project that has at least completed the step ' <u>Identify requirements</u> '.	
Trigger	Planner selects 'Define alternatives' or finishes the preceding step of the workflow, ' <u>identify requirements</u> '.	
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	<ol style="list-style-type: none"> 1. System presents a list of existing alternatives in a table. 2. The planner can iteratively <u>delete an alternative</u> from the list, <u>add a new alternative</u> or <u>specify resources</u> 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	<i>User Goal</i>	
Actors	<i>Planner</i>	
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	<p>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.</p> <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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	<i>Sub-function</i>	
Actors	<i>Planner</i>	
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	<ol style="list-style-type: none"> 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	<i>User Goal</i>	
Actors	<i>Planner</i>	
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	<ol style="list-style-type: none"> 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	<i>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.</i>	

Category	Entry	
Use Case ID	PP-11	
Title	Take Go-decision	
Level	<i>User Goal</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is working on a project that has at least completed the step ' <u>Define alternatives</u> '.	
Trigger	Planner selects 'Go/No-go decision' or finishes the preceding step of the workflow, ' <u>define alternatives</u> '.	
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	<ol style="list-style-type: none"> 1. System presents an interface with the decision options: <ol style="list-style-type: none"> 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	<i>User Goal</i>	
Actors	<i>Planner</i>	
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 <u>Take Go-Decision</u> or selects 'Develop experiment'	
Success guarantees	An experiment plan for each alternative is defined and stored.	
Main Success Scenario	<ol style="list-style-type: none"> 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	<i>User Goal</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is working on a project that has completed the step ' <u>Develop experiment</u> ' and has <u>taken the Go-decision</u> .	
Trigger	Planner finishes preceding step <u>develop experiment</u> 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 <u>evaluating experiment</u> .	
Main Success Scenario	<ol style="list-style-type: none"> 1. System presents a summary including <ol style="list-style-type: none"> 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. <p>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.</p> 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 stores the output of the experiment in the registry. 5. The system provides an interface to upload the outcome of experiments performed in an external environment 6. The planner uploads any outcome of experiments. 7. The system stores the output in the registry. 	
Exceptions	Step	Branching Action
	1	Problems occur during experiment: System presents 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 ' <u>Develop experiment</u> ', for example to edit parameter settings for services to be called.
Issues/Comments		

Category	Entry	
Use Case ID	PP-14	
Title	<i>Evaluate Experiment</i>	
Level	<i>User Goal</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is working on a project that has at least completed the step ' <u>Run experiment</u> ' and has <u>taken the Go-Decision</u>	
Trigger	Planner finishes preceding step ' <u>run experiment</u> ' or selects 'Evaluate experiment'	
Success guarantees	The objective trees for all alternatives are evaluated.	
Main Success Scenario	<ol style="list-style-type: none"> 1. The system presents a list of the alternatives 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: '<u>Transform values</u>'. 3. The system presents an overview of the characterisation services that the user has defined in '<u>Develop experiment</u>'. 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 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. 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		

Category	Entry	
Use Case ID	PP-15	
Title	Transform values	
Level	<i>Summary</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is working on a project that has completed the step ' <u>Evaluate experiment</u> '	
Trigger	Planner finishes the preceding step <u>run experiment</u> or selects 'Transform values'	
Success guarantees	For each leaf of the objective tree a transformation table has been assigned.	
Main Success Scenario	<ol style="list-style-type: none"> 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	<i>User Goal</i>	
Actors	<i>Planner</i>	
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	<ol style="list-style-type: none"> 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	<i>User Goal</i>	
Actors	<i>Planner</i>	
Preconditions	Planner is working on a project that has completed at least the step ' <u>Set importance factors</u> ' of the workflow	
Trigger	Planner finishes preceding step ' <u>Set importance factors</u> ' or selects 'Analyse results'	
Success guarantees	The final results of each alternative of the project are presented by the system.	
Main Success Scenario	<ol style="list-style-type: none"> 1. System presents a list of possible result views such as <ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> i. Sum ii. Multiplication iii. Minimum iv. Maximum v. Sum of differences <p>The user can also set the desired level of depth of the tree.</p> 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	<i>User Goal</i>	
Actors	<i>User</i>	
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	<ol style="list-style-type: none"> 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	<i>User Goal</i>	
Actors	<i>User</i>	
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	<ol style="list-style-type: none"> 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		

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 on the Planets Testbed environment this tool will be accessible through the experiment user interface of the Testbed. Thus the Preservation Planning process is integrated into the Planets Testbed.

Table 2 shows the first two releases as planned at the moment and the main features associated with each version. The accuracy of this planning is of course dependent on the timely availability of project results as they feed into PP4.

The second iteration of the software in month 27 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 institutions and institutions with less expertise to define practicable objectives and measurement units.

The integration of PA and PC- services is also planned in the second iteration. PA services allow performing preservation experiments within the Plato software and the results of the experiments can be captured by the PC services. Also the results of the PP5 workpackage will 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 12 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. PP3 and PP6 are currently working towards collection models and profiling services; PP2 is developing policy and strategy models that will be considered for integration into Plato. Further input might be provided by PP6 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 <ul style="list-style-type: none"> • 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

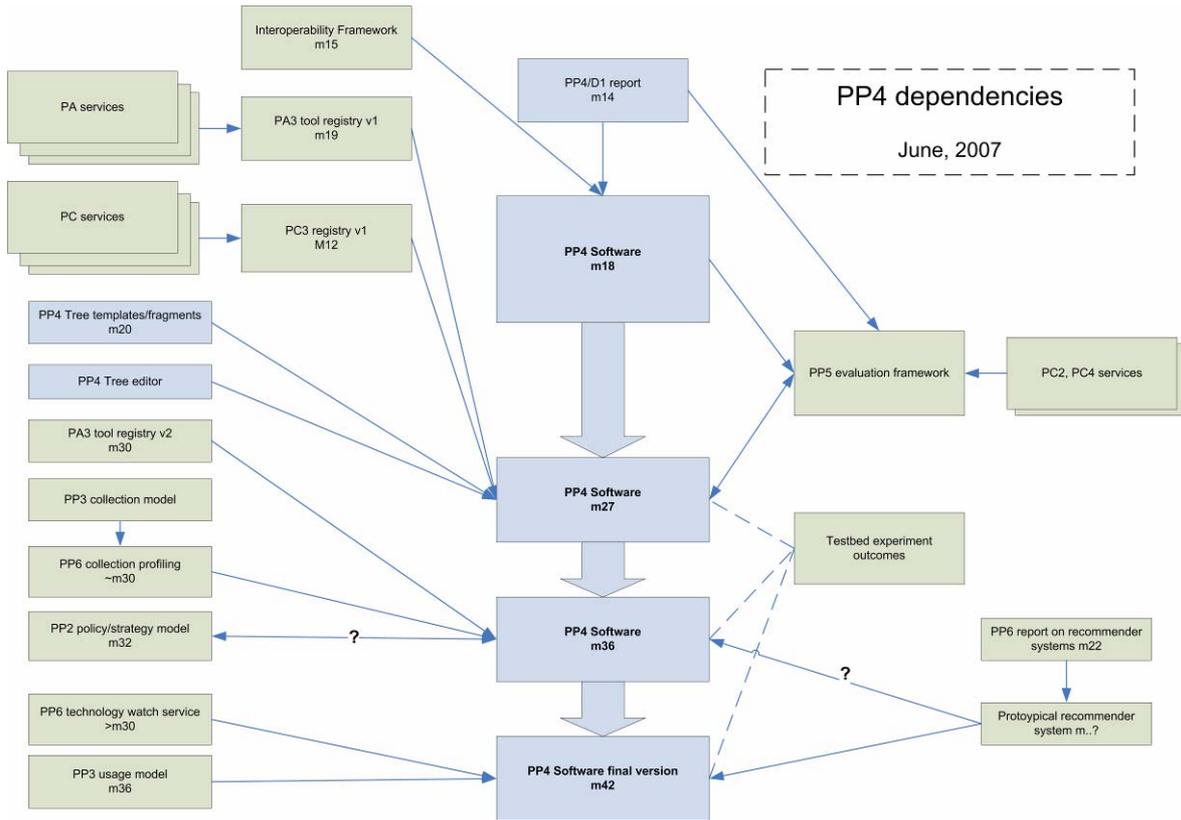


Figure 12 PP software dependencies