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Using Utility Analysis to Evaluate and Compare Preservation Strategies

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Motivation

- We have
  - collections with different file formats and preservation requirements
  - myriads of potential preserveration approaches (various converters, emulators, metadata schemes,…)
- We need
  - a *structured approach* to selecting and evaluating preservation solutions, rather than un-transparent „out-of-the-guts“ decisions

Outline

- Introduction
- Utility Analysis
  - Set objectives
  - Evaluate alternatives
  - Define preferences and decide
- Summary

Selecting a preservation strategy

Problem → Requirements → Solution

- Several preservation strategies, none excels in all circumstances
- Different requirements for different collections
- Steady change and development of strategies and tools

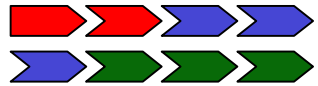
- Strategies that suit different requirements
- Means to make strategies comparable
- Measures to be equally applicable to new preservation strategies
- Structured approach

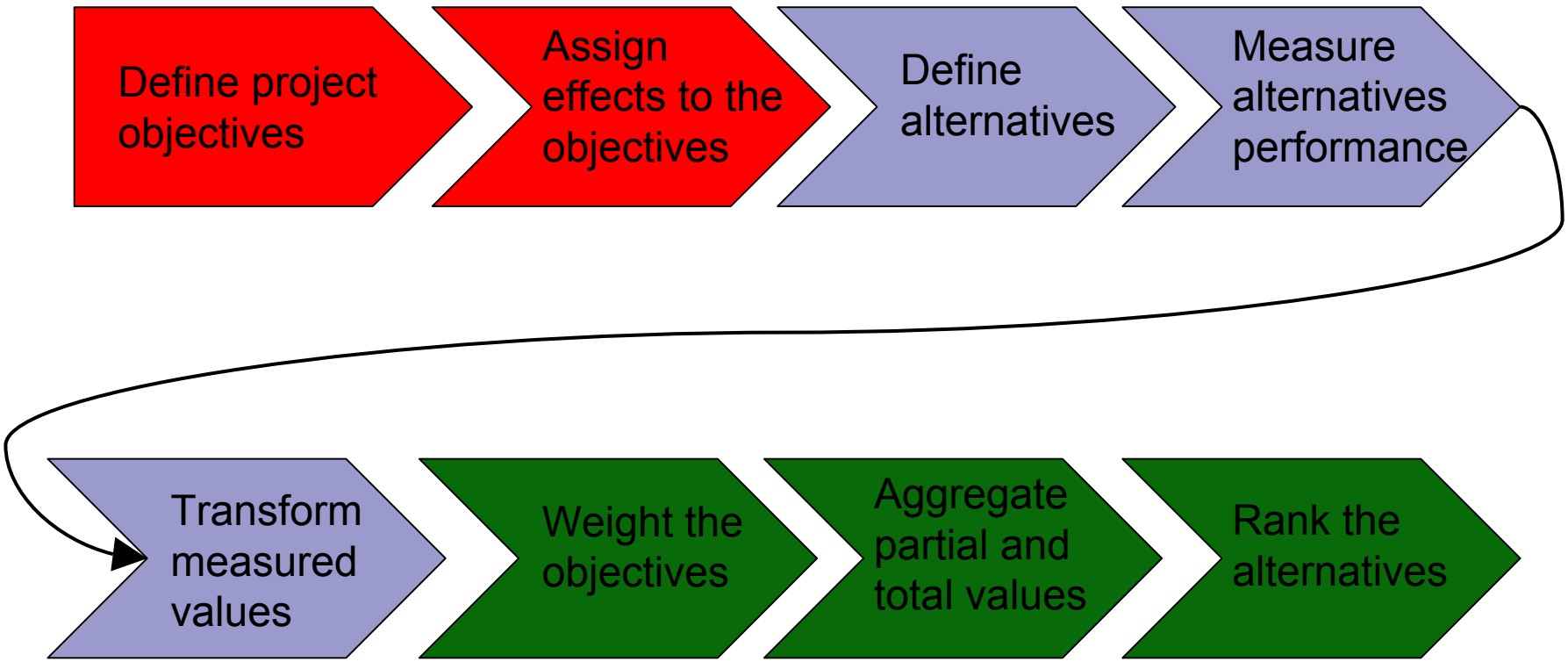
- Generic framework, which can be easily applied to specific environments
- Decision support system, which clearly ranks possible preservation solutions

Utility Analysis

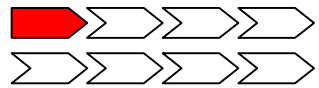
- Developed in the 1970s
- Applied mainly for infrastructure projects, such as dams, bridges, neighbourhoods
- Flexible and expandable
- Adapted to fit the preservation requirements

Utility Analysis Procedure





Define Project Objectives



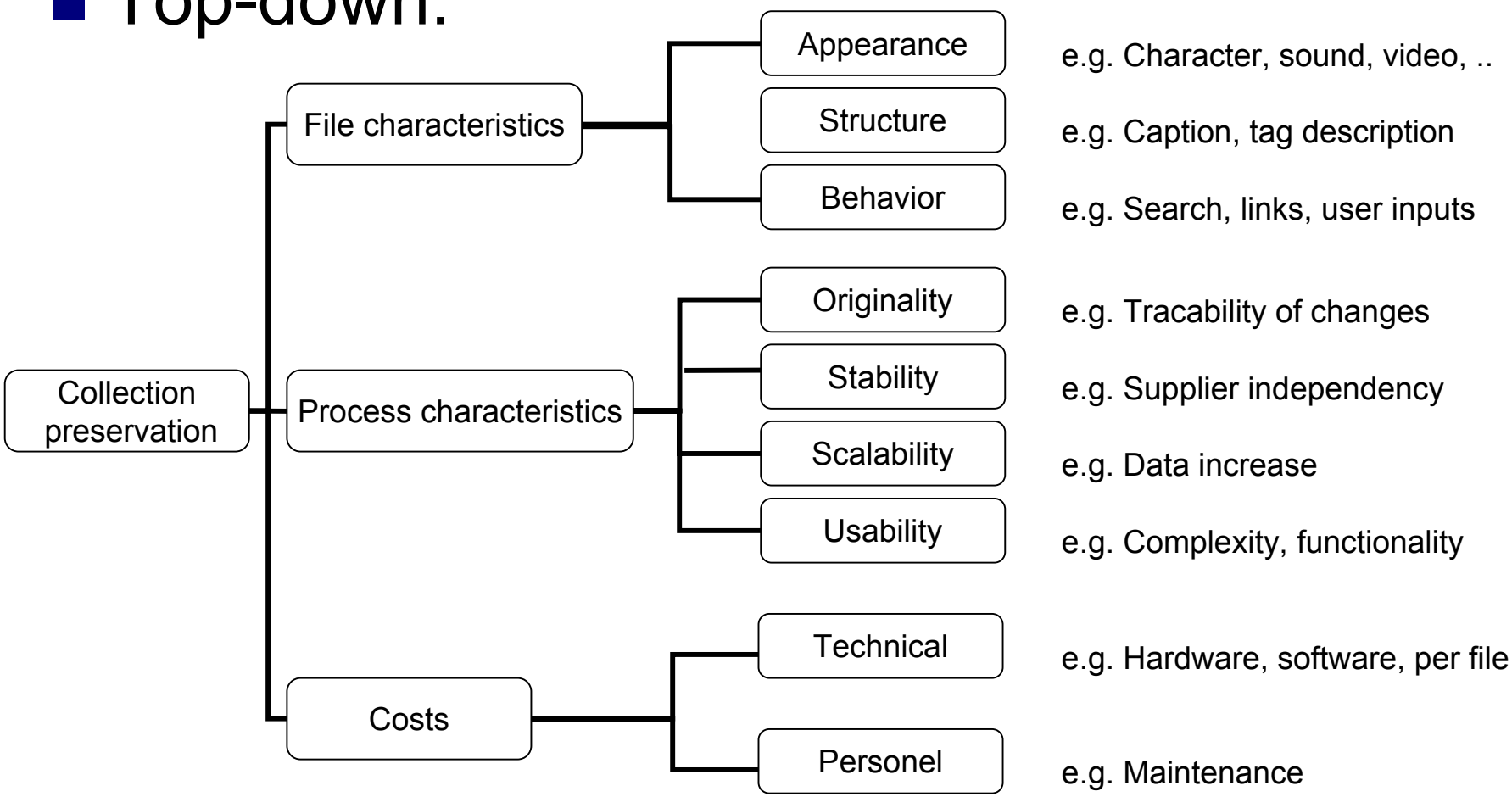
- Collect set of project objectives
- Include all requirements and desiderata
- Rather complex, extensive
- Procedure:
  - Bottom-up approach:
    brainstorming session
  - Top-down approach:
    according to generic objective tree
  - Structure as an *Objective Tree*

Define Project Objectives

- Bootom-up:

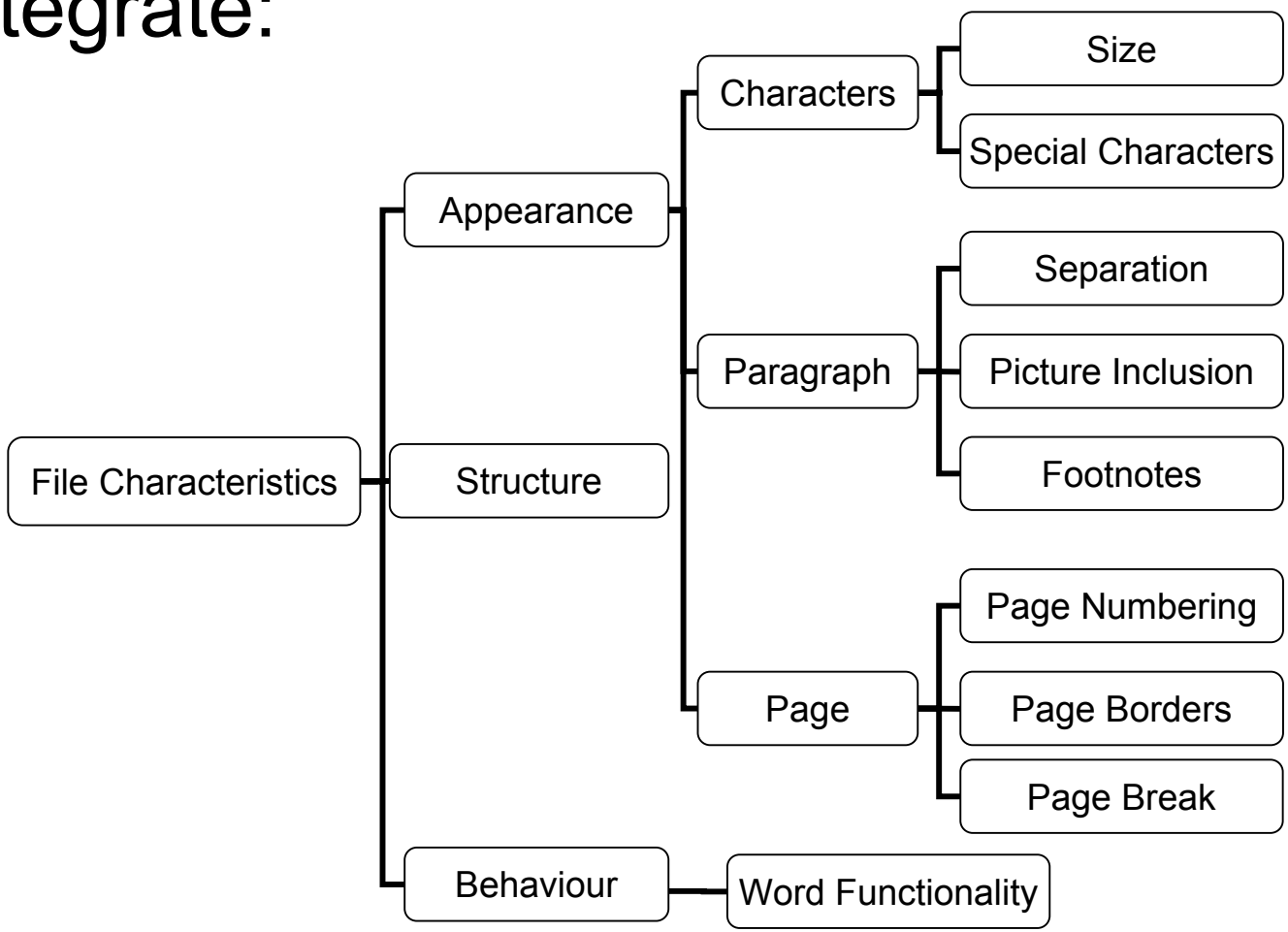
Define Project Objectives

- Top-down:

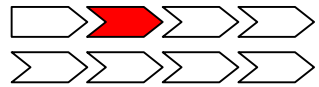


Define Project Objectives

- Integrate:



Assign effects to objectives



Objective$_i$

Measurable effects: for example in

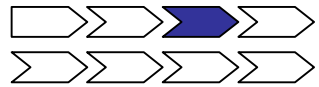
- dpi resolution, mm difference, true/false
- EURO per year, person months
- seconds per file
- ……

Subjective evaluation:

subjective impression when no measureable evaluation possible, for example

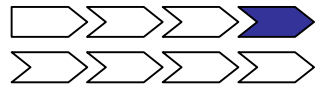
- display quality
- look-and-feel

Listing Alternatives



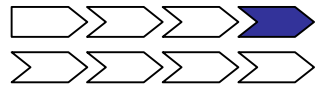
- Migration and Standardisation
  - Migrate documents to Adobe PDF using XXX
  - Migrate documents to OpenOffice 1.0
  - Migrate documents to PostScript using XXX
  - Migrate documents to MS Word 2003
- Encapsulation
- Hardware Museum
- …
- Maintain current strategy
- No action

Alternatives' evaluation



- Select files for evaluation
  - Original files from collection
  - Files from a testbed
- Ensure that they cover collection characteristics
- Perform preservation steps according to list of alternatives
- Measure results

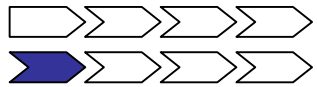
Alternatives' evaluation



- Result:
  Table of performance measures

	Word 2003	*OpenOffice*	*PDF 5.0*	*No changes*
Page margins	*0 mm*	*+ 3 mm*	*0 mm*	*0 mm*
Ingest: sec. per file	*10 sec*	*10 sec*	*15 sec*	*0 sec*
Software costs per year	*50 €*	*0 €*	*0 €*	*0 €*
Numbering of chapters	*3*	*N.A.*	*5*	*5*
Paragraph formatting	*3*	*2*	*5*	*5*

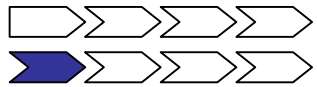
Transform Measured Values



- Need to make measured values comparable
- Define transformation table

	5	4	3	2	1	N.A
Page margins	*+/- 0mm*	*+/- 1mm*	*+/- 2mm*	*+/- 3mm*	*+/- 4mm*	*> 4mm*
Ingest: sec. per file	*0 -5 sec*	*5-10 sec*	*10-15sec*	*15-25sec*	*25-40sec*	*>.40sec*
SW costs/year	*0 €*	*1-30 €*	*31-50 €*	*51-70 €*	*71-100 €*	*> 100 €*
Chapter numbering	*5*	*4*	*3*	*2*	*1*	*N.A.*
Paragraph formatting	*5*	*4*	*3*	*2*	*1*	*N.A.*

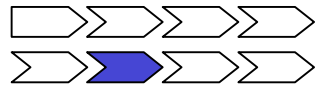
Transform measured Values



- Transform measures:

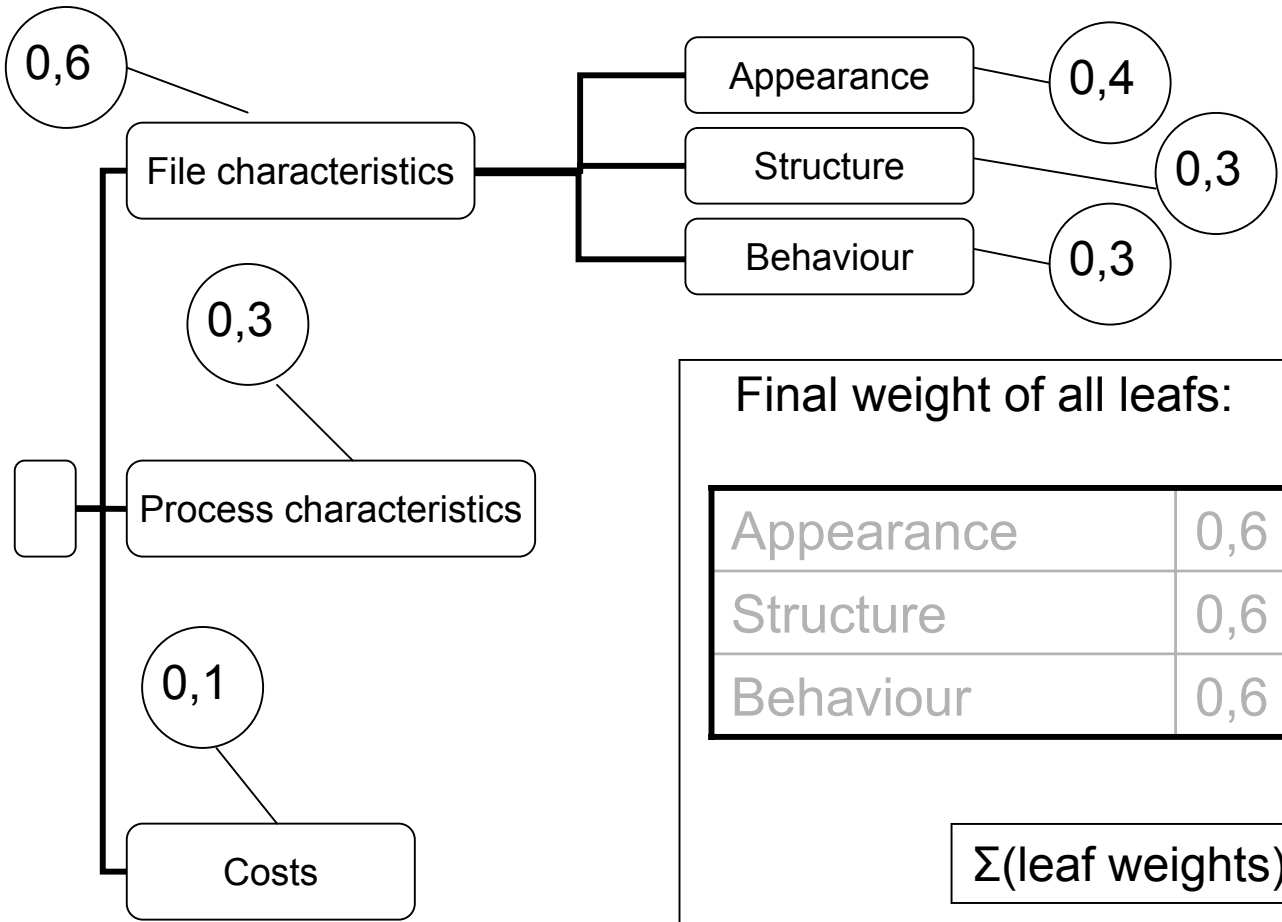
	Word 2003	*OpenOffice*	*PDF 5.0*	*No changes*
Page borders	*5*	*2*	*5*	*5*
Ingest: sec. per file	*4*	*4*	*3*	*5*
Software costs per year	*3*	*5*	*5*	*5*
Numbering of chapters	*3*	*N.A.*	*5*	*5*
Paragraph formatting	*3*	*2*	*5*	*5*

Weighting



- Objectives differ in importance / priority
- Assign weights to objectives
- Basically possible right after definition of Objective Tree
- Recommended to perform after measurement and transformation
- Weights per branch level sum up to 1

Weighting



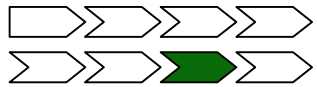
$\Sigma(w_{1,j}) = 1$

Final weight of all leafs:

Appearance	0,6 * 0,4 = 0,24
Structure	0,6 * 0,3 = 0,18
Behaviour	0,6 * 0,3 = 0,18

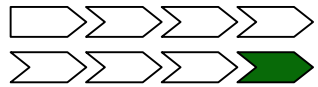
Σ(leaf weights) = 1

Aggregating part values



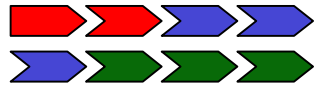
- Calculate leaf values by multiplying transformed measurements with weights
- Aggregate values per alternative
- If necessary, average or min/max over different demo-files
- Provides performance per alternative according to different branch levels, i.e. objective granularities

Final Ranking



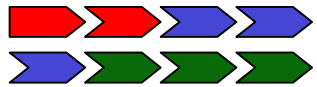
- Ranking of alternatives
- Not-acceptable alternatives are kept in ranking
- Final sensitivity analysis regarding non measurable influences on the decision, such as:
  - expertise in a specific alternative
  - good relation to a supplier
  - …

Summary



- Composition of Objective Tree depends strongly on collection requirements
- Different solutions vary mainly in
  - Objective tree composition
  - Objective‘s weights
- A few „standard“ Objective Trees may evolve
- We now have:
  - A structured approach to make accountable preservation decisions
  - A transparent decision process

Next steps



- Cooperating with institutions to elaborate "standard" Objective Trees
- Cooperate on generating "exhaustive" listings of file format characteristics
- Develop tool support for calculating different weighting scenarios
- Evolve into decision support system