The Decision Deck Project
Towards Open Source Software Tools
Implementing Multiple Criteria Decision Aid

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Decision Deck’s purpose

The Decision Deck project aims at collaboratively developing open source software tools implementing Multiple Criteria Decision Aid (MCDA).

Its purpose is to provide effective tools for three types of users:

- **practitioners** who use MCDA tools to support actual decision makers involved in real world decision problems;
- **teachers** who present MCDA methods in courses, for didactic purposes;
- **researchers** who want to test and compare methods or to develop new ones.
Decision Deck’s purpose

**Promote** MCDA research and make it more visible to the “outside world”.

**Generate** new open research issues and support them.

Help structuring a community composed of
- researchers in the field of MCDA;
- software developers;
- users/decision aid consultants.
Outline of this presentation

- Overview of the Decision Deck project;
  - A little bit of history & visible activities;
  - The Decision Deck Consortium & 6 initiatives;

- The future & what you can do.
But first . . .

. . . what is MCDA?

- **Alternatives** (decision actions) are evaluated on multiple preference dimensions (**criteria**, attributes);
  
  e.g. *cars evaluated according to their price, av. fuel consumption, look, max. speed, . . .*

- **Help** to determine the *best* alternative, rank the alternatives or assign them to ordered classes;

- By taking into account the **preferences** of the decision maker.
Dominance, Pareto-optimality

\[ \forall a, b \in A, \ a \Delta b \iff g_j(a) \geq g_j(b), \ \forall j \in F, \text{ one of the inequalities being strict,} \]

\[ \text{The dominance relation } \Delta \text{ expresses unanimity among criteria in favor of one action in the comparison,} \]

\[ \text{\(\Delta\) defines on } A \text{ partial order and is usually very poor,} \]

\[ a \in A \text{ is Pareto-optimal iff } \not\exists b \in A \text{ s.t. } b \Delta a, \]
Pareto front in a discrete bi-criterion problem
Multiple criteria aggregation procedures (MCAP)

define $A$  define $F$  preferences

evaluation matrix  preference parameters

MCAP

Overall preferences
But first . . .

. . . how does the software *situation* look like in the field?
- many different *methods*;
- many different *softwares*;
- **no unified** software to test the same problem on various methods.
Overview of the Decision Deck project

- A little bit of history & visible activities;
- The Decision Deck Consortium & 6 initiatives.
Overview of the Decision Deck project

1. A little bit of history & visible activities
Decision Deck’s history

- 2003
  EVAL project, financed by the Wallon Region (B), (SMG-ULB, MathRO-Mons, SCSI-ULB);

- 2006
  Lamsade (Paris-Dauphine) joined the project and restructured the existing platform with plugins (in conjunction with KarmicSoft)

  *Birth of the Decision Deck project and of the D2 client*;
Decision Deck’s history

- **2007**
  SMA (UL) joined in and invested in the Decision Deck project (plugin for **D2, D3, web services, XMCDA**);

- **2007**
  Contributions from Portugal (INESC Coimbra) and Poland (ICS Poznan) (plugins for **D2**);

- **2008-2009**
  Contributions from Télécom Bretagne (**web services, diviz prototype, XMCDA**);
Visible activities

- 4 past workshops + Current workshop
  Luxembourg, Paris, Coimbra, Mons, Brest;

- future workshops to come

- 2 developers days
  Luxembourg, Paris;

- 6 steering meetings
  Luxembourg, Paris, Brussels, . . .

- 7 specifications meetings
  Luxembourg, Paris, . . .

- a book in preparation (expected in March 2010)
  Evaluation and Decision Models with Multiple Criteria: Case Studies
Overview of the Decision Deck project

2. The Decision Deck Consortium & 6 initiatives
The Decision Deck Consortium

- A french non profit association\(^1\) which **steers** and **manages** the project;

- Headed by an administration board  
  V. Mousseau (*pres.*), P. Meyer (*trea.*), M. Pirlot (*sec.*),  
  R. Bisdorff, O. Cailloux;

- Guided by a general assembly (tomorrow!);

- **Individual** memberships! (30€)

- Formerly known as the “steering committee”.

\(^1\)Association loi 1901
Cette association a pour but de promouvoir le développement de logiciels d’aide à la décision, de favoriser leur diffusion, à travers notamment le développement de la plateforme logicielle Decision Deck. L'association prendra toute initiative en vue de coordonner l’ensemble des activités relative au développement de cette plateforme logicielle, en particulier organisation de conférences/workshops, publications d’ouvrages, recherche de fonds, coordination des participants au projet.
6 scientific initiatives

Decision Deck

- d2
- d4
- diviz
- MCDA web services
- XMCDA
- d3
6 scientific initiatives

D2
A rich open source Java client offering several MCDA methods.

- MCDA methods can be added as plugins;
- Role management and a first attempt of collaborative work;
- Currently offering IRIS, RUBIS and VIP, UTA-GMS/GRIP.
6 scientific initiatives

D2
6 scientific initiatives

MCDA web services
Algorithmic components or complete MCDA methods accessible online.

- Reuse of existing implementations of algorithms;
- Use of any programming language;
- Currently offering the RUBIS solver and the KAPPA LAB R library.

Further details later!
6 scientific initiatives

**XMCDA**

A standardised XML recommendation to represent objects and data structures issued from the field of MCDA.

- Allow different MCDA algorithms to interact and be easily callable;

- Direct applications:
  - MCDA web services;
  - Standard visualisation of data.
6 scientific initiatives

XMCDA

```xml
<alternatives name="myAlternatives">
  <alternative id="x1" name="Red Ferrari"/>
  <alternative id="x2" name="Blue Corvette">
    <type>real</type>
    <active>true</active>
    <reference>false</reference>
  </alternative>
  <alternative id="x3" "UFO">
    <type>fictive</type>
  </alternative>
</alternatives>
```

Further details later!
6 scientific initiatives

D3

An open source rich internet application for XMCDA web services management.

- Call and basic management of web services;
- Interface in a web browser.
6 scientific initiatives

D3

Time for a demo!
6 scientific initiatives

`diviz`

An open source Java client and server for XMCDA web services composition, workflow management and deployment.

- Call and advanced management of web services;
- Oriented towards algorithms (and not decision aid processes).
6 scientific initiatives

Further details later!

V. Mousseau  
Decision Deck
6 scientific initiatives

D4

A rich internet application host for implementing, running and auditing XMCDA compatible decision aid processes.

- Oriented towards decision aid processes and algorithms;
- Interface in a web browser.
Key websites

- http://www.decision-deck.org
  *General information about the project;*

  *Technical information about the D2 and D3;*

- http://sourceforge.net/projects/decision-deck
  *Download area of D2 and D3;*

- http://www.decision-deck.org/XMCDA
  *All information about the XMCDA standard;*

- http://www.diviz.org
  *All information on the diviz initiative.*
Focus on

MCDA web services
Observations:

- MCDA researchers are often not computer scientists;  
- MCDA researchers have programmed their algorithm(s) in the programming language they know best;  
- MCDA researchers are generally not interested in reimplementing their algorithm(s) in an *imposed* programming language.
MCDA web services

Raymond Bisdorff’s idea (2007)

Instead of asking researchers to rewrite their MCDA algorithms in a specific programming language, allow them to publish their programs online s.t. they can be accessed over a network, as publicly available web services.

Consequences:

- Programming language independence (+);
- GUI-less:
  - Exclusive focus on the algorithmic part (+);
  - Harder to interact with the program (−);
- At any time, the latest version of the program (+).
MCDA web services

How to use the web services?
Via various client softwares, like:
- D2 (via one of the plugins, called Rubis);
- D3;
- Command line (via a SOAP encapsulation);
- diviz.

What data is exchanged?
XML files respecting the XMCDA standard!
MCDA web services

Client software

weighted sum WS

plot criteria WS

RUBIS WS

ernst-schroeder.uni.lu

weighted sum program

plot criteria program

RUBIS solver

Java

R

python
MCDA web services

Web service architecture:

- **submitProblem**
- **jobSpooler**
- **spoolDaemon**
- **kappalab**
- **ticket ID**
- **requestSolution**
- **problems**
- **solutions**
MCDA web services

Properties:
- Programming language independance
  Nearly any GUI-less program can be run behind the WS;

- Asynchronous
  submitProblem & requestSolution
  Useful in case the calculations are time-consuming;

- Interoperable
  The output of a WS can be reinjected into another WS.
The future & what you can do.
17-18 September 2009

5th Decision Deck Workshop
17-18 September 2009, Brest, Bretagne, France
http://conferences.telecom-bretagne.eu/ddws5

What is Decision Deck?
- The Decision Deck project aims at collaboratively developing software tools implementing Multiple Criteria Decision Aid.
- The purpose of the project is to provide effective tools for three types of “users”:
  - practitioners who use MCDA tools to support actual decision makers involved in real world decision problems,
  - teachers who present MCDA methods in courses, for didactic purposes,
  - researchers who want to test and compare methods or to develop new ones.
- The project aims at developing several software modules that are able to interact.

Purpose of the workshop
- presentation of the latest software developments;
- advances on the MCDA data modelling language XMCDA;
- developments on the representation of decision aid processes;
- discussions on strategic issues;
- future developments in the project;
- meeting of the Decision Deck Consortium;
- discussions on applications.
How you can help the project

- Join the Decision Deck Consortium (contact patrick.meyer@telecom-bretagne.eu),
- Support our project (development, standardisation, ...),
- Test the software solutions & let us know your opinion.
If you want to support the project

WE WANT YOU TO DEVELOP MCDA COMPONENTS
Developing web services

WS architecture, independent from diviz.
What you have to do to develop a web service (with integration into diviz)

Rough recipe:

- **Determine** the XMCDA data types that your command line program needs;

- **Adapt** your program to read and write XMCDA files;
  
  *existing R library & soon to come Python library!*

- 2 input parameters for your program:
  - Input data directory;
  - Output data directory;

- **Specify** the mandatory and optional input and output data files and XMCDA data types;

- **Send** us the program with the specifications.

See also [http://www.diviz.org](http://www.diviz.org) for detailed instructions.
How to stay informed?

Low traffic informational mailing list of the Decision Deck project:
https://mlistes.telecom-bretagne.eu/wws/subscribe/decisiondeck-info

Low traffic informational mailing list of the diviz software:
https://mlistes.telecom-bretagne.eu/wws/subscribe/diviz-announcements
That’s all folks

Thank you for your attention!