# The XMCDA-2.0 recommendation

*a standard XML encoding of*
*Multiple Criteria Decision Aid Data*

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## Outline of the talk

- Conventions
    - *XMCDA Document object model*
    - *XML tags' names*
    - *default attributes and elements*

- Elementary XMCDA data types
    - *values*
    - *intervals, points & scales*
    - *functions*

- How to specify –
    - *MCDA problem descriptors*
    - *method–specific parameters & messages*
    - *alternatives, criteria & performance table*

## Motivation

A standard data format does not exist to test a same MCDA problem instance on various methods (and softwares);

Existing MCDA methods / algorithms cannot *communicate*.

Creation of the **specification committee** within the DECISION DECK Project with the objective to elaborate a standardised XML format for MCDA data.

## Introduction

XMCDA is an instance of **UMCDA-ML**, the *Universal Multiple Criteria Decision Aid Modelling Language*.

UMCDA-ML is intended to be a modelling language to express all potential MCDA concepts as well as generic decision aid processes.

XMCDA focusses actually more particularly on MCDA **concepts** and **data structures** and is defined by an **XML schema**.

The current release (Version 2.0) was published on March 31 2009.

The goals of the XMCDA standard are to ease :

- the **interaction** of different MCDA algorithms ;
- the execution of various algorithms on the **same problem** instance ;
- the **representation** and **illustration** of MCDA concepts and data structures via standard tools like web browsers.

XMCDA (©Decision Deck Consortium) is maintained by the specifications committee within the Decision Deck project.

Abstract description of the XMCDA structure is performed via a detailed XML schema ;

See schema documentation for further details :
http ://www.decision-deck.org/xmcda

General idea : express MCDA concepts through a few general XML structures.

- **MCDA concept** : a real or abstract construction related to the field of MCDA which needs to be stored in XMCDA ;
  *for example, the set of potential decision alternatives ;*

- XMCDA **type** : XML structure that we created for the purpose of XMCDA ;
  *for example, <alternatives> to store the relevant data concerning the description of a set of decision alternatives.*

A list of generic elements under the root element <XMCDA> like :

- Project or file **reference description**
- Output messages from methods (**log** or **error messages**) and input information for methods (**parameters**)
- Description of major MCDA concepts like :
  - **alternatives** and **criteria**
  - **performance tables** and **preference relations**
  - **best choice** and **ranking recommendations**
  - **sorting categories** and **sorting results**
  - ...

## XMCDA *convention on the tag names*

- The name of an XMCDA element tag starts by a **lower-case** letter
- The rest of the name is in mixed case with the first letter of each internal word capitalised
- We use **whole words** and avoid as much as possible acronyms and abbreviations like :

  `<methodParameters>`, `<performanceTable>` and
  `<preferenceDirection>`

- Objects of the same type can be gathered in a **compound** tag named after the plural form of its components' tag like : `<alternative>` tags are gathered under an `<alternatives>` tag)

## *Convention on the use of attributes*

**Three** attributes are defined for the main XMCDA data elements :

- `id` : *machine readable* code or identifier of an element instance
- `name` : *human-readable* name of an object
- `mcdaConcept` : MCDA type of a particular instance of an XMCDA data structure

```
<alternative id ="a01" name="first alternative"
          mcdaConcept="Potential Decision Action">
    <description>
    ...
    </description>
</alternative>
```

## *Elementary XMCDA value type*

```
<values>
    <value><integer>8</integer></value>
    <value><rankedLabel>
        <label>Good</label>
        <rank>1</rank>
    </rankedLabel></value>
    <value><rational>
        <numerator>10</numerator>
        <denominator>3</denominator>
    </rational></value>
    <value><real>3.141526</real>
    </value>
</values>
```

Note that there also exists a type called `<numericValue>` which restricts value to numerical values.

## *Interval, point & scale type*

```
<interval>
        <lowerBound><value>[..]</value></lowerBound>
        <upperBound><value>[..]</value></upperBound>
</interval>
```

```
<point>
        <abscissa><real>2.7182818</real></abscissa>
        <ordinate><integer>23</integer></ordinate>
</point>
```

Scales can be qualitative, quantitative or nominal.

```
<scale>
    <valuationType>{standard|bipolar}</valuationType>
    <quantitative>
        <preferenceDirection>{max|min}</preferenceDirection>
        <minimum><real>0.00</real></minimum>
        <maximum><real>1.00</real></maximum>
    </quantitative>
</scale>
```

## Elementary XMCDA types : functions

A `<function>` element can either describe a constant, a linear, a piecewise linear function or simply a set of points.

```
<function>
      <constant><real>456.3847</real></constant>
</function>

<function>
      <linear>
            <slope><real>4.00</real></slope>
            <intercept><real>4.00</real></intercept>
      </linear>
</function>

<function>
      <points>[..]</points>
</function>
```

## Elementary XMCDA types – generic description element

A generic `description` is potentially present in each XMCDA type.

```
<alternatives>
      <description>
            <title>The list of alternatives</title>
            <comment>European cars
                  are considered.</comment>
      </description>
      [..]
<alternatives>
```

## How to describe the current project ?

`projectReference` : description of the current project by different tags from the `description` type.

```
<projectReference id="testProblem">
      <version>1.2</version>
      <creationDate>2008-10-20T22:24:02</creationDate>
      <author>John B Smith</author>
</projectReference>
```

## How to specify method-specific parameters ?

Some methods require some specific parameters in order to guide the resolution of a decision problem.

```
<methodParameters>
      <approach>outranking</approach>
      <problematique>choice</problematique>
      <methodology>Rubis</methodology>
      <parameter name="variant">
            <value>
                  <label>standard</label>
            </value>
      </parameter>
</methodParameters>
```

## How to store method-specific messages?

Certain methods might generate some error or log messages.

```
<methodMessages>
      <errorMessage>
            <number>404</number>
            <name>Error 404</name>
            <message>
                  Data not found.
                  Did you specify a bad file name?
            </message>
      </errorMessage>
      <logMessage>
            <number>0</number>
            <name>OK</name>
            <message>Execution successful.</message>
      </logMessage>
</methodMessages>
```

## How to define alternatives?

```
<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" name="UFO">
            <type>fictive</type>
      </alternative>
</alternatives>
```

## How to define criteria or attributes?

```
<criteria>
      <criterion id="g1" name="Motor Engine Power">
            <description>
                  <comment>measured in horsepowers</comment>
            </description>
            <attributeReference>att1</attributeReference>
            <scale>
                  <quantitative>
                        <preferenceDirection>
                              max
                        </preferenceDirection>
                        <minimum><real>50</real></minimum>
                        <maximum><real>200</real></maximum>
                  </quantitative>
            </scale>
      </criterion>
      <criterion id="g2"/>
</criteria>
```

## How to define sorting categories?

```
<sortingCategories>
      <category id="g" name="goodStudents">
            <active>true</active>
      <category>
      <category id="m" name="mediumStudents">
            <active>false</active>
      <category>
</sortingCategories>
```

```
<performanceTable>
      <alternativesPerformance>
            <alternativeID>alt1</alternativeID>
            <performance>
                  <criterionID>g1</criterionID>
                  <value><real>72.10</real></value>
                  </performance>
            <performance>
                  <criterionID>g2</criterionID>
                  <value><real>82.62</real></value>
                  </performance>
            </alternativesPerformance>
      <alternativesPerformance>
            <alternativeID>alt2</alternativeID>
            [..]
            </alternativesPerformance>
</performanceTable>
```

You've got the general ideas !

More advanced preferential information on alternatives, criteria, attributes and categories may be described.

For further details : http ://www.decision-deck.org/xmcda.

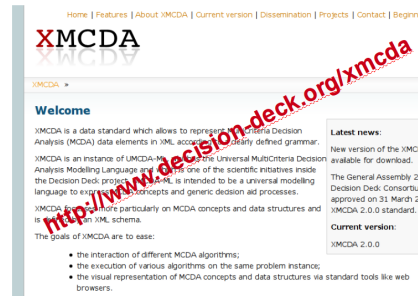In particular, have a look at the *Quick guide to* XMCDA.

## XMCDA : time for a demo

- A sample XMCDA instance ;

- The XMCDA schema description (XSD) ;

- Visualisation in a web browser with XSLT and CSS resources

## To conclude ...

- XMCDA provides **generic** types to represent a lot of concepts
- Some things are certainly missing ; the XMCDA standard is extensible
- Try to represent your MCDA data in XMCDA and tell us what is wrong and/or missing
- Who is *us* ?

## About the UMCDA-ML Specifications Committee

- Maintenance of XMCDA & management of its future versions
- Proposal of **evolutions**, according to needs expressed by users of XMCDA
- Regular specifications meetings and discussions
- Dissemination issues of the XMCDA releases



- Forthcoming work on UMCDA-ML
- **Don't hesitate to join us**, if you're interested !