Keynote

Smart data, decisions and processes

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Research and teaching:
Data & Process analytics
Business rules, processes and information
Decision models and tables
Smart Business
To visualize/improve the Business
* Document agreement on what the Business wants to accomplish
* Remove ambiguity
* Enable the “Big Picture” view of the Business

To automate the Business
* Driving software development with models
* Creating software directly from models
A business process model is a collection of related, structured activities that produce a specific service or product (serve a particular goal)

Objectives: (1) descriptive, (2) prescriptive, (3) explanatory
Overview

- Business process concerns
- Decisions and processes
- Decision model & notation
- Decision tables
- Decision processes
Business process concerns
What should be in the process model?

Exceptions?
Timers?
Happy path?
Decisions?
Decision logic?
Roles?
Messages?
Notifications?
Triggers?
Conditions?
...

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Decisions are important for business, not only processes. Why would we only model the processes?

* Where is the decision?
  How is the decision logic modeled?

* Model the Decision activity: Decide acceptance
Strategic decisions
• Do we enter the insurance market?
• Should we sell travel insurance?

Tactical decisions
• Which products will we promote?
• How to measure and manage performance?

Operational decisions
• How to handle routine cases?
• Follow known rules

Decision execution
• Handle the cases
• Execute the model
Nested decision paths

(Source: Decision Management Solutions)
Decision trees should not be process paths

* Do not hardcode decision rules into the process model
* Separating (decision) rules from the process simplifies the process
* Simplify nested decision paths: Decide applicant type

Applicant type depends on:
- Age
- (and in some cases also Medical Record)
Separate the rules from the process

Rules to decide the routing

Business Process Model (BPMN)
Decision models are not lower level details of one process

* **Decisions models can span over multiple activities, and even multiple processes**

* **Separation of concerns**
* Decisions and process are equal partners
Observation 4: model decisions

Decision(s) (rules) need to be modeled

* A standard for processes (BPMN) is not enough

* Upcoming Decision Modeling & Notation standard (DMN)
Good decision table models are a proven technique to represent decision rules.

*Consistency, completeness and correctness by design*

<table>
<thead>
<tr>
<th>Applicant Risk Rating</th>
<th>Applicant Age</th>
<th>Medical History</th>
<th>Applicant Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt; 60</td>
<td>good</td>
<td>Medium</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 60</td>
<td>bad</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>[25..60]</td>
<td>-</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>&lt; 25</td>
<td>good</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>&lt; 25</td>
<td>bad</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Observation 6: the decision process

Sometimes the entire process is about a decision

* Model the decision first, and then think about how to execute it

* The same decision can be processed in many ways

* The process of making a decision depends on the desired criteria

(throughput, efficiency, customer comfort, ...)

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There are many more business rules than decision rules

*Behavioral rules & constraints, timing rules, task allocation rules, ...*

*If all you have is a hammer ...*

*Separate rules and processes*

BPMN really stands for “Business People May Not…understand”
(Jim Sinur's blog "Burn Baby Burn, August 2010)
Observation 8: the continuum

Business rules constrain and guide the process(es)

* The Process - Rule continuum
* Declarative process modeling, smart BPM, smart decisions, smart business

Figure 1. Axis of Adaptability

Source: Gartner (May 2013)
Multiple models

*The blind men and the elephant*. Poem by John Godfrey Saxe (Cartoon G. Renee Guzlas, artist).

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Decisions and processes
Decisions need to be modeled

Decision Management
Decision Analytics
Decision Modeling

Rule Task

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Process and Decision Model
Why separate decisions-processes?

* The process can be rather stable
* But the decision rules can change all the time
Why separate decisions-processes?

* Simpler processes
* Different responsibilities, different stakeholders
* Different timing of changes
* Improved agility (change decision and keep process)

* Simpler decision modeling and discovery
* Reuse decisions across processes
* Improved visibility and focus
* Automate manual decisions
Decision model & notation
DMN components

Decision Model (DMN)

Routing

Routing table

Application risk score model

Application risk

Eligibility

Eligibility rules

Eligibility rules

P | Employment status | Country | Age | Eligibility
---|------------------|---------|-----|----------------
1  | UNEMPLOYED      | -       | -   | INELIGIBLE
2  | -                | no(UK)  | -   | INELIGIBLE
3  | -                | -       | < 18| INELIGIBLE
6  | -                | -       | -   | ELIGIBLE
Decision Requirements Graph

- Eligibility
- Policy rules
- Application form
- Risk
- Score model
- Customer behaviour
- Policy group
- Decision
- Business knowledge
- Knowledge source
- Input data

Information requirement
Knowledge requirement
Authority requirement
What is to be decided? Possible outcomes?

Decisions require:
- Input data
  - Transactions
  - Master data
  - External data
- Decision logic
  - Rules, knowledge
  - Policies
  - Analytics
- Outcome of other decisions
  - Reusability

The process of decision making?
Example: decision model
* **Decision logic**

* **Natural language**
  * Unclear, ambiguous

* **Logic**
  * Powerful, unambiguous, but not for business people

* **Structured English Rules**
  * Subset of natural English
  * Trade-off between:
    * easy of use (but not very powerful)
    * powerful (but difficult to use)

* **Decision trees, tables, graphs, diagrams**
  * Different representations for different purposes:
    acquisition, V&V, decision making, dependencies, impact analysis

* **Object Constraint Language**
  * Part of UML
  * Useful for pre- and postconditions
Decision tables
Kim Clijsters' Tennis Ranking

“Clijsters becomes the world's number one if she reaches the final, OR If Davenport doesn't reach the final, OR Mauresmo doesn't win the tournament.

Lindsay Davenport stays number one if she wins the tournament AND Clijsters doesn't reach the final, OR she looses the final (against another player than Mauresmo) AND Clijsters looses in the semi-finals.

Amélie Mauresmo becomes number one if she wins the tournament and Clijsters looses in the quarter-finals.”

(Translated from www.sporza.be, ...)

<table>
<thead>
<tr>
<th>1. Clijsters</th>
<th>goes out before semi-final</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Davenport</td>
<td>goes out before final</td>
</tr>
<tr>
<td>3. Mauresmo</td>
<td>does not win tourn.</td>
</tr>
<tr>
<td></td>
<td>wins tourn.</td>
</tr>
<tr>
<td>1. Clijsters number 1</td>
<td>x</td>
</tr>
<tr>
<td>2. Davenport number 1</td>
<td>.</td>
</tr>
<tr>
<td>3. Mauresmo number 1</td>
<td>.</td>
</tr>
</tbody>
</table>

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<tr>
<td></td>
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</tr>
<tr>
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<td>x</td>
</tr>
<tr>
<td>2. Davenport number 1</td>
<td>.</td>
</tr>
<tr>
<td>3. Mauresmo number 1</td>
<td>.</td>
</tr>
</tbody>
</table>
Tables, methodology and standard

* **Decision tables (DT)**
  * Decision rules in a tabular format

* **Decision table methodology (DTM)**
  * How to use a constrained form of decision tables in order to model decisions
  * Goal-oriented decision modeling network
  * Good decision table design
  * Single hit tables (complete, consistent and correct), relations between tables, table notation, contraction, optimization, normalization.

* **Decision Modeling & Notation (DMN) standard**
  * Standard syntax and notation for exchange
  * Recognize other forms of tables
  * Combine tables with other concepts in decision modeling
  * Standard expression language
Modeling Issues

- The global model

  Decision table hierarchy
  A condition subtable returns the outcome of a decision and uses it in another table

- The detailed model

  Decision table construction
  Kinds of tables

<table>
<thead>
<tr>
<th>Car group</th>
<th>Booked &gt;= 3 days in advance</th>
<th>Duration (D=Daily, W=Weekly, M=Monthly)</th>
<th>Discount 10%</th>
<th>Discount €50.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Compact</td>
<td>Y</td>
<td>-</td>
<td>x</td>
<td>.</td>
</tr>
<tr>
<td>2</td>
<td>N</td>
<td>-</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>3 Mid-sized, Full Sized, Luxury, Sport, Utility, Minivan</td>
<td>Y</td>
<td>D</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>N</td>
<td>W</td>
<td>x</td>
<td>.</td>
</tr>
<tr>
<td>5</td>
<td>D</td>
<td>M or (other)</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>6</td>
<td>N</td>
<td>D</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>7</td>
<td>M or (other)</td>
<td>W</td>
<td>.</td>
<td>x</td>
</tr>
<tr>
<td>8</td>
<td>(other)</td>
<td>M or (other)</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>9</td>
<td>Y</td>
<td>-</td>
<td>x</td>
<td>.</td>
</tr>
<tr>
<td>10</td>
<td>N</td>
<td>-</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

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* Decision tables

* Single hit (returns 1 rule with outcome(s))

  * Default:
    If rules are non-overlapping: unique hit

  * Recognize others:
    If rules are overlapping, the 1 rule has to be selected:
    any hit, first hit, priority hit

* Multiple hit (returns a list of rules)
DMN identifies different table types, indicated by the first letter:

* **unique hit** tables: every input case is included in one rule only. There is no overlap between rules.

* **any hit** tables: every input case may be included in more than one rule, but the outcomes are equal. Rules are allowed to overlap.

* **priority hit** tables: multiple rules can match, with different outcome values. This policy returns the matching rule with the highest output value priority (e.g. highest discount).

* **first hit** tables: multiple (overlapping) rules can match, with different outcome values. The first hit by rule order is returned (and evaluation can halt). This is a common usage, because it resolves inconsistencies by forcing the first hit.

It is important to distinguish this type of table from others because the meaning depends on the sequence of the rules. Because of this sequence, the table is hard to validate manually and therefore has to be used with care.
Tables with redundancy (ugly)

Overlapping rows (but with the same conclusion)

<table>
<thead>
<tr>
<th>TypeOfOrder</th>
<th>CustomerLocation</th>
<th>TypeOfCustomer</th>
<th>SpecialDiscount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web</td>
<td>US</td>
<td>Wholesaler</td>
<td>10%</td>
</tr>
<tr>
<td>Phone</td>
<td>non-US</td>
<td>Retailer</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Retailer</td>
<td>-</td>
<td>-</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Phone</td>
<td>-</td>
<td>-</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

-> multiple rows can apply: what if one is changed? **Contradiction**
This is a list of rules, not a good decision table (where is Phone, non-US?)

The better version:

<table>
<thead>
<tr>
<th>TypeOfOrder</th>
<th>CustomerLocation</th>
<th>TypeOfCustomer</th>
<th>SpecialDiscount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web</td>
<td>US</td>
<td>Wholesaler</td>
<td>10%</td>
</tr>
<tr>
<td>Retailer</td>
<td>non-US</td>
<td>Retailer</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Retailer</td>
<td>-</td>
<td>-</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Phone</td>
<td>-</td>
<td>-</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
First-hit tables (bad)

First hit table (overlapping rows but with different conclusions)

<table>
<thead>
<tr>
<th>TypeOfOrder</th>
<th>CustomerLocation</th>
<th>TypeofCustomer</th>
<th>SpecialDiscount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web</td>
<td>US</td>
<td>Wholesaler</td>
<td>10%</td>
</tr>
<tr>
<td>Phone</td>
<td>non-US</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Retailer</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

-> multiple rows can apply: take the first hit (requires sequence!)
Hard to validate. This is a list of rules, not a good decision table

The better version:

<table>
<thead>
<tr>
<th>TypeOfOrder</th>
<th>CustomerLocation</th>
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<td>US</td>
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</tr>
<tr>
<td>Phone</td>
<td>non-US</td>
<td>Retailer</td>
<td>5%</td>
</tr>
<tr>
<td>Retailer</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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The decision table as relation

- Exclusivity

Exclusivity:

- Column 4 subsumes column 1

- Completeness

Completeness:

- (C₁₁, C₂₁)
- (C₁₁, C₂₂)
- (C₁₂, C₂₁)
- (C₁₂, C₂₂)
- ...

- (x, x)
- (x, -)
- (-, x)
- (-, -)
- ...

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2011: Gwen (from insurance):

“Jan, I attended your presentation last year, and we applied the ideas you told us. I must thank you. What used to take 5 people for 5 months is now done by 1 person in 2 weeks or less. And ...”

2012: Gwen & Kate:

Actually, it saves the company 2.9 million $

... a year

2013: Hey Jan, good news, we got promoted this year.
Issues DMN solves
*Separating decisions and processes*

*Using a standard modeling notation.*
* **Separating decision structure and decision logic**

* Allows to model decision relations, even if not all logic is expressed in tables.
* Decision modeling methodology
  * Good decision table models are a proven technique to represent decision rules
    
    Consistency, completeness and correctness by design

* Decision table types
  * Recognize, and unambiguously exchange.

* Standard notation for exchange and implementation
  * Strict notation and simple expression language ((S-)FEEL).
  * FEEL (“Friendly Enough Expression Language) implements the required mechanisms
  * S-FEEL (“Simple FEEL”) is a basic subset of FEEL designed to cover the essential requirements of Decision Table-based DMN models
The Decision Process
Start each individual decision activity as soon as all its preconditions are fulfilled.

Avoid superfluous decision activities (unnecessary work).

Group customer contacts.
The basic message

*First make it correct
  * Overview, Consistency, Format, Verification, Business View, Analysis, ...
  * Make sure the business can do it

*Then you can make it efficient, optimal
  * If it executes automatically, fine
  * If the execution is optimized, even better
Thank you
**Classic References**


