Explaining Meaning
Interpreters in MPS

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Problems

• Software-development is
  – Too Expensive
  – Time consuming
  – Complicated
• System cannot be easily changed
• Little reuse of business logic
Causes

• Complexity
  – Inherent
  – Accidental
• Business – IT gap
• Unclear requirements
• Formulating requirements is an art
  – No tool support
Solutions

- Separation of concerns
- Fast feedback
- Tool support
- Language that can be understood by business people
- Automate automation
Agile Law Execution

Life events & Legal actions

Citizens and Companies

Products & Services

Develop

Execute

Process of Legislation

Executive process

Analysis

Design

Specifications

Design & Realisation Human activities

Design & Realisation automated activities

Organisation 1

Organisation 2

Organisation 3

IT suppliers

IT exploitanten

Scope of Agile Law Execution

Develop
Elicit annotations

Specificy Business rules

Transform / Accept

Use

Cognitatie
RuleXpress
Jetbrains MPS
Jetbrains MPS
Blaze (Service)

The terms, concepts and contexts in the law text are annotated
Specify rules based on the annotations
Simulation of rules for validation
Transform rules to working code
Test the generated code and deploy into production

Specification of rules
Various concerns

Will the decisions be correct?

How about response times?

Is the systeem user-friendly?
Software-development
Software-development
Software-development

!!

automatic transformation
Development proces
Development process

A slow and lengthy feedback loop in which all aspects are involved
Separation of concerns

Multiple fast feedback loops
one per aspect/concern
Model driven software engineering

• Model the essence
  – That which is likely to change
  – Model it in only one place

• Generate the code
  – Using proven programming-/technology patterns

• Automate automation
Domain Specific Languages

- Law
- Execution/Policies
  - How do we gather/deal with information
- Conceptual models
  - Facts vs assertions vs data
  - Time aspects
  - Sources
  - Reliability
- Accountability
  - Traceable rule applications
- Technology
  - Databases, services, network latency, scalability, performance
Language Design and Decomposition

• Abstraction

• What if:
  – We have infinitely fast computers with infinite memory?
  – We would know all there is to know about citizens/companies?
  – Time aspects would play no role?
Example: current design document

Number of days ZVW (U1):

If  [startdate obligation ZVW] (H1) = [empty]
   [number of days ZVW] (U1) = 0
Else
   If  [startdate military service] (1)
       and
       [enddate military service] present
       Then
       [number of days ZVW] (U1) =
         (month of [enddate obligation ZVW] (H2) minus
          month of [startdate obligation ZVW] (H2)) times
          30 plus
         (day of [enddate obligation ZVW] (H2) minus
          day of [startdate obligation ZVW] (H2)) minus
         (month of [enddate military service] (f) minus
          month of [startdate military service] (e)) times
          30 minus
         (day of [enddate military service] (f) minus
          day of [startdate military service] (e))
In other words

Nr of days per month ZVW = nr of days in each month
in which premium liable ZVW

Exception:

Nr of days per month ZVW = 30
in case that premium liable ZVW is valid for the whole month

Nr of days per year ZVW = sum nr of days per month ZVW
for each month year

premium liable ZVW = liable ZVW and not military service
Example: time aspects

• Concept model contains information about time aspect
  • Attribute has history
  • Validity granularity: day, month, or year
  • Rounding to month boundaries
• Specificaties contain time operator

A is partner of B
  in case that A and B live on the same address for more that 6 months in a year
  or
  in case that A and B have or once had a child together
A and B are partners for at least 6 months in the year.
Law-speak

• Use gecontrolled natural language
  – Combines intuïtive and formal meaning
• Scope is limited to factual situations
• Use examples to validate formal meaning
• Explain results
  – Which rules have been applied, to which values
Separation of concerns

- The law deals with factual circumstances and events
- Execution uses data about circumstances and events
- Facts and data can only be correlated in terms of communication (assertions...)
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![Diagram showing separation of concerns]

- **Facts**
  - Communication
- **Rules**
- **Data**
  - Communication
Feedback

• Model checks
  – Type checking
  – Scope rules
  – Static analysis

• Interpreter
  – Compare results with expectations
  – Accountability (debug traces)
Rules

• One-to-one traceability to law articles
• Exception rules
• Increment / Decrement rules
• Rounding rules
• Time operators
Income tax service

• Shadow run
• 12 million calculations
• Differences with production system ABS
  – 0 for definitive assessments
  – 20 for preliminary assessments
• Nightly build runs all production cases of the whole year
• Dashboard
Demo