Method Engineering: Achievements, Trends & Challenges

Outline
- Backdrop
- Challenges

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Evolution in Information System Development Methods (ISD)

Engineered Situated Method

Method Engineering

Universal Method
Method engineering is the discipline of developing, customizing, and/or configuring a situation-specific method from parts of existing methods.

[Brinkkemper 96, Leppanen 2006]
Method Engineering

ME process & research questions

Initial Method Description

Reverse engineering step

Method reengineering guidelines

Situational Method

Construction of a new method reusing method method parts

Several strategies for SME

Storage of method parts in a method base

Modular Method Description:
Modular Method model

Method Engineering

Software engineering vs Method Engineering *

<table>
<thead>
<tr>
<th>Software engineering</th>
<th>Method engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modelling (specification)</td>
<td>Meta- Modelling</td>
</tr>
<tr>
<td>CASE</td>
<td>CAME</td>
</tr>
<tr>
<td>(Computer Aided S/W Engineering)</td>
<td>(Computer Aided Method Engineering)</td>
</tr>
<tr>
<td>Software Base</td>
<td>Method Base</td>
</tr>
<tr>
<td>Software metrics</td>
<td>Method metrics</td>
</tr>
</tbody>
</table>

*Motoshi Saeki talk (EMISE)
Method Engineering

Key Method Engineering Artefacts*

ME products

ME meta models
& meta-modelling languages
to represent method parts

ME processes

ME strategies, approaches,
workflows to combine, integrate,
assemble method parts & to guide
the ME process

Kumar & Welke, 1992, Oei, 95, Philhon et al 97, Heym&Osterle 97,
Rolland & Prakash 96, Saeki, 98, Leppanen 00 Saeki 03,
Karlsson & Agerfalk 04,

* Leppanen06

Method Engineering Products

A modularization issue based on two assumptions

(1) A method is composed of a product model and a process model
(2) Meta-Modelling is an appropriate means to describe methods (Yourdon & Coad)

Concept = \{ Class, Attribute, Service\}
Relationship = \{has(CS), has(CA)\}

(a) Meta model of product part

(b) Meta model of process part

*Motoshi Saeki talk (EMISE)*

The Method Fragment Perspective

[Harmsen 94, Harmsen 97, Brinkkemper 99]
The Method Chunk Perspective


 Tight coupling in a chunk of the process and related product parts

<(Problem description), Discover goal / scenario couples with CREWS-L'Ecrtoire

Method Engineering Products

Towards a consensual view (Cossentino et al, 2006)
Method Engineering Products

- Less consensual view on method part relationship types

Variability (choice context)

Variant

Mandatory

Method Part

Generic patterns (Plihon96)

Abstracts

Composed of

0,N

1,N

- Aggregation mechanism (road maps, trees of contexts, etc.)

Method Engineering Processes

- Emphasis on composition strategies* (classification by Ralyté & Rolland)

- Assembly based

- Extension based

- Paradigm based

* Motoshi Saeki talk in EMISE
Method Engineering Processes

Method Assembly* : classification by J.Ralyté & C.Rolland

Integration strategy

Association strategy

New added association

Overlapped & unified

Method Engineering Processes

Method Assembly by association*: example of product models assembly

Object Model

State Transition Model

ObjectChart, Coleman et al92
Method Engineering Processes

Method Assembly by integration: L’Écritoire and OOSE

- Product assembly operators
  - RENAME (concept, link, property)
  - ADD (concept, link, property)
  - DELETE (concept, link, property)
  - GENERALISE (concept)
  - OBJECTIFY (link, property)
  - MERGE (concept, link, property)

- Process assembly operators
  - RENAME (intention, section)
  - ADD (intention, section)
  - DELETE(intention, section)
  - MERGE(intention, section)

Method Engineering Processes

Less studies on ME processes
“Towards a life cycle for method engineering “(Gupta, Prakash 2007)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Process</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements engineering</td>
<td>Intention matching</td>
<td>Goal of the method To-Be</td>
<td>Intentionally similar methods</td>
</tr>
<tr>
<td>Design engineering</td>
<td>Architecture matching</td>
<td>Architectures of intentionally similar methods</td>
<td>Architecturally similar method</td>
</tr>
<tr>
<td>Construction engineering</td>
<td>Organization matching</td>
<td>Workflows of architecturally similar methods</td>
<td>Method To-Be</td>
</tr>
</tbody>
</table>

Bajec et al 2007, Agerflak 2007, Mirbel & Ralyté 2006 etc.
Method Engineering Processes

A generic process model for method engineering (Ralyté, Rolland 2003)

Two key tasks to perform:
- Set method engineering goal
- Construct a method that matches this goal

A number of strategies

Method Engineering Processes

A still fragmented position on designing ME processes (Leppanen 2006)

Goodies ………

- a rich set of composition approaches and procedures
- attempts to integrate various composition strategies
- set of generic taxonomy of assembly operators
- proposals for decomposing ME into ME workflows
Method Engineering Processes

and remaining issues .......

- an incomplete coverage of the systelogical, infological, conceptual, datalogical & physical perspectives (Leppanen, 2006)
- need for a better understanding of the dimensions of situational method development (Aydin et al, 2007)
- poor understanding of the notion of situation (Bucher et al, 2007)
- need for more syntactic and semantic checking techniques
- too conventional workflow type of ME process modeling

Method Engineering Framework (Caise98&..)

SUBJECT WORLD

• Nature
  {situational, rigid, semi-rigid}

USAGE WORLD

• Purpose
  prescriptive, descriptive, explanatory
• Method Management policy
  change, reuse

SYSTEM WORLD

• Characterisation
  {criteria, descriptor, matrix, profile}
• Notation
  {formal, semi-formal, informal}
• Detail
  Abstraction (type, meta-type)
  Granularity: primitive, aggregate, generic
• Enactment support
  presence

DEVELOPMENT WORLD

• Construction approach
  {contingency, on the fly, static}
• Construction technique
  {instantiation, language, composition, ad-hoc}
Method Engineering  Trends & Challenges

♣ ♣ Where to go next?

A shift of focus: from engineering issues to usage concerns

From components to services
Towards CoP (Mirbel 07)
- Emphasize and standardize MP interface descriptions
- Publish and make them publicly available
- Provide contextual information to ease MP finding
- Facilitate MP composition
Towards MOA: Method Oriented Architecture

- Use method services as fundamental elements
- Reorganize a portfolio of existing methods into self-describing, elements (services), accessible through standard interfaces and that can be assembled together
- Based on an interaction between three kinds of method agents

MaaS: Methods as Services

- Using Web service technology to provide self-describing, platform agnostic elements (MaaS), accessible through standard interfaces and that can be assembled together

Types:
- LastTradePriceRequest (ticketSymbol: String)
- TradePrice (price: float)

Messages:
- GetLastTradePriceInput (body: LastTradePriceRequest)
- GetLastTradePriceOutput (body: LastTradePrice)

Port-type:
- StockQuotePortType GetLastTradePrice (in: GetLastTradePriceInput, out: GetLastTradePriceOutput)

Binding:
- StockQuoteSoapBinding (StockQuotePortType, soap, document, http) GetLastTradePrice: http://example.com/GetLastTradePrice

Web Service

StockQuoteService

GetLastTradePrice (LastTradePriceRequest) -> (LastTradePrice)

http://example.com/stockquote
MaaS : An XMI based solution (CRI’s approach 07)

Types:

- ImproveRoleRequest
  - inputSchema: XMIDocument
  - RoleName: XmiIdref, ClassWithRole: String, ClassWithoutRole: String
- ImproveRoleResult
  - ResultSchema: XMIDocument

Messages:

- ImproveRoleInput
  - body: ImproveRoleRequest
- ImproveRoleOutput
  - body: ImproveRoleResult

Port-type:

- ImproveRolePortType
  - ImproveRoleAction

Binding:

- ImproveSoapBinding
  - ImproveRolePortType, soap, document, http
  - ImproveRoleAction:
    - http://maas.crinfo.univ-paris1.fr/ImproveRoleAction

From ME to MaaS Management
Method Engineering  Trends & Challenges

- Emphasise the evolutionary perspective of ME  (Rossi et al, 2004)

From static ME...

Adapt to project contingencies at time t
Assuming a sharp time-space disjuncture*

....To evolutionary ME

Co-evolution of method and system development
Need for evolutionary ME processes
Continuous search for fit at all times

*Orliwowski

Method Engineering  Trends & Challenges

- The continuous improvement loop (BPR/TQM like)

Learn & Adapt  (Prat,98)

Measure  (Sacki,03)
Method Engineering Trends & Challenges

- Engineering methods in an evolutionary perspective

Method rationale (Rossi et al, 2004):
- trace of method changes & associated use experiences

Method configuration (Karlsson & Agerfalk, 2007):
- Three-layered configuration reuse model consisting of method components, configuration packages & templates

Method families:
- Organization of a set of method variants and their justifications

Variability as a central concept for reuse and adaptability

Method Engineering Trends & Challenges

♣♣ Adapt Variation meta-model to method lines [Bühne05]

- accurate level of expression
- expression of variation requirements (Caise07)
- automatic adaptation of method services

Method Line?

Variant VP dependency

VP requires VP excludes

Variant dependency

V requires V
V excludes V

Variant

constraints

Method Engineering Trends & Challenges

♣♣ The radical change (BPR like)

Innovative Method Theories

Method Ontology (theory)

instance-of

abstracted from

ISD Context

ME Context

New ways of System Design

instance-of

abstracted from

ISD models

abstracted from
Move towards intentional process modelling

From prescriptive workflows...

- ISD & ME processes are decision making processes
- Design is a cognitive act and intentionality is at the core of cognition
- Method guidance shall use human intentions as the drive of the process

To flexible intentional guidance...

Method Engineering  Trends & Challenges

Using philosophical foundations

- Intentionality is at the core of cognition (all modern philosophers: Brentano, Twarsdwowski, Hurssel, Sartre, Merleau Ponty, Berner...)
- Intention is a mental state that integrates desires and beliefs and determines actions

Intentionality Model

Intentional action attributes

- Desire
- Belief
- Intention
- Skill
- Awareness

Intention baseline
### Method Engineering Trends & Challenges

#### Guiding the achievement of intentions

- **Intention refinement**
- **Nature meta-model**

#### Choice Guideline in NATURE

- **CC1**: a2
- **CC2**: a4 or a9 or a10 or a11
- **CC3**: a1 or a7 or a8
- **CC4**: a6
- **CC5**: a5
- **CC6**: a1 or a7
- **CC7**: a8

Possible choices:

- a1: cardinalities are: \(<t, s, -p, a, v>\)
- a2: cardinalities are: \(<p, ?, ?, -?, ?>\)
- a3: cardinalities are: \(<?, ?, -p, ?, ?>\)
- a4: cardinalities are: \(<t, m, -p, s, p>\)
- a5: cardinalities are: \(<?, v, ?, ?, p>\)
- a6: cardinalities are: \(<?, ?, -p, ?, v>\)
- a7: cardinalities are: \(<t, s, p, -p, s, p>\)
- a8: cardinalities are: \(<p, m, -p, m, v>\)
- a9: cardinalities are: \(<t, m, -v, t, s, p>\)
- a10: cardinalities are: \(<t, s, p, -t, s, p>\)
- a11: cardinalities are: \(<t, s, v, -t, s, p>\)
Method Engineering Trends & Challenges

**Guidance types**

Step guidance: the satisfaction of an intention (step guidance)

Flow guidance: selecting the next intention to make the process proceed

<table>
<thead>
<tr>
<th>Technique</th>
<th>Intention</th>
<th>Solve goal conflict</th>
<th>Operationalize goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brainstorming session</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SWOT analysis</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Scenario construction</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Metrics</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Heuristics</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Method Engineering Trends & Challenges

**Can we export reuse mechanisms?**

From aggregation based Web services composition …

Reuse Mechanisms in ME*:  
- Analogy construction (Ralyté, paradigm based)  
- Aggregation (almost all)  
- Configuration (Bajec, Karlsson&Agerfalk)  
- Specialization (Rossi, Ralyté, Baskerville..)  
- Instantiation (Nuseibeth, view point super templates)

*Jorg Becker

To a more complete set of mechanisms (2007) …
Method Engineering Trends & Challenges

Can we export reuse mechanisms?

<table>
<thead>
<tr>
<th>Reuse Mechanism</th>
<th>Number of utilizations (over 19)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogy construction</td>
<td>3</td>
<td>16%</td>
</tr>
<tr>
<td>Aggregation</td>
<td>14</td>
<td>74%</td>
</tr>
<tr>
<td>Configuration</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Specialization</td>
<td>9</td>
<td>47%</td>
</tr>
<tr>
<td>Instantiation</td>
<td>1</td>
<td>5%</td>
</tr>
</tbody>
</table>

Conclusion

Motivations
- Composability
- Dynamicity
- QoS
- Variability

Usability (easy use of method services)

Needed assembly of elements (method services)
Thank you for your attention