Enterprise Modelling: A Declarative Approach for FBPML

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Part I:
Introducing Enterprise Modelling
Enterprise Modelling

- EM methods are well-recognised for their value and are used in practice;
- EM methods may be characterised in the following types:
  - Business modelling method:
    - business modelling of IBM's BSDM (Business System Development)
  - Process modelling method:
    - IDEF0, IDEF3, PSL, RAD, RACD
  - Organisational modelling method:
    - Ordit, Ulrich Frank’s MPM approach
  - Capability Modelling Method
  - Ontology
Technical Challenges -
The Gap between EM and Reality

Enterprise Models (EM)

- Business Model
- Business Process Model
- Organisational Model
- Capability Model
- Ontology

GAP

Software System Development

- Relational DBMS
- OO DBMS
- Other Software Systems

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Bridging The Gap between EM and Reality

Enterprise Models (EM)
- Business Model
- Business Process Model
- Organisational Model
- Ontology
- Capability Model

Workflow System
- Automating BPM
- Mapping of Data Structure
- Quality Assurance

Software System Development
- Relational DBMS
- OO DBMS
- Other Software Systems
- UML Class Diagram
- Data Model

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What is a business process?

• “A business process is a course of events consisting of one or more coherent activities (operations) which are necessary to deliver a product or service with a tangible value to a customer (client).”

• Christofer Tolis, Anders G. Nilsson
  • Advancing Your Business: People and Information Systems in Concert, EFI
  • Stockholm School of Economics, Sweden
  • Research project: business modelling

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Types of Business Process Models

- Communication based model
  - Winograd/Flores Model
- Activity based model
- Artefact based model
  - Karen Myers, Pauline Berry
  - SRI, SWIM project
- Behaviour Model
- Transformation Model
  - Christofer Tolis, Anders G. Nilsson
  - Advancing Your Business: People and Information Systems in Concert, EFI
Types of Business Process Models

- Artefact-Centric
- Process- and Activity- Centric
- Agent-Centric
- General: a combination of some or all of the above

Editor: Nicola Guarino, Milena Stefanova

ONTObweb report
State of the Art in Content Standards
Nov. 2001
Types of Business Process Models

- 3

• **Role-Central Business Process Model**
  – Electronic Institution, RAD, RACD, UML’s Activity Diagram

• **Activity-Central Business Process Model**
  – IDEF0, IDEF3, PIF, PSL, Petri-Net, Flow-Control

• **Data-Central Business Process Model**
  – BSDM’s Business Process Model, Data-Flow

• **Communication-Central Business Process Model**
  – Swim-lane diagram

• **State-Central Business Process Model**
  – IDEF3’s Object Schematic (Object-centered), BSDM’s Life Cycle Diagram (entity-centered), State Transition Diagram (object and system-centered)

– Jessica Chen-Burger
Example Business Process Modelling Languages (Methods):

- Process Interchange Format (PIF)
- Process Specification Language (PSL)
- Handbook of Organisational Processes
- IDEF0
- IDEF3
- UML’s Activity Diagram
- SAP R/3: EPC
- Petri Net
- Process Model, BSDM
- RAD, RACD
- Flow-Control, Data-Flow Diagram
What is workflow?

• “The automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules”

• Workflow: An Introduction
  • Rob Allen, Open Image Systems Inc., UK
  • Chair, WfMC External Relations Committee
  • Workflow Handbook 2001
Why does people want a workflow system?

• A recent survey published by Delphi Group:
  
  • Automate repetitive tasks – streamline practice and improve efficiency (30%)
  
  • Manage and monitor performance of processes (25%)
  
  • Business users modify process logic, not IT personnel, and without IT’s help. (20%)

Types of Workflow Processes

• Application to Application
  – Data-centric
  – Simple in Complexity, process duration is short
  – Discrete, typical involves data transfer

• Person to Application
  – Transaction-centric workflow management
  – E.g. individual validation, exception handling
  – State based process with few variations (standard practice),

• Person to Person
  – Collaboration-centric
  – Process or knowledge-driven
  – Tacit and explicit knowledge (Res. scheduling, project mgmt)
  – Complex, process duration is long
History

Degree Of BPM Approach

Time

1990 2000 2002

WF 1st

EAI

B2B

BPM-WF

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Origins of Workflow Systems/vendors

• **Transaction-centric or Document-centric:**
  – E.g. FileNET, Optika

• **Workflow approach**
  – Manual and automatic workflow, e.g. Ultimus, Fujitsu

• **Integration approach**
  – System, EAI: Sterling Commerce, HP and Staffware
  – B2B internet cross-enterprise application to internal and external process: Peregrine
  – Collaborative software: Handsoft (BizFlow)
  – Separation from application to process logic: Fuego, Q-Link
Pitfalls

- Lack of training and understanding of BPM
- Complicated, not easy to use and understand
- Brittle in reaction to dynamic and changing environment that the workflow
- Lack of connection from high level modelling method to lower lever implementation method

Result: two kinds of systems?
- BPM tool
- Workflow System
How can Business Process Modelling Help?

• Focus on a few issues – operation-related
• Provide a structural method to capture and document the operation of a business
• Provide a communication medium between businessmen to understand key operations of the business and to form a consensus
• Provide an alternative analysis tool for business practice (As-is and To-be)
• Provide early requirement specification for software systems from a business’ view
How can Business Process Modelling Help? (2)

- Participating and becomes part of everyday business operations – I.e manual and automatic processes
- Ensure standardisation of practice
- Training
- Automation/connection of manual procedures
- Alert at critical business circumstances
- Business management tool
- React to a fast changing environment
Part II:

Developing a Workflow System based on a BPM approach
Problem Context

• Internal Factors:
  – Modern organisations are virtual entities;
  – People involved are located in different places, each with different capabilities and responsibilities;
  – People needs to work collaboratively to accomplish tasks and together achieve organisational goals.

• External Factors:
  – Organisations want to make use of modern technology, esp. internet to provide Web Services;
  – Organisations want to be able to react to changes in the environment and hand exceptions correctly and swiftly
  – Organisations want to communicate and integrate with applications not just internally, but also externally, B2B.
Requirements on BPM - 1

• Describe and record business processes

• Can un-ambiguously specify all important “things” that are related to those business processes

• Can express temporal relations and enable latency automation

• Flexible in reaction to changes of business practices
Requirements - 2

• Agile in reacting to changes in dynamic business practice

• Sharable “knowledge base” for diversified business practice

• Easy to use and maintain by non-BPM or IT personnel

• Easy to understand and can be used to communicate to business folks
Solution

• Business process modelling (bpm) approach that separates business logic from application logic
• Sharable ontology as a communication medium among different processes that may be carried out by different system components
• Formal representation of the business process model that may interact and enact processes in the workflow system level
• Altogether enable: improved workflow technology
The Three-Layered Business Process Modelling Approach

- Business Requirements
  - Business Layer
  - Logical Layer
  - Implementation Layer
- Operational Requirements
- System Requirements
Business Layer - 1

• High level description

• Robust against changes of technologies and change of current practice (manual or automatic practice)

• Include business objectives

• Include business constraints
Business Layer - 2

• Include policies

• “Long lasting” organisational structure, e.g. authority.

• Business level decision making
Logical Layer - 1

• Procedural description

• Inherit all properties and constraints defined in the Business Layer

• Robust against changes of implementation method

• Provide a common and sharable knowledge base for all implemented systems – Ontology

• Operational level decision making
Logical Layer - 2

• Specify all “integrity constraints” that are required in a business operation so that any implementations of this description do not violate business or operational constraints; example operational constraints are:
  
  – R/W policies on data fields – each data field may have different R/W policies
  
  – Detailed authorisation policies on processes
Implementation Layer - 1

• The description of procedures for implementing a workflow system
• Inherit all properties and obey constraints defined in the Logical Layer
• Processes defined in this layers are changeable, disposable, and application- and technology-dependent
Implementation Layer - 2

• May have multiple mappings to the same process defined in the Logical Layer – each describes a specific implementation method, e.g.
  – Ordering process by phone
  – The same logical ordering process by Web
  – The same logical ordering process by mobile phone (WAP)
• Use knowledge base in the Logical Layer to communicate with other processes in the Implementation Layer
• System building level decision making
An Ontology Based BPM Approach

Workflow System

The User/Developer

Business Process Model

Formal Representation

Sharable Ontology

System Components

Interface

System Components

End User
Case Study: Implementation Layer

The process “Get Valid Credit Card Info”: may be implemented by
- Voice (e.g. over the Phone)
- Web
- Mobile phone (e.g. WAP)
- Over the counter
- Or a combination of the above operating at the same time.

- Each implementation is described in a different “implementation” process.

- **Question:** How do they communicate with each other?
- **Solution:** the data is constrained at the Logical Layer and shared among models in the Implementation Layer.

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Case Study
Business Layer

Receive Customer Order → Get Financial Commitment → Ship Product

Business Rules:
Financial Commitments may be one of the below methods:
Receive money or check in sterling pounds, or valid credit card details.

A Simplified Customer Order Process

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Case Study
Logical Layer

- at least one activity has to be carried out
- all (activated) activities must end
Case Study
Implementation Layer

Receive Customer Order → Get valid Credit card info → Consolidate Payment → Ship Product

Receive Customer Order or Get valid Credit card info or Receive Sterling Cash → Consolidate Payment → Ship Product

Over the phone
Over the counter

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Part III:
Creating FBPML
Foundation of the Business Process Modelling Language

• Design Principles:
  – Compliant with standardised process modelling languages
  – Minimum notations - easy to understand and use (extendable)
  – INCA framework compliant – issue based
  – Semi-Formal modelling language based on formal theories
    » Notation with formal semantics - junction
    » Transaction theory
    » Declarative - executable
  – Visual Modelling Language
  – Capture role
  – Explicit communication processes
  – Methodical way of building BPM – iterative process in two higher level stages
Fundamental Business Process Modelling Language (FBPML)

• An Integration of concepts from several standard modelling languages:

  – IDEF3 – graphical notation, process concept
  – PSL – formal semantics
  – INCA framework compliant
  – IBM’s business model in BSDM – modelling principle
  – RAD – concept of roles
  – Planning and Workflow – formalism that is executable BPML
Business Process Model using FBPML
PC Configuration Domain
Collaboration between two types of Actors

Edinburgh: Costing Site
- I-X Process Panel
  - Com I-1
  - BPM - 1
    - Com P-1
    - INCA-FBPM Ontology
    - PC Config. Ontology

Aberdeen: Tech. Site
- I-X Process Panel
  - Com I-2
  - BPM - 2
  - Com P-2
  - Constrain Ontology
  - PC Config. Ontology

Mapped Ontology

User Req
Comp Spec

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Presenting in an I-X Process Panel – Costing Site

<table>
<thead>
<tr>
<th>Description</th>
<th>Annotations</th>
<th>Priority</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Perform Top Level Process for PC Configuration&quot; john 1 (type, PC-desktop), (case, mesh-midi-tower)</td>
<td></td>
<td>Medium</td>
<td>Expand using perform_to</td>
</tr>
<tr>
<td>&quot;Obtain Requirements for PC Configuration&quot; 1 (type, PC-desktop), (case, mesh-midi-tower)</td>
<td></td>
<td>Medium</td>
<td>Done</td>
</tr>
<tr>
<td>&quot;Determine Processor&quot; 1 (type, PC-desktop), (case, mesh-midi-tower), (processor,AMD)</td>
<td></td>
<td>Medium</td>
<td>Done</td>
</tr>
<tr>
<td>&quot;Determine Disk Controller&quot; 1 (type, PC-desktop), (case, mesh-midi-tower), (processor,AMD)</td>
<td></td>
<td>Medium</td>
<td>No Action</td>
</tr>
<tr>
<td>&quot;Determine IO Boards&quot; 1 (type, PC-desktop), (case, mesh-midi-tower), (processor,AMD)</td>
<td></td>
<td>Medium</td>
<td>No Action</td>
</tr>
<tr>
<td>&quot;Determine Specification for Other Preferences&quot; 1 (type, PC-desktop), (case, mesh-midi-tower), (processor,AMD)</td>
<td></td>
<td>Medium</td>
<td>No Action</td>
</tr>
<tr>
<td>&quot;Examine PC Specification&quot; john 1 (type, PC-desktop), (case, mesh-midi-tower), (processor,AMD)</td>
<td></td>
<td>Medium</td>
<td>No Action</td>
</tr>
<tr>
<td>&quot;Provide Customer the Configuration&quot; john 1 (type, PC-desktop), (case, mesh-midi-tower), (processor,AMD)</td>
<td></td>
<td>Medium</td>
<td>No Action</td>
</tr>
</tbody>
</table>
## Presenting in an I-X Process Panel – Technical Site

<table>
<thead>
<tr>
<th>Description</th>
<th>Annotations</th>
<th>Priority</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>receive dispatched technical details for device 3 &quot;internet-browsing, high-speed, (dvd, yes), (cd, rewriter),&quot;</td>
<td>Medium</td>
<td>Expand using top_level_process_panel_info</td>
<td>No Action</td>
</tr>
<tr>
<td>&quot;Obtain Partial Specification For Device&quot; 3 &quot;internet-browsing, high-speed, (dvd, yes), (cd, rewriter),&quot;</td>
<td>Medium</td>
<td>No Action</td>
<td></td>
</tr>
<tr>
<td>&quot;Refine Partial Specification&quot; 3 &quot;internet-browsing, high-speed, (dvd, yes), (cd, rewriter),&quot;</td>
<td>Medium</td>
<td>No Action</td>
<td></td>
</tr>
<tr>
<td>&quot;Suggest Alternative Specification&quot; 3 &quot;internet-browsing, high-speed, (dvd, yes), (cd, rewriter),&quot;</td>
<td>Medium</td>
<td>No Action</td>
<td></td>
</tr>
<tr>
<td>dispatch without report-back technical specification for device 3 &quot;internet-browsing, high-speed, (dvd, yes), (cd, rewriter),&quot;</td>
<td>Medium</td>
<td>No Action</td>
<td></td>
</tr>
</tbody>
</table>

Advanced Knowledge Technologies  
Based on I-X Process Panel Technology
Ultimate Goal – Support for a Virtual Organisation

• To provide distributed knowledge- and semantic-based manipulation and collaboration;

• A realisation where multiple tools are used (e.g. OU and Soton’s hyperlink tool, processor modeller, AKT-0, AKTbus, netmeeting) multiple methodologies and disciplines are involved, and information from multiple domains are used. Most importantly, people with different responsibilities and capabilities are working together to accomplish tasks, solve problems, and achieve organisational goals.
End of Slides

AIAI, CISA, Informatics
The University of Edinburgh
www.aiai.ed.ac.uk