Modeling of Cross-Organizational Business Processes - Current Methods and Standards

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Background – Cross-Organizational BP projects @ IWi

• Cross-Organizational Business Processes and Interoperability recently tackled by various research projects

• National, e.g.
  – P2E2 (Peer-to-Peer Enterprise Environment)
  – ArKoS (Architektur kollaborativer Szenarien)

• EU, e.g.
  – ATHENA IP (www.athena-ip.org)
    • Focus on Enterprises, ended march 2007
  – Interop (www.interop-noe.org)
    • Network of Excellence, ended march 2007
  – R4eGov IP (www.r4egov.eu)
    • Focus on Public Administrations, start march 2006, duration 3 years
    • Goal: secure interoperations of web service enabled legacy public sector applications via collaborative workflows
    • Demonstrate on real cases, driven by demanding public administrations, capable of leading the way in Europe.
    • 5 Uses cases, including
      – Eurojust-Europol (Netherlands, Den Haag)
Research question and methodic

• Which modeling languages could we use or extend to describe our processes? Such that …
  – they describe the important characteristics on the conceptual level,
    • Interaction sequence, security perimeters, involved actors, etc.
  – support an automated analysis of the models,
    • Verification, monitoring, controlling
  – represent a basis for the model-driven generation of executable code?
    • Mapping to Services and SOA based workflows

• Methodic
  – Analysis of literature, expert interviews, analysis of related projects and case studies
  – Description of requirements on modeling languages
  – Description of concepts that fulfill these requirements
  – Evaluation of languages regarding both
    • Selected concepts,
    • but also directly to requirements
  – Evaluation regarding
    • Typical, “core” language attributes
    • Existence of concepts supplementing/extending the core
Languages tackled

Value Chain Diagram
“Picture” Approach

EPC
BPMN
Petri Nets
UML

PIM4SOA/UPMS  Let’s dance

BPEL, XPDL, WS-CDL
WS-Security, WS-
atomicTransaction, etc.

Collaborative House of Business Engineering
Standards on corresponding levels
Requirements
Generic vs. CBP specific requirements

• Business Process modeling in general
  – Business Process (BP): Sequence of organizational activities undertaken for the purpose of creating output
  – Requirements on BP models, e.g.
    • Correctness, easiness, operational, adaptability/flexibility, support of various enterprise dimensions (cp. Frank, van Laak 2005)

• CBP specific requirements, e.g.
  – Heterogeneity of actors involved in process
  – Different trust spheres
  – Distributed, complex processes

• Some solution for BP modeling requirements have to be transferred to CBP, e.g.
  – Controlling
  – Process automation
CBP modeling languages – Requirements …
Requirements in the light of CBP automation

Public Administration A

Organization

Data

Process

Function

Keep private information private

Describe rights and roles

Specify the interface of partners formally

Communicate

Comprehend

Adapt

Validate

Business Process Stub

Support of data flow

Mapping to executable processes

Technical Gateway Specification

Exchange XML Messages

Technical Gateway Specification

Public Administration B

Organization

Data

Process

Function

Output

Executable private processes

Analysis/controlling of CBP

Executable private processes
... and concepts for CBP modeling
Concepts supporting CBP modeling
Concepts supporting CBP modeling – Displaying trust spheres with private, public and global processes

- Public process displays only those parts of a private process from one partner relevant for interaction with others
- Global process displays all possible interactions between partners
- Orchestration vs. Choreography
- Apart from technical approaches (“Let’s dance”, BPEL) EPC based concepts exist
  - Horizontal transformation
  - Vertical transformation
Concepts supporting CBP modeling – Public Processes

- Public process displays only those parts of a private process from one partner relevant for interaction with others
- Can be derived from private processes, e.g.
  - “Show just those activities where messages are sent or received from organizational unit ‘Buyer’ “
- Concept exist to transform EPC view processes to BPEL protocols
Concepts supporting CBP modeling – “Controllability”

• Can be seen as complementary to public processes

• In order to detect controllability, a strategy for the own workflow is generated (cp. Lohmann et al. 2006)
  – A strategy describes a set of workflows that could interact with the own workflow

• Developed for open workflow nets (oWFN)
  – Extension of Workflow Nets (low-level petri nets)
Concepts supporting CBP modeling – Existence of proven interaction patterns

- Interaction sequences which can be used in different contexts
- Exist on different vertical levels, mainly on the technical ones
  - EPC/IEM patterns (cp. Interop)
  - RosettaNet Partner Interface Processes (PIPs)
  - Service Interaction patterns (cp. Barros et al.)
Concepts supporting CBP modeling – Swim lanes

- Global models are divided into subsets according to different actors
- Subsets can also be seen as “view processes”

- Applied in EPC and Petri Nets …
- … but more common in BPMN and UML Activity diagrams
  - UML Sequence diagrams are implicitly separated into Swim lanes
Concepts supporting CBP modeling – Distributed transactions

- Can be seen as interaction pattern
- Special model elements for
  - Compensation spheres
  - Compensation activities
- BPMN offers explicit support
Concepts supporting CBP modeling – Visualization of static interfaces

- Detailed description of individual interactions
- Enterprise dimensions useful
- Explicit support for EPC
  - Kupsch, Klein 2004
Concepts supporting CBP modeling – Semantic Annotation

- Use of ontologies to unambiguously describe objects comprised in process
  - Structured glossary shared by a community
- Two aims:
  - Horizontal understanding / matchmaking
  - Vertical model Transformation / Synchronization
- Concept for EPC exist (cp. Thomas/Fellmann)
Summary
### Summary - Concepts supported by selected business process modelling languages

<table>
<thead>
<tr>
<th>Concept</th>
<th>UML</th>
<th>Petri nets</th>
<th>BPMN</th>
<th>EPC</th>
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</thead>
<tbody>
<tr>
<td>Swim-lanes</td>
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<tr>
<td>Private, public and global processes</td>
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<td>Representing long running transactions</td>
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<tr>
<td>Interaction patterns</td>
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## Summary - Requirements fulfilled by selected business process modelling languages

<table>
<thead>
<tr>
<th>Requirement</th>
<th>UML</th>
<th>Petri nets</th>
<th>BPMN</th>
<th>EPC</th>
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<td>Keep private information private</td>
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<td>Specify the interfaces formally</td>
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<td>Mapping the CBP to executable processes</td>
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<td>+</td>
<td>0</td>
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<td>Support of data flow</td>
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<tr>
<td>Support of involved roles</td>
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<td>0</td>
<td>-</td>
<td>+</td>
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<tr>
<td>Support of analysis/controlling of the CBP</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
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</table>
Future work

- Definition of Collaborative Business Metamodel
  - Common metamodel for EPC / BPMN
    - Automatic transformation/switch between BPMN and EPC models
  - Basis for BPEL transformation
    - Annotation of XML documents
    - Annotation of Web Services representing business functions
  - Deriving View Processes from Private Processes
    - Abstraction of process elements
    - Aggregation of process elements

- Further development of corresponding tool
  - “Business Interoperability Interface Modeler”
  - EPML based
  - Realizing above mentioned functions
Business Interoperability Interface Modeler
Thank you!

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