



On the Translation between BPMN and BPEL: Conceptual Mismatch between Process Modeling Languages

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From the BPMN Specification:



... The primary goal of BPMN is to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes. Thus, BPMN creates a **standardized bridge** for the gap between the business process design and process implementation.

Another goal, but no less important, is to ensure that XML languages designed for the execution of business processes, such as **BPEL4WS** (Business Process Execution Language for Web Services), can be visualized with a business-oriented notation.

Agenda



1. Introduction to BPMN and BPEL
2. Conceptual Mismatch
 1. Domain Representation Capability
 2. Control Flow Support
 3. Process Representation Paradigm
3. Conclusions and Recommendations

Agenda



Introduction to BPMN and BPEL

A BPEL Process



```
001 <process name="purchaseOrderProcess"
002     targetNamespace="..."
003     xmlns="..."
004     xmlns:Ins="...">
...
044 <sequence>
045   <receive partnerLink="purchasing"
046     portType="Ins:purchaseOrderPT"
047     operation="sendPurchaseOrder"
048     variable="PO">
049   </receive>
050   <flow>
051     <links>
052       <link name="ship-to-invoice"/>
053       <link name="ship-to-scheduling"/>
054     </links>
055     <sequence>
056       <assign>
057         <copy>
058           <from variable="PO" part="customerInfo"/>
059           <to variable="shippingRequest"
060             part="customerInfo"/>
061         </copy>
062       </assign>
063       <invoke partnerLink="shipping"
064         portType="Ins:shippingPT"
065         operation="requestShipping"
066         inputVariable="shippingRequest"
067         outputVariable="shippingInfo">
068         <source linkName="ship-to-invoice"/>
069       </invoke>
070       <receive partnerLink="shipping"
071         portType="Ins:shippingCallbackPT"
072         operation="sendSchedule"
073         variable="shippingSchedule">
074         <source linkName="ship-to-scheduling"/>
075       </receive>
076     </sequence>
077   <sequence>
078     <invoke partnerLink="invoicing"
079       portType="Ins:computePricePT"
080       operation="initiatePriceCalculation"
081       inputVariable="PO">
082     </invoke>
083     <invoke partnerLink="invoicing"
084       portType="Ins:computePricePT"
085       operation="sendShippingPrice"
086       inputVariable="shippingInfo">
087       <target linkName="ship-to-invoice"/>
088     </invoke>
089     <receive partnerLink="invoicing"
090       portType="Ins:invoiceCallbackPT"
091       operation="sendInvoice"
092       variable="Invoice"/>
093   </sequence>
094   <sequence>
095     <invoke partnerLink="scheduling"
096       portType="Ins:schedulingPT"
097       operation="requestProductionScheduling"
098       inputVariable="PO">
099     </invoke>
100     <invoke partnerLink="scheduling"
101       portType="Ins:schedulingPT"
102       operation="sendShippingSchedule"
103       inputVariable="shippingSchedule">
104       <target linkName="ship-to-scheduling"/>
105     </invoke>
106   </sequence>
107 </flow>
108 <reply partnerLink="purchasing"
109   portType="Ins:purchaseOrderPT"
110   operation="sendPurchaseOrder"
111   variable="Invoice"/>
112 </sequence>
113 </process>
```

A BPEL Process: Structured Activities



```
001 <process name="purchaseOrderProcess"
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066         inputVariable="shippingRequest"
067         outputVariable="shippingInfo">
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069       </invoke>
070       <receive partnerLink="shipping"
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074         <source linkName="ship-to-scheduling"/>
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076     </sequence>
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100     <invoke partnerLink="scheduling"
101       portType="Ins:schedulingPT"
102       operation="sendShippingSchedule"
103       inputVariable="shippingSchedule">
104       <target linkName="ship-to-scheduling"/>
105     </invoke>
106   </sequence>
107 </flow>
108 <reply partnerLink="purchasing"
109   portType="Ins:purchaseOrderPT"
110   operation="sendPurchaseOrder"
111   variable="Invoice"/>
112 </sequence>
113 </process>
```

A BPEL Process: Basic Activities



```
001 <process name="purchaseOrderProcess"
002     targetNamespace="..."
003     xmlns="..."
004     xmlns:Ins="...">
...
044 <sequence>
045     <receive partnerLink="purchasing"
046         portType="Ins:purchaseOrderPT"
047         operation="sendPurchaseOrder"
048         variable="PO">
049     </receive>
050     <flow>
051         <links>
052             <link name="ship-to-invoice"/>
053             <link name="ship-to-scheduling"/>
054         </links>
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056             <assign>
057                 <copy>
058                     <from variable="PO" part="customerInfo"/>
059                     <to variable="shippingRequest"
060                         part="customerInfo"/>
061                 </copy>
062             </assign>
063             <invoke partnerLink="shipping"
064                 portType="Ins:shippingPT"
065                 operation="requestShipping"
066                 inputVariable="shippingRequest"
067                 outputVariable="shippingInfo">
068                 <source linkName="ship-to-invoice"/>
069             </invoke>
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071                 portType="Ins:shippingCallbackPT"
072                 operation="sendSchedule"
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074                 <source linkName="ship-to-scheduling"/>
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076         </sequence>
077     </flow>
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085             portType="Ins:computePricePT"
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087             inputVariable="shippingInfo">
088             <target linkName="ship-to-invoice"/>
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092             operation="sendInvoice"
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098             operation="requestProductionScheduling"
099             inputVariable="PO">
100         </invoke>
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102             portType="Ins:schedulingPT"
103             operation="sendShippingSchedule"
104             inputVariable="shippingSchedule">
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106         </invoke>
107     </sequence>
108 </flow>
109 <reply partnerLink="purchasing"
110     portType="Ins:purchaseOrderPT"
111     operation="sendPurchaseOrder"
112     variable="Invoice"/>
113 </process>
```

A BPEL Process: Data Flow



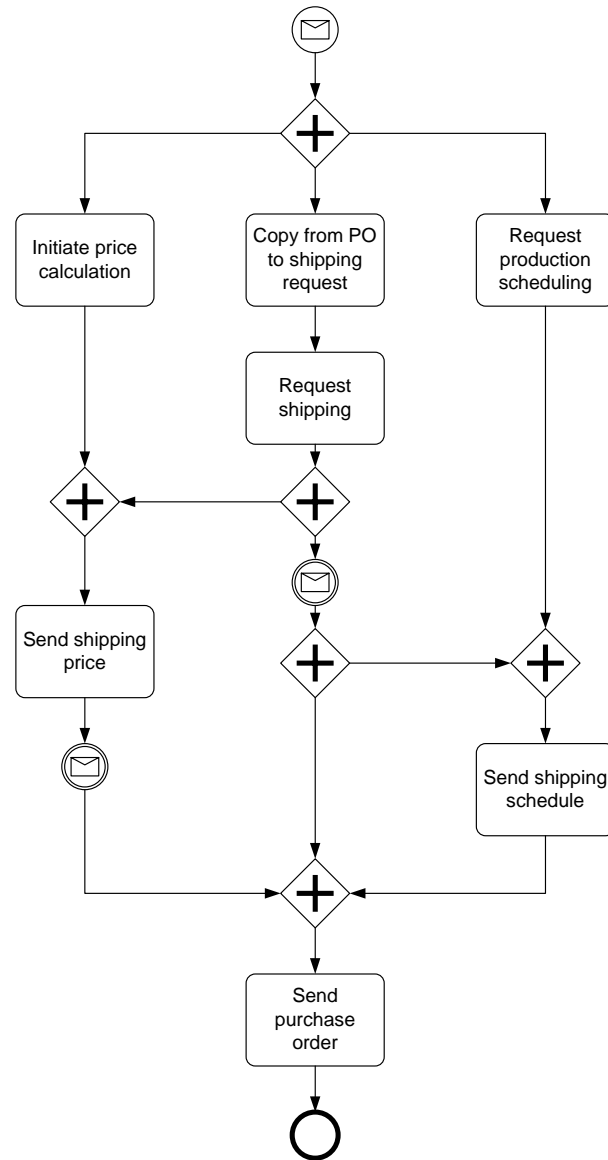
```
001 <process name="purchaseOrderProcess"
002     targetNamespace="..."
003     xmlns="..."
004     xmlns:Ins="...">
...
044 <sequence>
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047     operation="sendPurchaseOrder"
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049   </receive>
050   <flow>
051     <links>
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105     </invoke>
106   </sequence>
107 </flow>
108 <reply partnerLink="purchasing"
109   portType="Ins:purchaseOrderPT"
110   operation="sendPurchaseOrder"
111   variable="Invoice"/>
112 </sequence>
113 </process>
```

A BPEL Process: Partner Links

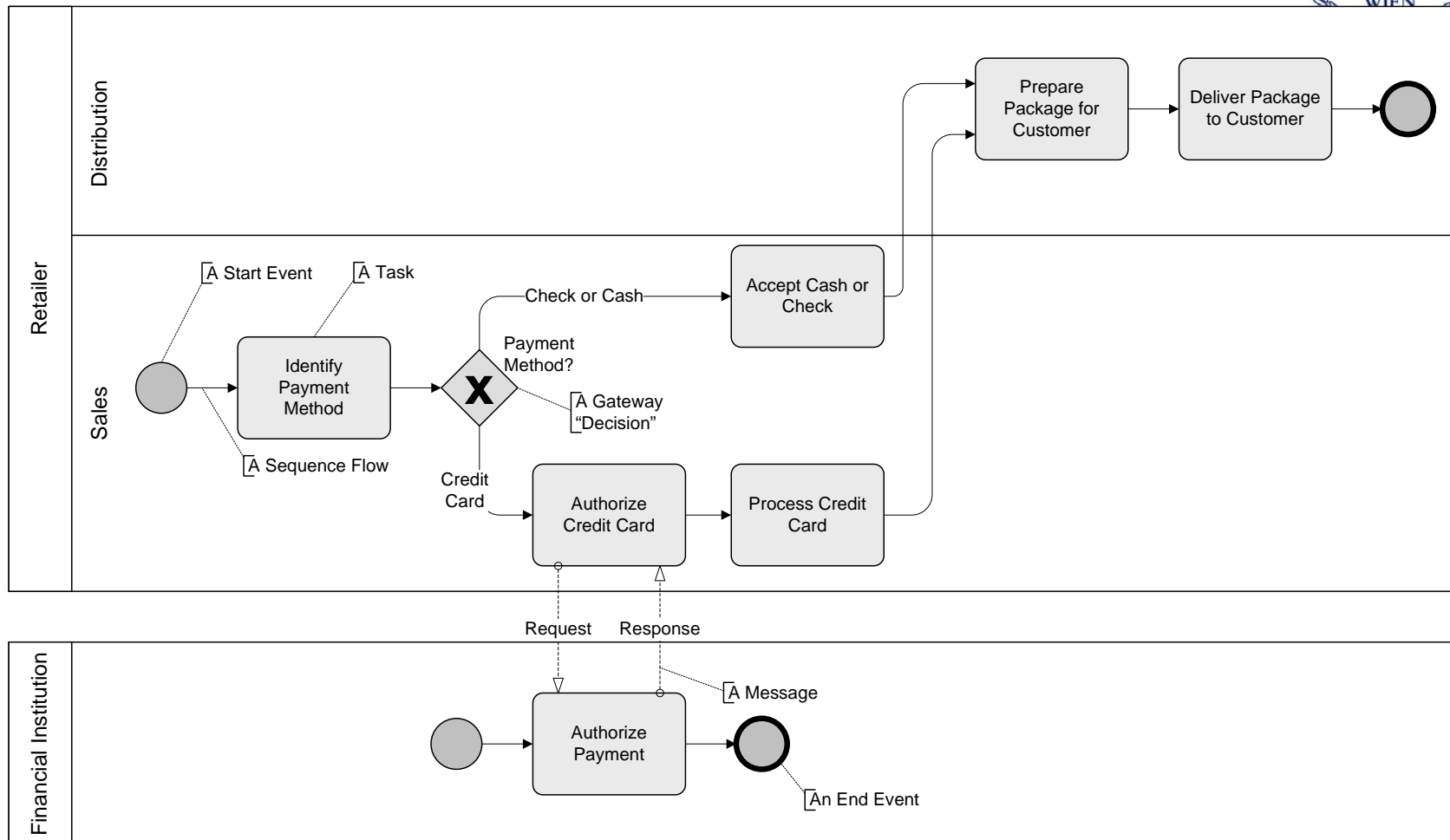


```
001 <process name="purchaseOrderProcess"
002     targetNamespace="..."
003     xmlns="..."
004     xmlns:Ins="...">
...
044 <sequence>
045   <receive partnerLink="purchasing"
046     portType="Ins:purchaseOrderPT"
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049   </receive>
050   <flow>
051     <links>
052       <link name="ship-to-invoice"/>
053       <link name="ship-to-scheduling"/>
054     </links>
055     <sequence>
056       <assign>
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058           <from variable="PO" part="customerInfo"/>
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061         </copy>
062       </assign>
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064         portType="Ins:shippingPT"
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067         outputVariable="shippingInfo">
068         <source linkName="ship-to-invoice"/>
069       </invoke>
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071         portType="Ins:shippingCallbackPT"
072         operation="sendSchedule"
073         variable="shippingSchedule">
074         <source linkName="ship-to-scheduling"/>
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076     </sequence>
077   <sequence>
078     <invoke partnerLink="invoicing"
079       portType="Ins:computePricePT"
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105     </invoke>
106   </sequence>
107 </flow>
108 <reply partnerLink="purchasing"
109   portType="Ins:purchaseOrderPT"
110   operation="sendPurchaseOrder"
111   variable="Invoice"/>
112 </sequence>
113 </process>
```

The BPEL Process in BPMN



BPMN explained



Agenda



Conceptual Mismatch

Conceptual Mismatch



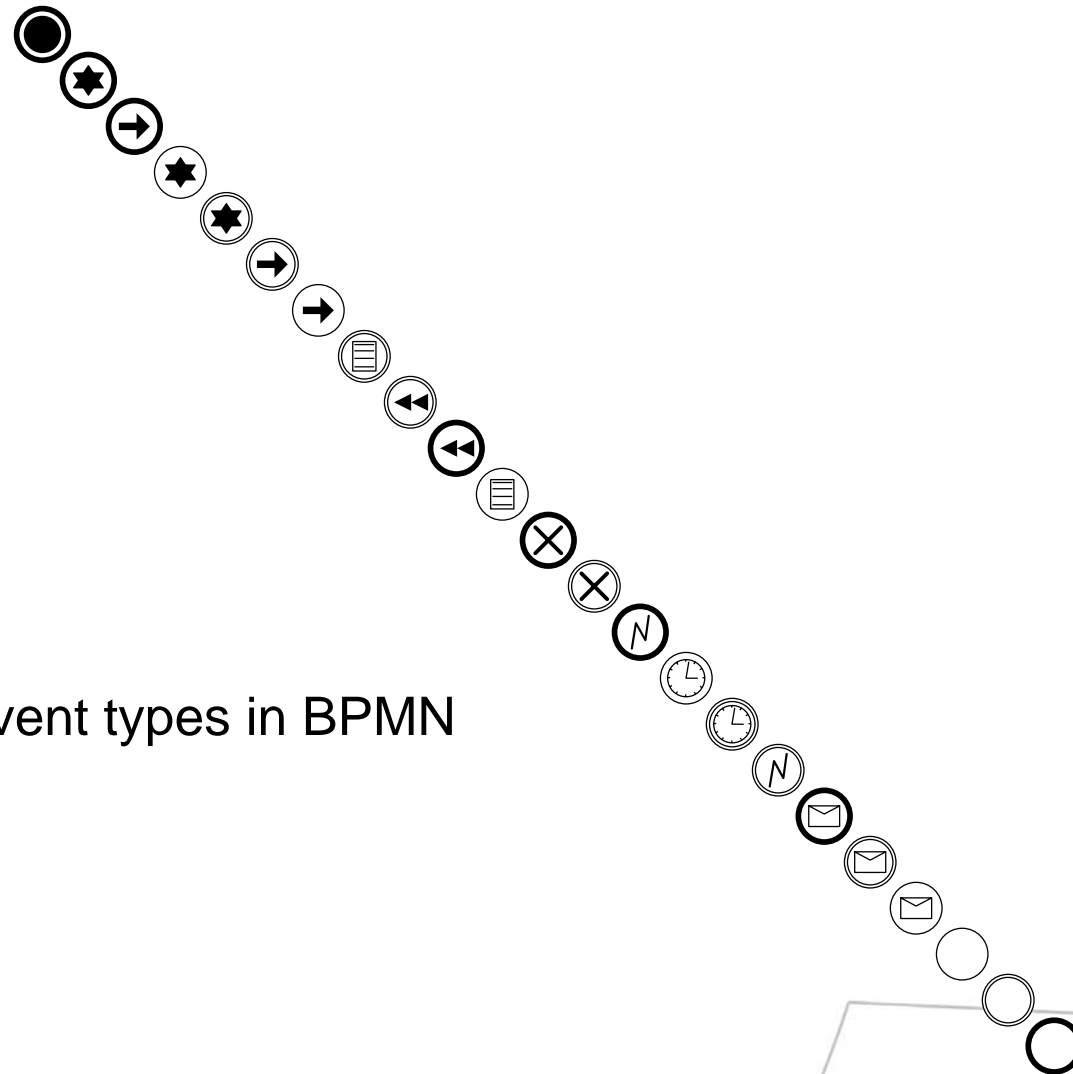
- Is there always a mapping between arbitrary BPMN and BPEL?
- Coming from the general to the specific:
 1. Compare Domain Representation Capabilities (BWW-Model)
 2. Compare Control Flow Support (Workflow Patterns)
 3. Identify Transformation Strategies

BWW Thing



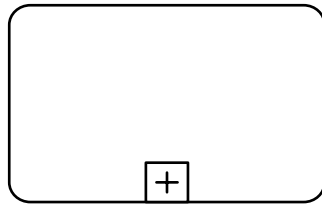
Accounting	Jane Lane
	Peter Miller

BWW Events



Redundant event types in BPMN

BWW Subsystem



BPMN Subprocess

```
<sub:call name="handleOrder"  
  partnerLink="myOrderProcess"  
  requestOperation="submitOrdner"  
  inputVariable="myOrder"  
  outputVariable="orderingResult"  
  responseOperation="receiveOrderResult"/>
```

BPEL Subprocesses Extension

Domain Representation Capability



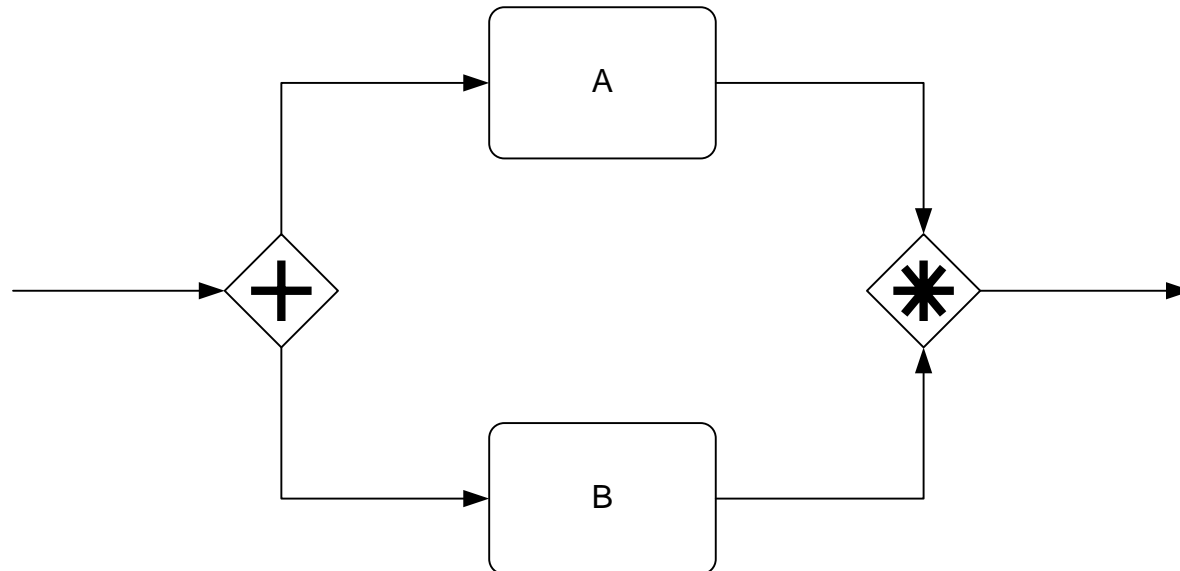
BWW Construct	BPMN	BPEL
<i>Things, including their Types and Properties</i>		
THING	++	-
PROPERTY	N/A	N/A
in general	++	+
in particular	-	-
hereditary	-	-
emergent	-	+
intrinsic	-	-
mutual: non-binding	-	-
mutual: binding	-	-
attributes	-	+
CLASS	++	+
KIND	+	-
<i>States assumed by Things</i>		
STATE	-	+
CONCEIVABLE STATE SPACE	-	-
LAWFUL STATE SPACE	-	-
STATE LAW	-	-
STABLE STATE	-	-
UNSTABLE STATE	-	-
HISTORY	-	-

Domain Representation Capability II

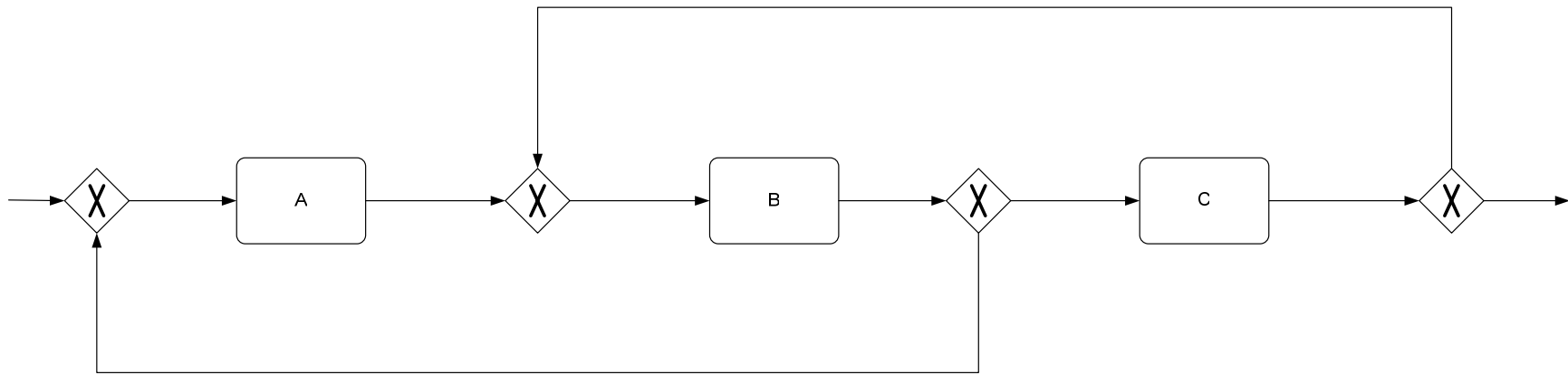


BWW Construct	BPMN	BPEL
<i>Events and Transformations occurring on Things</i>		
EVENT	++	++
CONCEIVABLE EVENT SPACE	-	-
LAWFUL EVENT SPACE	-	-
EXTERNAL EVENT	++	+
INTERNAL EVENT	++	++
WELL-DEFINED EVENT	++	+
POORLY-DEFINED EVENT	++	++
TRANSFORMATION	++	++
LAWFUL TRANSFORMATION	++	++
stability condition	++	+
corrective action	++	-
ACTS ON	+	+
COUPLING	+	+
<i>Systems structured around Things</i>		
SYSTEM	++	+
SYSTEM COMPOSITION	++	+
SYSTEM DECOMPOSITION	++	-
SYSTEM STRUCTURE	-	+
SYSTEM ENVIRONMENT	++	-
SUBSYSTEM	++	-
LEVEL STRUCTURE	++	-

Workflow Pattern Discriminator



Workflow Pattern Arbitrary Cycles

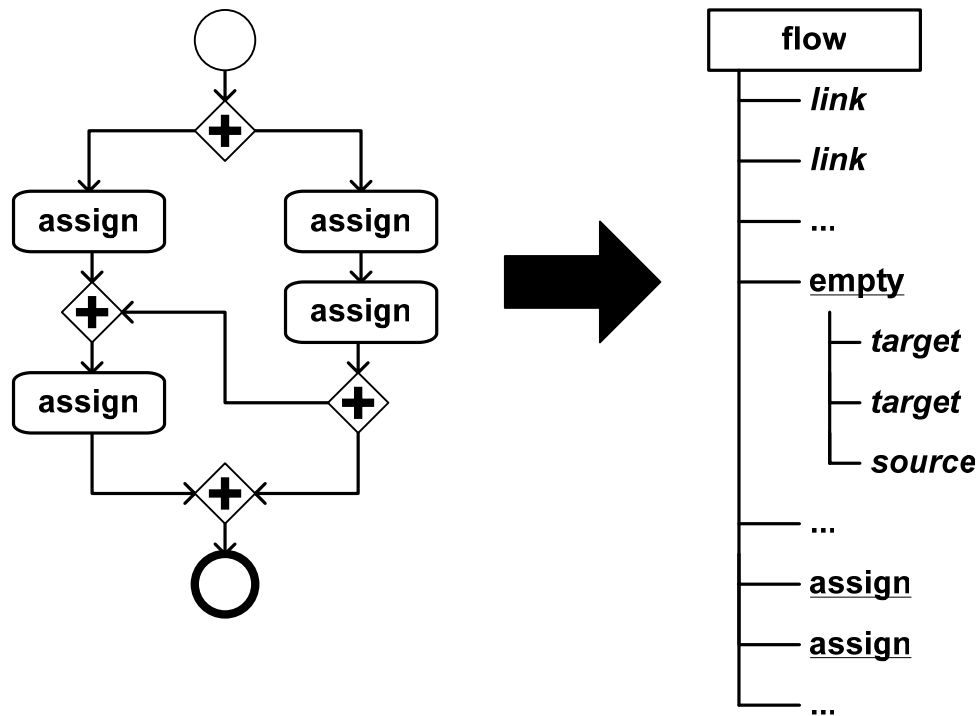


Control Flow Support



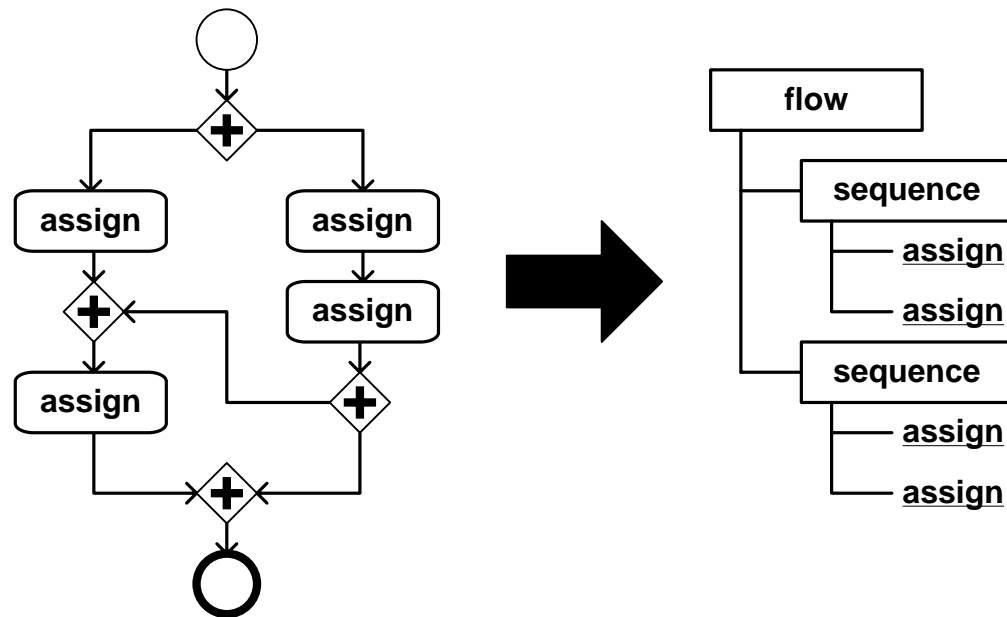
Workflow Patterns	BPMN	BPEL	Workflow Patterns (ctd.)	BPMN	BPEL
<i>Basic Control Flow</i>			11. Implicit Termination	+	+
			<i>Multiple Instances Patterns</i>		
1. Sequence	+	+	12. MI without Synchronization	+	+
2. Parallel Split	+	+	13. MI with a priori Design Time Knowledge	+	+
3. Synchronization	+	+	14. MI with a priori Runtime Knowledge	+	-
4. Exclusive Choice	+	+	15. MI without a priori Runtime Knowledge	-	-
5. Simple Merge	+	+	<i>State-Based Patterns</i>		
<i>Adv. Synchronization</i>			16. Deferred Choice	+	+
6. Multiple Choice	+	+	17. Interleaved Parallel Routing	+/-	+/-
7. Synchronizing Merge	+/-	+	18. Milestone	-	-
8. Multiple Merge	+	-	<i>Cancellation Patterns</i>		
9. Discriminator	+	-	19. Cancel Activity	+	+
<i>Structural Patterns</i>			20. Cancel Case	+	+
10. Arbitrary Cycles	+	-			

Transformation Strategies: Element Preservation



Mendling, Lassen, Zdun (2006)

Transformation Strategies: Structure Identification



Transformation Strategies



Transformation Strategies from BPMN to BPEL	Structured BPMN	Acyclic BPMN	All BPMN	Transformation Strategies from BPEL to BPMN	Structured BPEL	All BPEL
Element-Preservation	-	+	-	Flattening	+	+
Element-Minimization	-	+	-	Hierarchy-Preservation	+	-
Structure-Identification	+	-	-	Hierarchy-Maximization	+	+
Structure-Maximization	+	+	-			

Agenda



Conclusions

Conclusions



- Framework for analysis
- BPMN is richer than BPEL
- Transformation from BPEL to BPMN less a problem
- From BPMN to BPEL
 - Loss of information
 - Loss of design considerations
- Potential Solutions
 - Restriction to a subset of BPMN
 - Extension of BPEL

Agenda



Thank you for your attention!