

BPMN - BPEL Transformation and Round Trip Engineering

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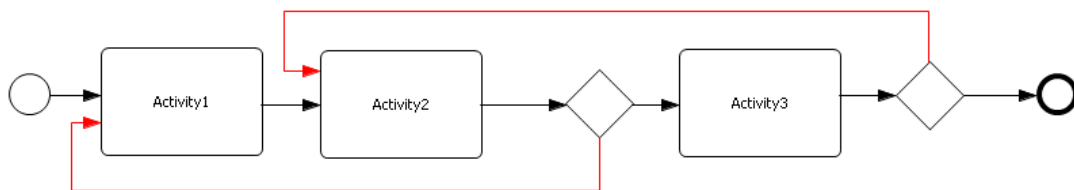
INTRODUCTION

Business Process Modeling Notation (BPMN) has emerged as an important open standard graphic notation for drawing and modeling business processes. Its design goals include being readily understandable by all business users, from the business analysts that create the initial drafts of processes, to IT architects and developers that implement and deploy processes, and to business and IT users that manage and monitor those processes.

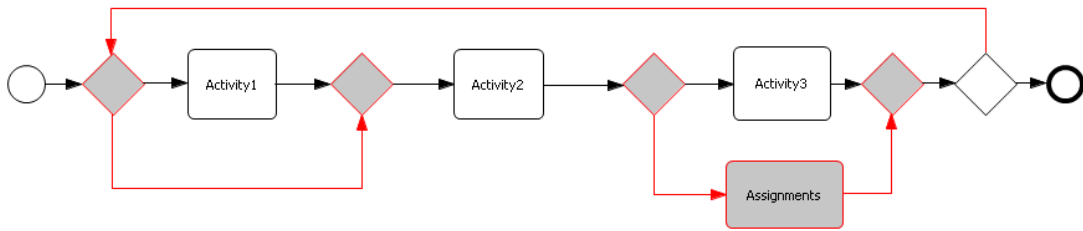
BPMN diagrams can be mapped to Business Process Execution Language (BPEL) processes to bridge the gap between business process design and implementation. The mapping has been illustrated using several examples in the BPMN specification and numerous other articles.

However, it is intrinsically complex to map the diagrams to BPEL processes because of the structural disparity between BPMN and BPEL. BPEL is a block structured language overall, even though a flow with links in BPEL can be more flexible. In contrast, BPMN is a constrained, but relative free form graph. Structurally, BPMN can be a super- set of BPEL. There are no fundamental difficulties in mapping a BPEL process to an isomorphic BPMN diagram. In other words, any BPEL process can be visualized as a BPMN diagram without rearranging the flows. But it is not always possible to map a BPMN diagram directly to an isomorphic BPEL process. Arbitrary sequence flows allowed in BPMN are similar to the GOTO statements in some computer languages. Without analyzing and redrawing such diagram flow structures, it is practically impossible to map all processes correctly.

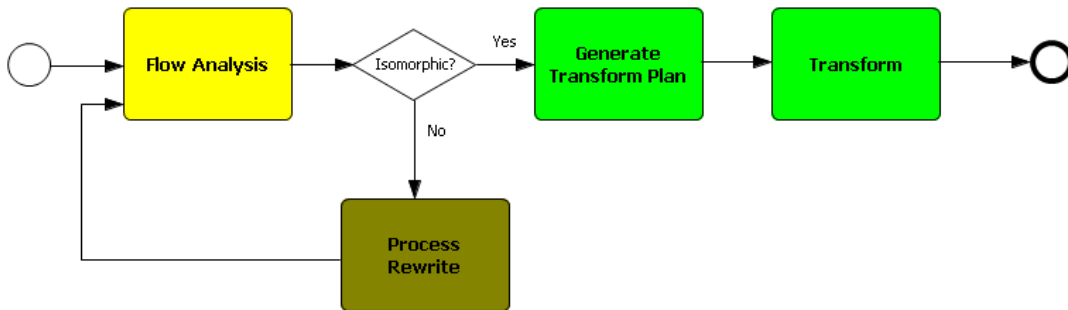
The following diagram is an example. Since BPEL does not have GOTO constructs, we need to redraw a semantically equivalent process flow.



The two overlapped loops can be redrawn as the following with only one loop before isomorphic mapping to a BPEL process.



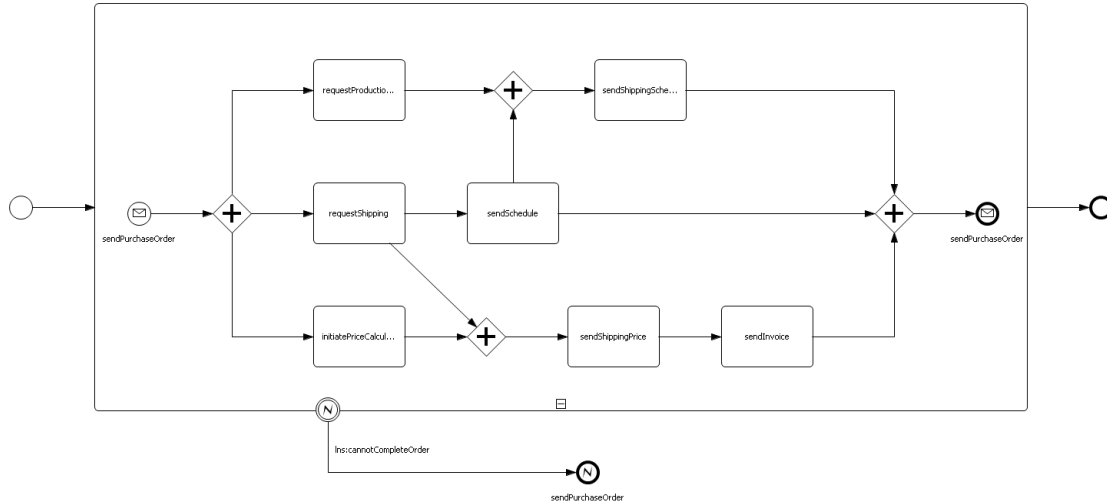
In general, the process of validating, redrawing and transforming BPMN can be illustrated as the following workflow. Note it is critical to analyze if a BPMN diagram can be isomorphically mapped to BPEL. And it is technically challenging to rewrite arbitrary BPMN diagrams to be BPEL isomorphic.



BPEL VISUALIZATION IN BPMN

The transformation is relatively straightforward. Sequences in BPEL map to linear flows in BPMN. Flows map to parallel gateways. Picks map to event-based exclusive gateways. And etc.

Compared with most BPEL graphic editors in proprietary notation, BPMN has semantic rich visual representation. Especially, BPMN offers clearer visual representation for abnormal flows, such as fault handling, event handling, and compensation handling. The following diagram was generated automatically by eClarus Business Process Modeler from one of the sample processes in the BPEL4WS 1.1 specification.



Also, a standard notation can be easily accepted and understood. And therefore, it can promote better integration among BPM and SOA products from different vendors.

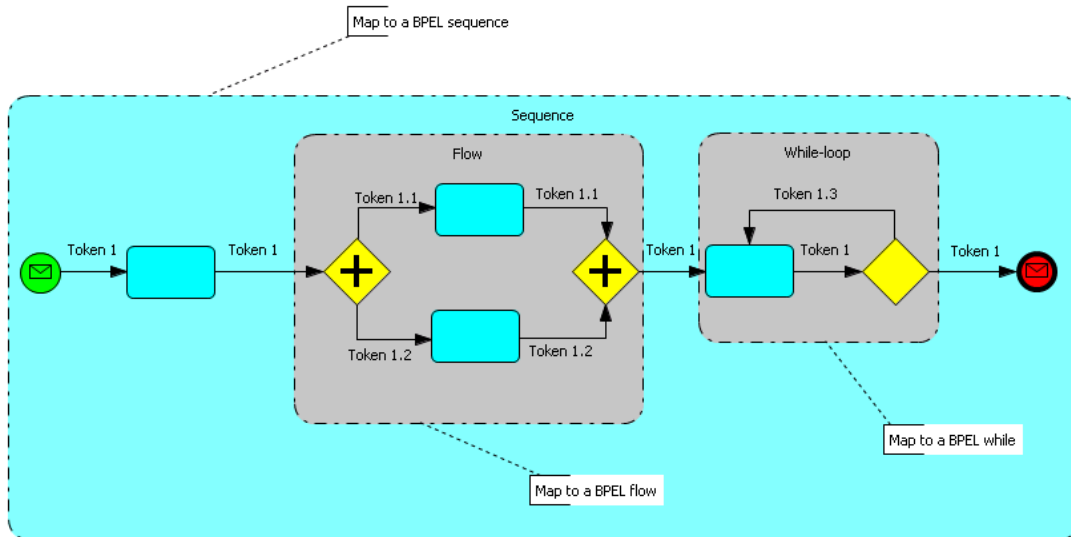
STATIC FLOW TOKEN ANALYSIS

Flow token analysis has been extensively used in runtime environments. The basic idea can be applied for static analysis as well. This approach is well suited to the problem of programmatically transforming BPMN to BPEL.

A flow token is assigned to each sequence flow within a process. Downstream flows inherit upstream tokens. A flow token can be divided into sub tokens at a branching gateway, and they can merge back, reforming the original token at a merging gateway. A flow token can also be composite to indicate an interleaved branching.

By analyzing the signatures of the flow tokens, we can find out if a group of flow objects and the sequence flows between them can be mapped to a BPEL block. For example, if a flow object has two incoming sequence flows, and the token of one sequence flow is a sub-token of the token carried by the other sequence flow, then a loop structure can be inferred. Repeating the inference, a non-isomorphic overlapping loop structure can be identified.

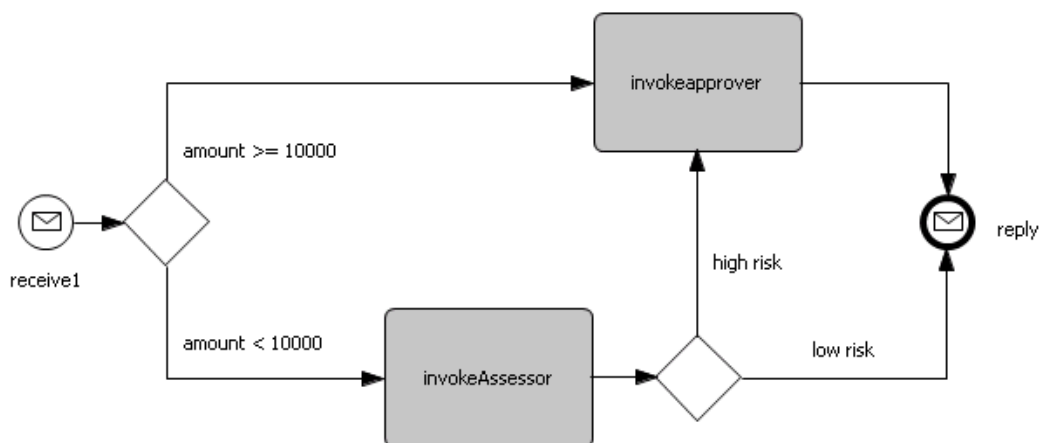
Further analysis is a pattern matching from parts of a BPMN diagram to BPEL elements. A linear flow can match a “sequence” in BPEL. A branching parallel gateway, a merging parallel gateway and flow objects in between could match a BPEL “flow”. Loops match BPEL “while” elements. And so on, as IBM’s Stephen White and others have described.



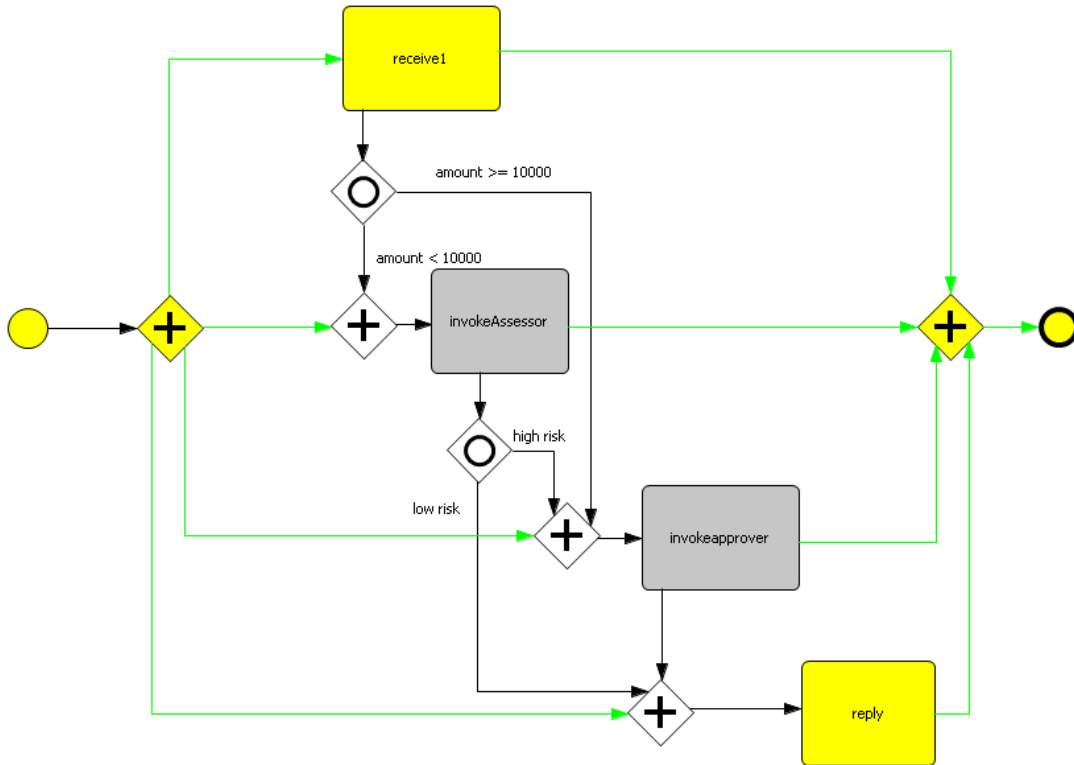
PROCESS REWRITE

If a BPMN diagram is not BPEL isomorphic, it is necessary to rewrite (redraw) the diagram. Rewriting BPMN diagrams is a semantic analysis process which is very hard for people without in-depth knowledge of BPMN, BPEL and the expression languages. It can be done manually by IT architects and developers. It is also possible to automate in software along with other BPEL mapping steps.

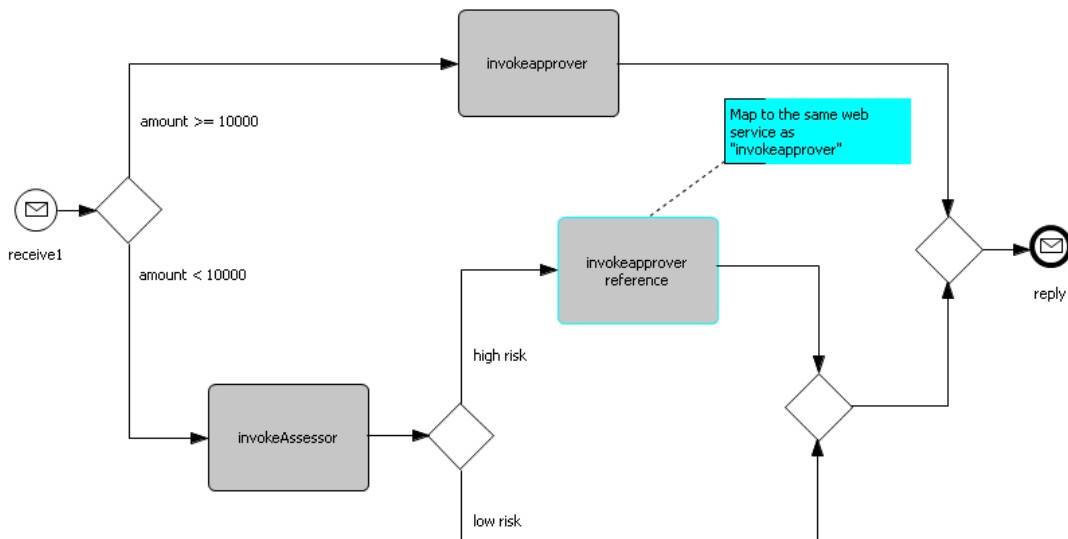
The following diagram is based on sample process “Loan Approval” in the BPEL4WS 1.1 specification.



The sequence flow “high risk” mixes the flow tokens of both branches. But it can be rewritten as the following to isomorphically map to a BPEL flow with links, the sample BPEL process in the BPEL4WS specification.



Or use nested exclusive gateways as shown in the following diagram. And it can be isomorphically map to nested switches in BPEL.



CONCLUSION

Business Process Modeling Notation contributes significantly to better collaboration among business analysts, software architects, and IT. But sophisticated tools, methodologies, and best practices are needed to bring the promise of BPMN for accelerating SOA adoption, business agility and compliance to reality.

In practice, business analysts can first describe business processes in BPMN with additional artifacts to articulate the requirements, like rules and goals. Based on the requirements, IT architects and developers can refine the processes with implementation details, and restructure the flows to be BPEL isomorphic, either manually or using sophisticated modeling software, then transform them to BPEL. The refined BPMN diagrams and BPEL files can be round trip transformable, aligning services with business requirements.

BPM and SOA software vendors need to create sophisticated tools with flow analysis, BPMN to BPEL transformation, and even diagram rewriting capabilities.

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