Diagram Interchangeability in BPMN 2

Matthias Kurz (DATEV eG), Falko Menge (camunda services GmbH), Zbigniew Misiak (BOC Group)

1   Introduction

With the increasing adoption of Business Process Model and Notation (BPMN), businesses are more and more using BPMN-based tools. In order to avoid recreating processes for tools from different vendors, it is imperative to have a standard format for exchanging BPMN-based processes.

This is valid both for exchanging BPMN processes among BPA tools (to avoid vendor lock in and allow cooperation in projects with various tools used) and moving from "business BPMN" in BPA tools to "technical BPMN" in execution engines.

This paper introduces the basic concepts of BPMN process interchange.

2   Model Interchange History

The BPMN versions prior to BPMN 2.0 provided no standardized mechanisms for exchanging BPMN diagrams. Instead, the BPMN 1.2 specification suggests a non-normative mapping from BPMN to WS-BPEL 2.0, which in turn has a standardized exchange format. With BPMN 1.2 and WS-BEPL 2.0 having different capabilities, the lossless interchange of BPMN 1.2 models between various tools was not possible (especially in roundtrip scenarios).

This was partially alleviated by existence of XPDL standard. However mapping to XPDL was not part of BPMN specification and the standard itself was maintained by external entity (WfMC), so there was no sure solution.

In order to resolve this, BPMN 2.0 introduced its own XML-based interchange format for BPMN processes.

3   Interchange Capabilities

In BPMN 2.0, processes[1] comprise two aspects:

- **Process models** contain the semantics.
- **Process diagrams** store the visual representation of the process models.

In the trivial example process of Figure 1, the process model stores the start event, the task, and the end event along with the two connecting sequence flows. The model contains only the semantics, but not the graphical visualization, e.g., the model has no information about whether the task should be right of the start event or below it. For storing the graphical visualizations, diagrams refine the model with information about the layout of the shapes.
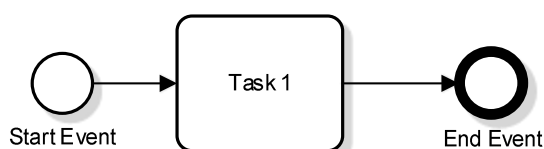

Figure 1: Example process

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[1] Technically, the BPMN 2.0 specification refers to processes as *process definitions*.

BPMN 2.0 defines standardized formats for creating XML files which contain both aspects. This allows exchanging BPMN processes between tools of different vendors. Mirroring the two aspects of BPMN processes, these XML BPMN files comprise two parts:

- One or more **process models** contain the semantics.
- One or more **process diagrams** store the visual representation of the process models.
  In the BPMN specification, this part is referred to as BPMN Diagram Interchange (BPMN DI).

BPMN 2.0 offers two XML formats for storing BPMN processes:

- A format defined using **XML Schema Definition** (XSD).
- A format defined using **XML Metadata Interchange** (XMI).

Both formats provide the same expressive power[2]. In case a tool can only process one XML format, the OMG provides XSLT rules for lossless transformation between the XSD- and XMI-based XML formats. With the XSD-based format being more popular, this transformation is only occasionally used in practice.

From a user point of view, BPMN diagram interchange capable tools should allow exporting the processes modelled in BPMN 2.0 to XML files (usually with the extension *.bpmn*) and importing processes from these files in such a way that the model content (i.e., events, tasks, etc.) and layout are preserved, so that there is no need to re-draw the processes manually.

While BPMN 2.0 still contains a mapping to WS-BPEL in order to make the business-oriented BPMN notation available to WS-BPEL, WS-BPEL is not considered to be an interchange format for BPMN diagrams.

4   BPMN Model Interchange Working Group

Even though the BPMN 2.0 specification contains definitions for the diagram interchange, practice showed that in some cases there are ambiguities or even contradictions in the specification document and there was no "single source of truth". Because of this, various tool vendors may interpret parts of the specification differently and thus tool implementations of the BPMN standard could vary significantly.

Obviously, this made interchange of models between various tools very difficult as each vendor would need to handle exports from other tools, trying to be able to import them. That kind of "catching the moving target" lead to high efforts and in the best case caused that tool vendor did tests with 2-3 other popular tools.

In order to resolve this problem, the BPMN Model Interchange Working Group (BPMN MIWG) was set up as a part of OMG. Being a joint effort of vendors interested in diagram interchange, the initiative's goal is to guide and support vendors in creating standard-compliant BPMN tools, identify issues in BPMN specification, and facilitate model interchange. The group's guiding principles are: transparency, inclusion, collaboration, and openness.

In order to contribute real-world results, the BPMN MIWG – chaired by Denis Gagné – used the practical approach and started with a test suite comprising several BPMN models that are used as reference points both for the import and export functionality of various tools.

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[2] There is one exception to this rule: The XMI-based format may hold incomplete process models (i.e., process models where required attributes are not set or required associations are missing).

Apart from the set of test cases, a special mechanism for the automated comparison of the test results provided by vendors assists in identifying interoperability issues of BPMN tools.

First results of the BPMN MIWG efforts were shown in June 2013 in Berlin during OMG technical meeting in form of a "chained demo" where single BPMN model was moved between 8 tools from 6 vendors (cf. Figure 225).
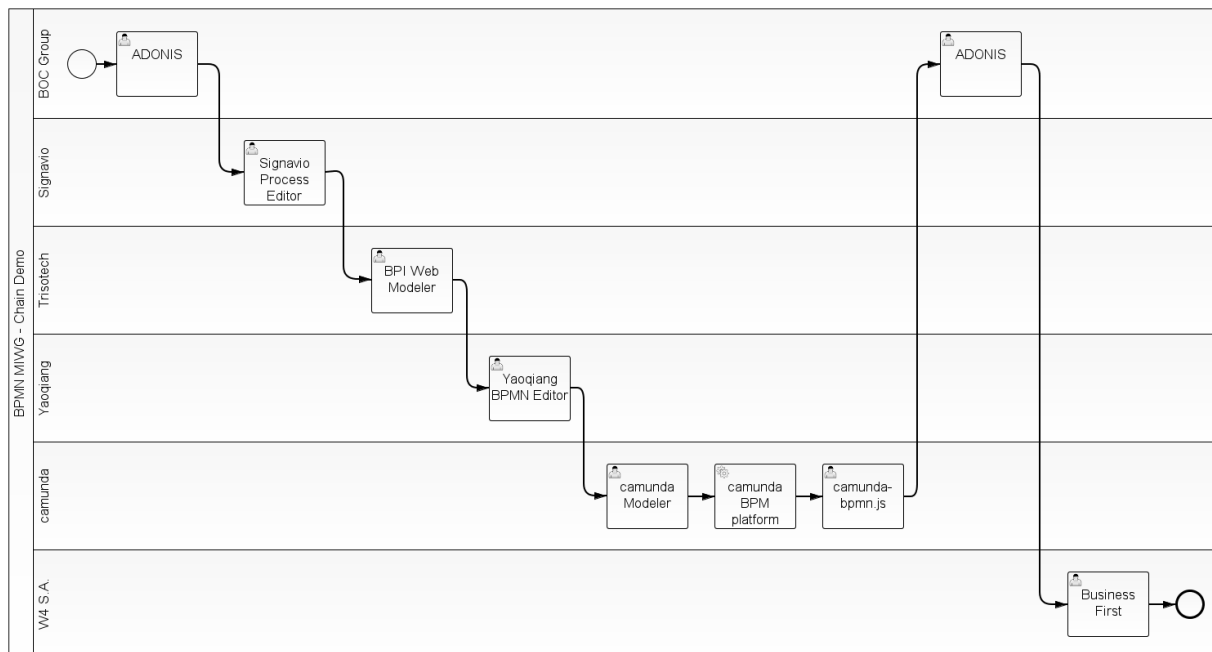

Figure 2: Chain demo in Berlin

Starting from a simple business model, more and more details were added using various tools. Then the process was executed with camunda BPM platform and moved back to ADONIS, proving that full roundtrip retaining technical attributes is possible thanks to the BPMN Diagram Interchange. For more information about the mechanism allowing exchange of proprietary technical information see section 5.3.
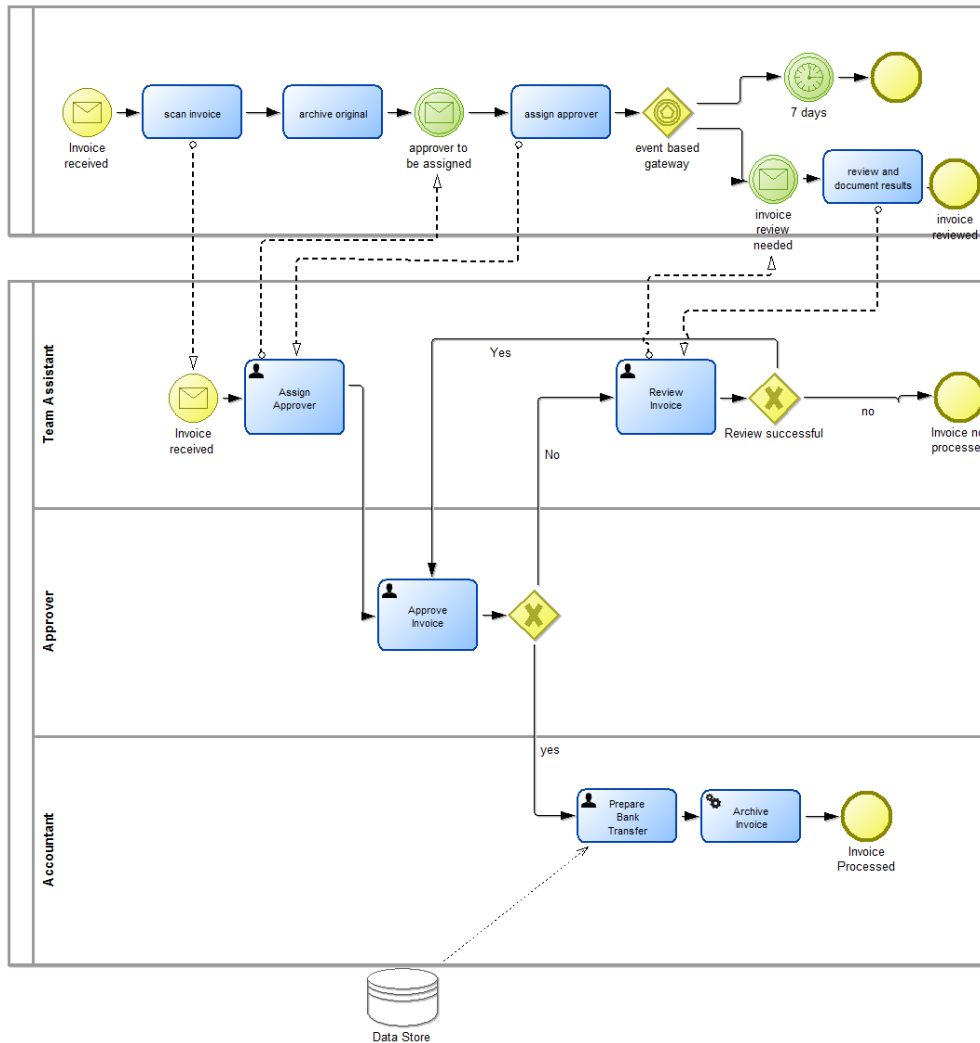
Figure 3: Test BPMN model after full roundtrip

Results of the demo session can be summarized with quote from Dennis Wisnosky, Senior Advisor and Consultant at the EDM Council: "What has been accomplished is truly impressive. It is the answer to lossless data interchange between BPM tools that has been only a dream for decades".

5   Interchange Limitations

Even though the BPMN 2 Diagram Interchange supports exchanging BPMN process models, there are still some limitations, which may be broadly defined as:

- Visual aspects of process diagrams which are not interchangeable.
- Semantic aspects of process models which are not interchangeable.
- Vendor-specific extensions.

The following sections will examine these limitations in more detail.

5.1   Visuals

The BPMN Diagram Interchange (BPMN DI) provides mechanisms for specifying the basic layout of BPMN diagrams. However, the BPMN DI provides no mechanisms for the following aspects for a BPMN diagram:

- Colors of shapes and text
- Decoration of shapes like shadows, gradients, or backgrounds
- Text font and text size
- Text wrapping
- Thickness and style of the lines

Therefore, the same BPMN diagram may be rendered differently in different tools without violating BPMN compliance. Figure 441 and Figure 552 depict such two correct renderings of the same BPMN diagram[3]. Both renderings have several differences although they are based on the same diagram:

- The pools and lanes have different colors.
- The shapes have different backgrounds.
- The message flow is dashed using different styles.
- The borders of the pools have different thicknesses.
- Due to different text sizes, the text *Message Flow 2* is not centered on the message flow in Figure 552 while it is in Figure 441.
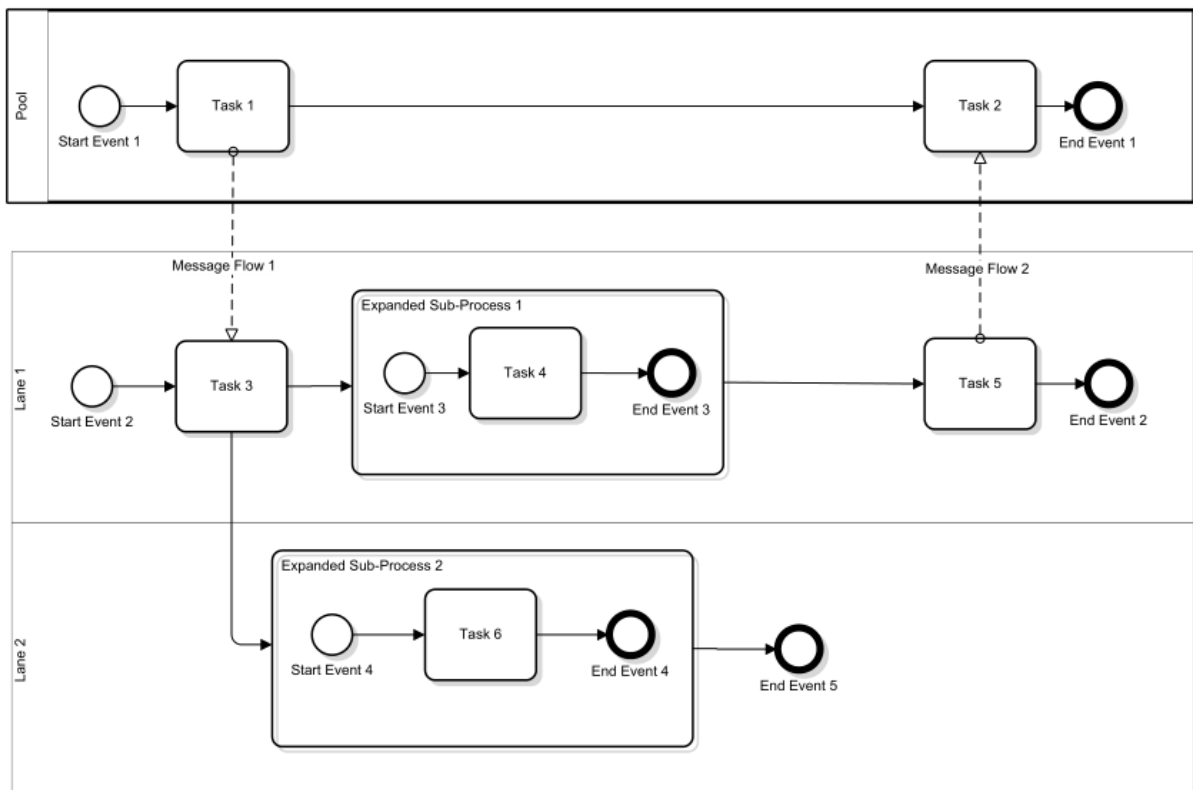

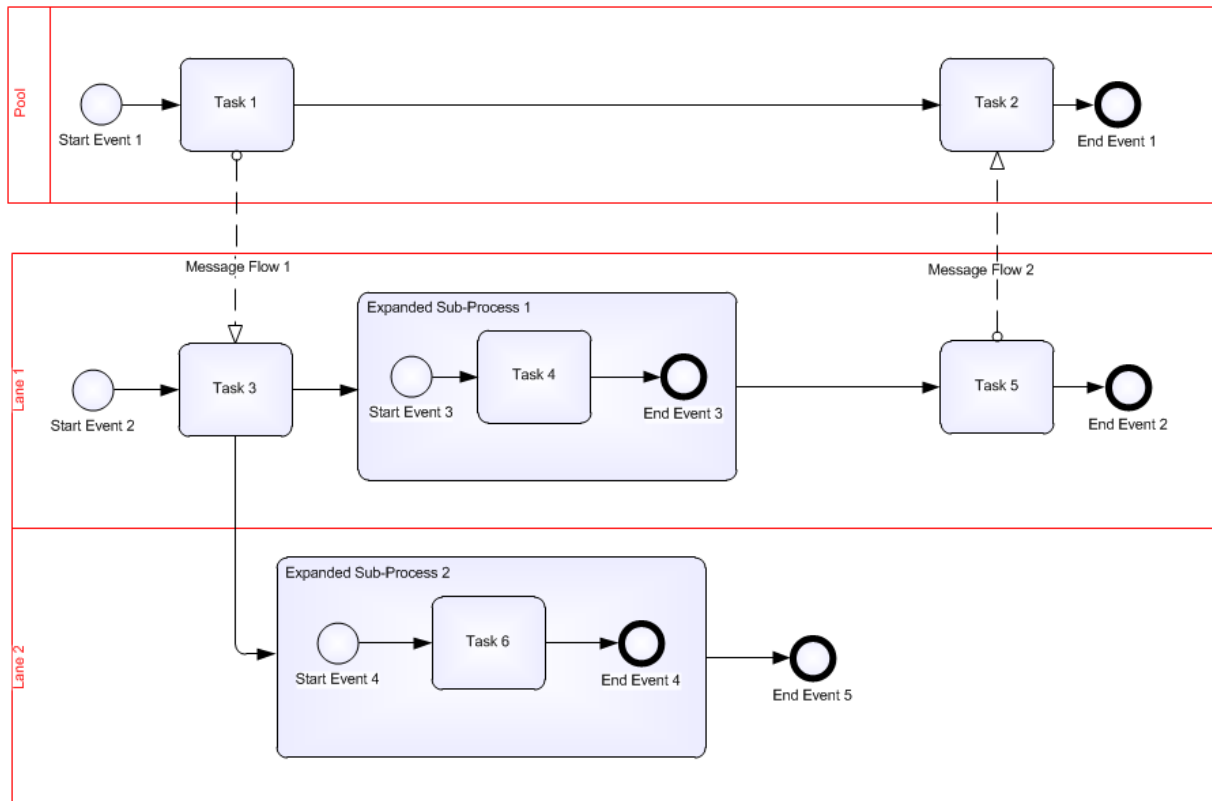*Figure 4: First rendering of an example diagram*

Figure 5: Second rendering of an example diagram

A common problem in diagram interchange is word wrapping. With text size and style not being part of BPMN DI, BPMN tools may use different text sizes when rendering a BPMN diagram. This may lead to different word wrapping, e.g., even if a diagram has adequate text wrapping in tool *A* (cf. Figure 663a), the same diagram may be sub optimally rendered in tool *B* (cf. Figure 663b).

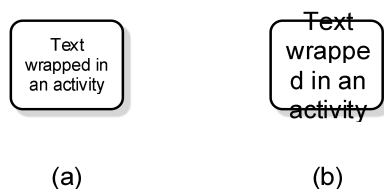(a)   (b)

Figure 6: Word wrapping

5.2   Semantics

Besides the visual aspects of process diagrams, there are some semantic aspects which are not covered by BPMN interchangeability as well. First, elements that are specified in BPMN models using non-standardized notations may cause problems when exchanging these models between tools. This includes the following BPMN elements:

- Script of a script task
- Implementation of a user task
- Implementation of a global user task

Furthermore, elements that are not contained within but referred to by a process model are not guaranteed to be interchangeable. This primarily applies to web services which are referenced by service tasks, send tasks and receive tasks.

The interchangeability of such elements is limited because (1) the web services may not be available to the recipient of a process model and (2) the web service may use a proprietary implementation which is not supported by the tool used by the recipient.

5.3 Vendor-specific Extensions

BPMN models and diagrams allow tool vendors to add proprietary information to the XML serialization. This is particularly useful for business process management systems (BPMS) that may require additional information.

Technically, this is achieved by adding an `extensionElement` or additional attributes in an own namespace to an XML element of the BPMN file. The following excerpt from a BPMN file shows how a fictional BPMS may add a four eye requirement and a user interface form to a user task.

```
<bpmn:userTask id="check_rq" name="Check Request" vendor:form="check.html">
  <bpmn:extensionElements>
    <vendor:fourEyePrinciple group="managers" />
  </bpmn:extensionElements>
</bpmn:userTask>
```

Although extension elements are a standard way to add proprietary information to a BPMN file, this information is vendor-specific. Therefore, users cannot expect that information contained in extension elements can always be exchanged between different tools without losses. Tools should ideally ignore the extension elements they do not support, while still keeping them in the exported BPMN, so that a round-trip is possible.

6 Outlook

The BPMN Model Interchange Working Group (BPMN MIWG) is constantly working on identifying and clarifying potentially misleading elements of the BPMN specification and improving the BPMN interoperability among various tools.

Even though the group's results are already significant, there is still much to do – both in terms of the number of tools that are developed with model interchange in mind and using the reference models as well as in terms of extending the scope of the reference models, so that they cover more and more sophisticated aspects of BPMN modelling.

Vendors, practitioners, and other parties interested in improving BPMN process interchange are encouraged to join the weekly web conference and participate in testing their tools using the BPMN MIWG test suite and / or the automated tests.

To learn more and join the BPMN MIWG visit: http://www.omgwiki.org/bpmn-miwg

7 References

[BPMN 1.2]   Business Process Model and Notation (BPMN) 1.2.
                http://www.omg.org/spec/BPMN/1.2/
[BPMN 2.0]   Business Process Model and Notation (BPMN) 2.0.
                http://www.omg.org/spec/BPMN/2.0
[WS-BPEL 2.0]   Web Services Business Process Execution Language Version 2.0.
                http://docs.oasis-open.org/wsbpel/2.0/
[XMI 2.4.1]   OMG MOF 2 XMI Mapping Specification.
                http://www.omg.org/spec/XMI/2.4.1