# BPMN to FHIR

Mapping of BMPN process patterns to the FHIR Resource PlanDefiniton developed by the **University of Applied Sciences Upper Austria** ("FH Hagenberg") and **CGM Clinical Austria** for a prototype for medical boards (project "KIMBo").

The definition of a Process is done by using either BPMN or FHIR Plan Definition. The Atlas Transformation Language (ATL) was used to transform between the two, based on the Control Flow and Data Flow Patterns used as metamodel (see definition: <http://workflowpatterns.com/evaluations/standard/>). A short List of currently implemented Patterns can be found here:

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| Sequence Flow | |
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| BPMN | Start-Event, BPMN End-Event, BPMN Sequence |
| PlanDefinition | PlanDefinition.relatedAction Before-Start |
| BPMN Representation | <bpmn:process id="Process\_1" isExecutable="false">  <bpmn:startEvent id="se\_1">  <bpmn:outgoing>sf\_1</bpmn:outgoing>  </bpmn:startEvent>  <bpmn:task id="t\_1" name="Sample Task">  <bpmn:incoming>sf\_1</bpmn:incoming>  <bpmn:outgoing>sf\_2</bpmn:outgoing>  </bpmn:task> sourceRef="t\_1" targetRef="ee\_1" />  </bpmn:process> |
| PlanDefinition Representation | <PlanDefinition xmlns="http://hl7.org/fhir">  <id value="protocol-example"/>  <text>  <status value="generated"/>  </text>  <!-- The status of the protocol.draft | active | retired -->  <status value="draft"/>  <actionDefinition>  <id value="task\_1"/>  <label value="Task 1" />  <title value="Task 1" />  <!-- related action definition -->  <relatedAction>  <actionId value="task\_2" />  <relationship value="before-start" />  </relatedAction>  </actionDefinition>  <actionDefinition>  <id value="task\_2"/>  <label value="Task 2" />  <title value="Task 2" />  </actionDefinition>  </PlanDefinition> |
| Definition | A sequence flow is a directed arc from one source node to exactly one target node. |

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| ParallelSplit | |
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| BPMN | ParallelGateway |
| PlanDefinition | PlanDefinition.groupingBehavior, PlanDefinition.selectionBehavior |
| BPMN Representation | ...  <!-- parallel gateway definition -->  <bpmn:parallelGateway id="par\_group">  <bpmn:extensionElements>  <camunda:taskListener event="create"/>  </bpmn:extensionElements>  <bpmn:incoming>sf\_ad\_1\_par\_group</bpmn:incoming>  <bpmn:outgoing>sf\_par\_group\_ad\_2</bpmn:outgoing>  <bpmn:outgoing>sf\_par\_group\_ad\_3</bpmn:outgoing>  </bpmn:parallelGateway>  <!-- sequence flows for the parallel gateway above -->  <bpmn:sequenceFlow  id="sf\_par\_group\_ad\_2" targetRef="ad\_2" sourceRef="par\_group"/>  <bpmn:sequenceFlow  id="sf\_par\_group\_ad\_3" targetRef="ad\_3" sourceRef="par\_group"/>  ... |
| PlanDefinition Representation | <PlanDefinition xmlns="http://hl7.org/fhir">  ...  <action>  <id value="par\_group"/>  <label value="par\_group"/>  <title value="par\_group"/>  <groupingBehavior value="logical-group"/>  <selectionBehavior value="all"/>  <action>  <id value="ad\_2"/>  <label value="Task 2"/>  <title value="Task 2"/>  <relatedAction>  <actionId value="par\_group"/>  <relationship value="before"/>  </relatedAction>  </action>  <action>  <id value="ad\_3"/>  <label value="Task 3"/>  <title value="Task 3"/>  <relatedAction>  <actionId value="par\_group"/>  <relationship value="before"/>  </relatedAction>  </action>  <relatedAction>  <actionId value="ad\_4"/>  <relationship value="before"/>  </relatedAction>  </action>  ...  </PlanDefinition> |
| Definition | A parallel split is seperating the sequence flow in parallel branches that are executed concurrently |
| Remarks | A merge element is created implicitly |

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| ExclusiveChoice | |
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| BPMN | ExclusiveGateway, ExtensionElement, TaskListener |
| PlanDefinition | PlanDefinition.groupingBehavior, PlanDefinition.selectionBehavior |
| BPMN Representation | ...  <!-- exclusive gateway definition -->  <bpmn:exclusiveGateway id="xor\_group">  <bpmn:extensionElements>  <camunda:taskListener event="create"/>  </bpmn:extensionElements>  <bpmn:incoming>sf\_ad\_1\_xor\_group</bpmn:incoming>  <bpmn:outgoing>sf\_xor\_group\_ad\_2</bpmn:outgoing>  <bpmn:outgoing>sf\_xor\_group\_ad\_3</bpmn:outgoing>  </bpmn:exclusiveGateway>  ...  <!-- connected sequence flows with conditions -->  <bpmn:sequenceFlow id="sf\_xor\_group\_ad\_2">  <bpmn:conditionExpression>$foo==bar</bpmn:conditionExpression>  </bpmn:sequenceFlow>  <bpmn:sequenceFlow id="sf\_xor\_group\_ad\_3">  <bpmn:conditionExpression>$foo!=bar</bpmn:conditionExpression>  </bpmn:sequenceFlow>  ... |
| PlanDefinition Representation | <PlanDefinition xmlns="http://hl7.org/fhir">    <action>  <id value="xor\_group"/>  <label value="Xor\_group"/>  <title value="Xor\_group"/>  <groupingBehavior value="logical-group"/>  <selectionBehavior value="exactly-one"/>  <action>  <id value="ad\_2"/>  <label value="Task 2"/>  <title value="Task 2"/>  <condition>  <kind value="applicability"/>  <description value="the expression"/>  <language value="EL"/>  <expression value="$name==2" />  </condition>  <relatedAction>  <actionId value="xor\_group"/>  <relationship value="before"/>  </relatedAction>  </action>  <action>  <id value="ad\_3"/>  <label value="Task 3"/>  <title value="Task 3"/>  <condition>  <kind value="applicability"/>  <description value="the expression"/>  <language value="EL"/>  <expression value="$name==1" />  </condition>  <relatedAction>  <actionId value="xor\_group"/>  <relationship value="before"/>  </relatedAction>  </action>  <relatedAction>  <actionId value="ad\_4"/>  <relationship value="before"/>  </relatedAction>  </action>  <action>  <id value="ad\_4"/>  <label value="Task 4"/>  <title value="Task 4"/>  </action>  </PlanDefinition> |
| Definition | An exclusive choice is an element where the sequence flow  is split into two or more branches, whereas only one of the branches  can be activated with respect to a specified condition on the exclusive choice element. |
| Remarks | A synchronization element is created implicitly |

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| TimedStartEvent | |
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| BPMN | Start-Event, BPMN End-Event, BPMN Sequence |
| PlanDefinition | PlanDefinition.relatedAction Before-Start |
| BPMN Representation | <!-- Version 1: start a specific date time -->  <bpmn:startEvent id="start">  <bpmn:timerEventDefinition id="sampleTriggerDef">  <bpmn:timeDate id="sampleTriggerDef\_timeDate">  2017-07-28T04:05:56+02:00  </bpmn:timeDate>  </bpmn:timerEventDefinition>  </bpmn:startEvent>  <!-- Version 2: start after a specified duration (in 10 seconds) -->  <bpmn:startEvent id="start">  <bpmn:timerEventDefinition id="sampleTriggerDef">  <bpmn:timeDuration id="sampleTriggerDef\_timeDate">  P10S  </bpmn:timeDuration>  </bpmn:timerEventDefinition>  </bpmn:startEvent>  <!-- Version 3: repeat execution in interval (once every 10 seconds) -->  <bpmn:startEvent id="start">  <bpmn:timerEventDefinition id="sampleTriggerDef">  <bpmn:timeCycle id="sampleTriggerDef\_timeDate">  R1/10S  </bpmn:timeCycle>  </bpmn:timerEventDefinition>  </bpmn:startEvent> |
| PlanDefinition Representation | <PlanDefinition xmlns='http://hl7.org/fhir'>  <action>  ...  <!-- Version 1: start a specific date time -->  <triggerDefinition>  <type value="periodic"/>  <eventName value="sampleTriggerDef"/>  <eventTimingTiming>  <event value="2017-07-28T02:05:56.742Z"/>  </eventTimingTiming>  </triggerDefinition>  <!-- Version 2: start after a specified duration (in 10 seconds) -->  <triggerDefinition>  <type value="periodic"/>  <eventName value="sampleTriggerDef"/>  <eventTimingTiming>  <repeat>  <duration value="10"/>  <durationUnit value="s"/>  </repeat>  </eventTimingTiming>  </triggerDefinition>    <!-- Version 3: repeat execution in interval (once every 10 seconds) -->  <triggerDefinition>  <type value="periodic"/>  <eventName value="sampleTriggerDef"/>  <eventTimingTiming>  <repeat>  <!-- once every ten seconds -->  <frequency value="1"/>  <period value="10"/>  <periodUnit value="s"/>  </repeat>  </eventTimingTiming>  </triggerDefinition>  ...  </action>  ...  </PlanDefinition> |
| Definition | A TimedStartEvent is a special StartEvent that has a TimerEvent associated with it, which defines when the process has to be executed. |
| Remarks | As PlanDefinition does not offer a specific action for either start or end, these BPMN-Elements are to be created implicitly. Whilst the start Event is based on the Elements in the first action in the list of actions in the PlanDefinition |