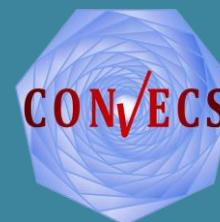


Model Transformation and Web Interface for Verifying Business Processes

Ajay MUROOR NADUMANE

Student, MOSIG M1

Université Grenoble Alpes - Grenoble INP

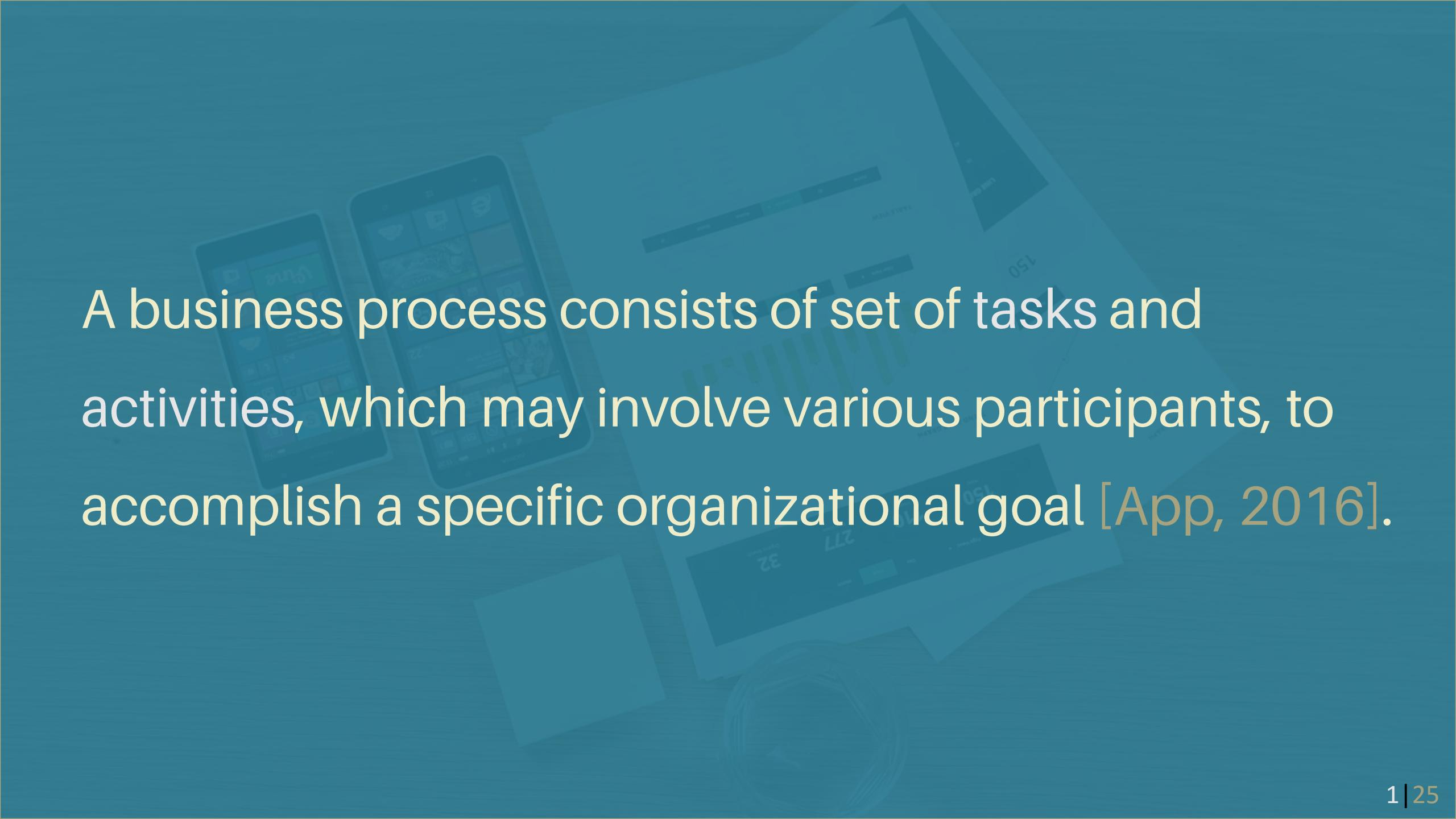


Gwen SALAÜN

Professor (PhD, HDR)

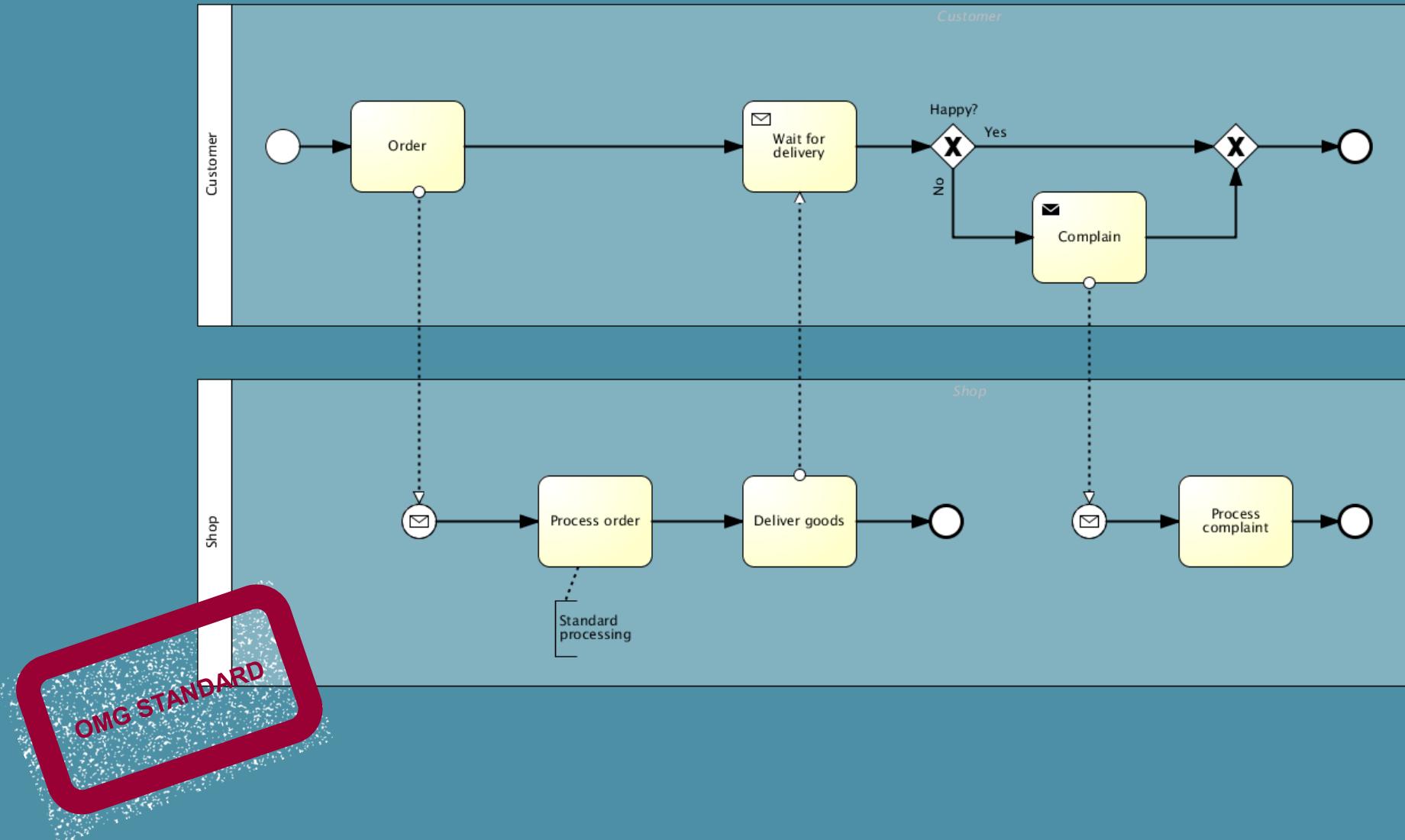
Université Grenoble Alpes - Inria





A business process consists of set of tasks and activities, which may involve various participants, to accomplish a specific organizational goal [App, 2016].

Business Process Model Notation (BPMN)



A stack of coins from various countries, including the United States, Japan, and the European Union, arranged in a circular pattern.

Businesses constantly **evolve**, so do their processes.

How can we measure the **quality** of evolution?

A medium shot of a light blue car being washed with a high-pressure water hose. The water is spraying from the top left, creating a large misty area over the car. The car's windows are tinted dark. In the background, there are some trees and a building. The overall scene is slightly overexposed.

Where existing tools **fail**?

 Support only basic validation of semantics

 No exhaustive verification

 Infinite domains for data

 Hard to identify cycles and deadlocks

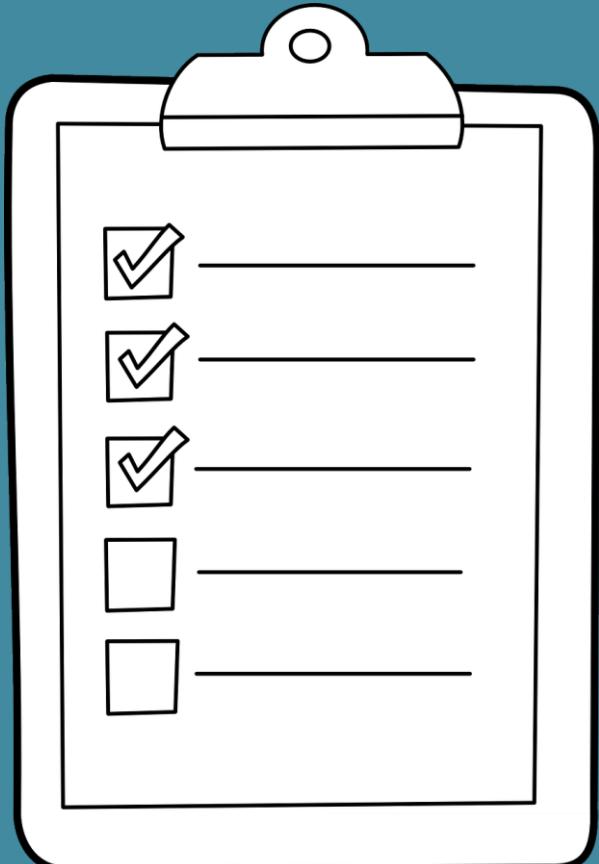
"Organizations have a greater focus on business transformation and addressing the dimensions of big change need to reinvent themselves while also driving improvements in efficiency" - Gartner, 2015

~ USD **2.7** billion invested in 2015

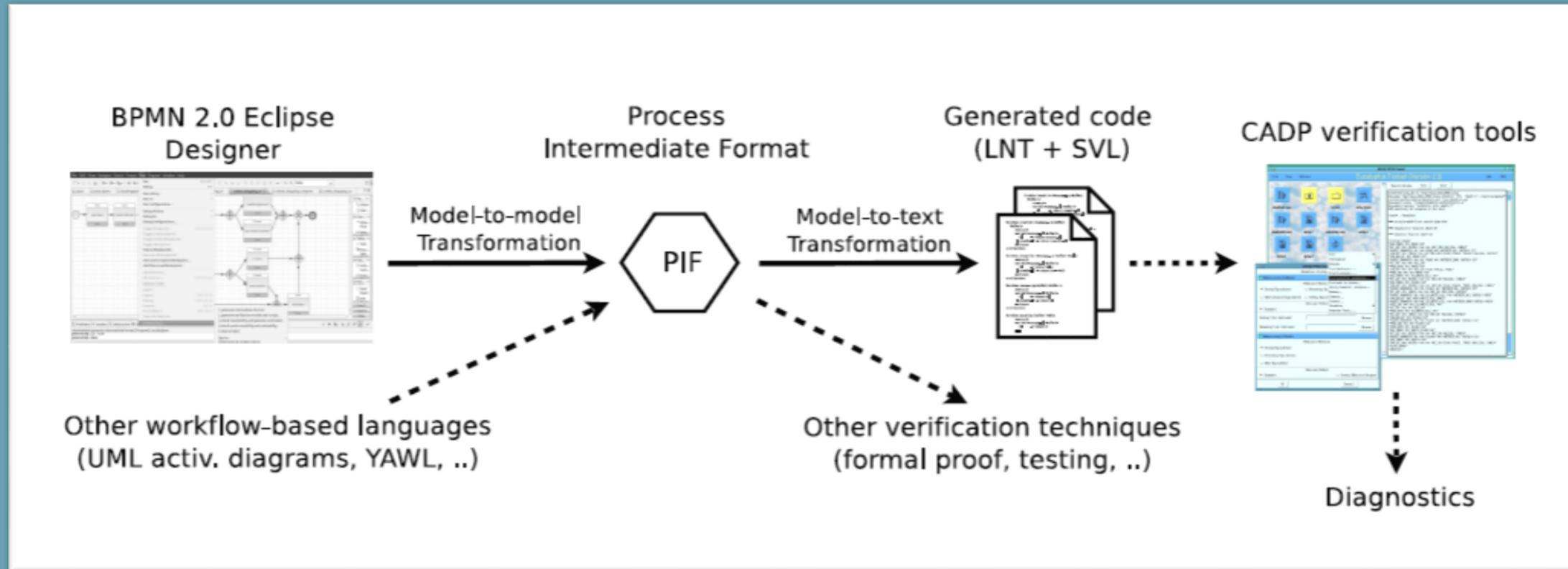


ReactionGIFS.me

Verification of BPMN (VBPMN)



VBPMN aims at formal modelling
and automated analysis of
business processes using formal
verification tools



Process Intermediate Format

XML Scheme

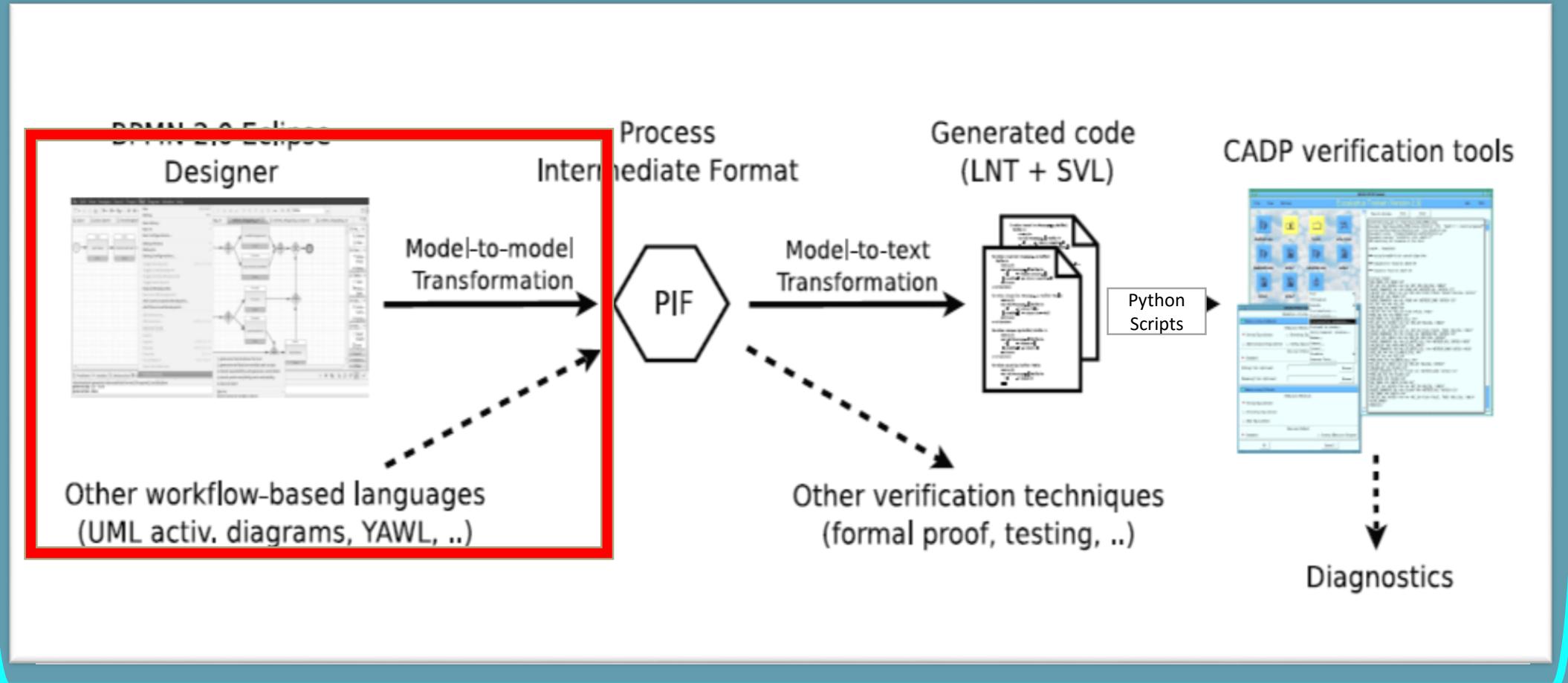
Supports multiple workflow languages

Link between modelers and formal verification tools

```
<pif:nodes id="inclusivegateway2" xsi:type="pif:OrJoinGateway">
    <pif:incomingFlows>flow24</pif:incomingFlows>
    <pif:incomingFlows>flow25</pif:incomingFlows>
    <pif:incomingFlows>flow28</pif:incomingFlows>
    <pif:outgoingFlows>flow26</pif:outgoingFlows>
</pif:nodes>
```



Where my contribution fits in?



USER INTERFACE



Internship Goals



Study of existing modelers



Develop an automated transformation from modeler format to PIF



Integrate transformation and analysis to a GUI



Validate the approach through real world examples

Study of Popular Tools

Activiti

Bonita BPM

Obeo Designer

jBPM



BPMN 2.0 Compliant!



Transformation Strategy

Streaming parser

Pull parser

Intermediate object representation

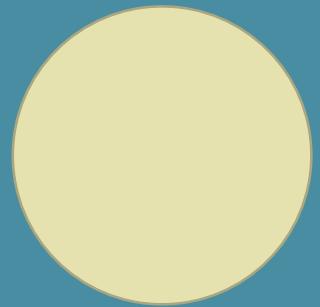
Sequential transformation

Streaming writer

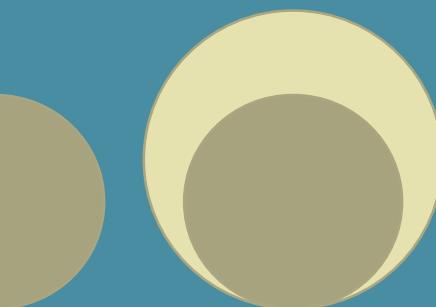
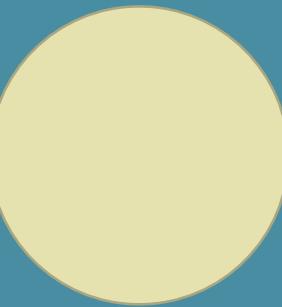


User Interface

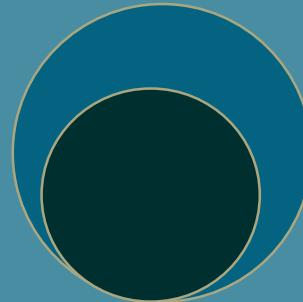


 Comparison Modes

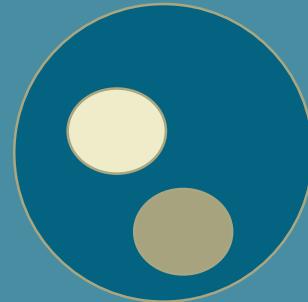
Conservative



Inclusive



Exclusive



Selective

Model and Equivalence checking using CADP Tools

Technology Stack



HTML5/JavaScript UI



Jersey REST API



Java based transformation



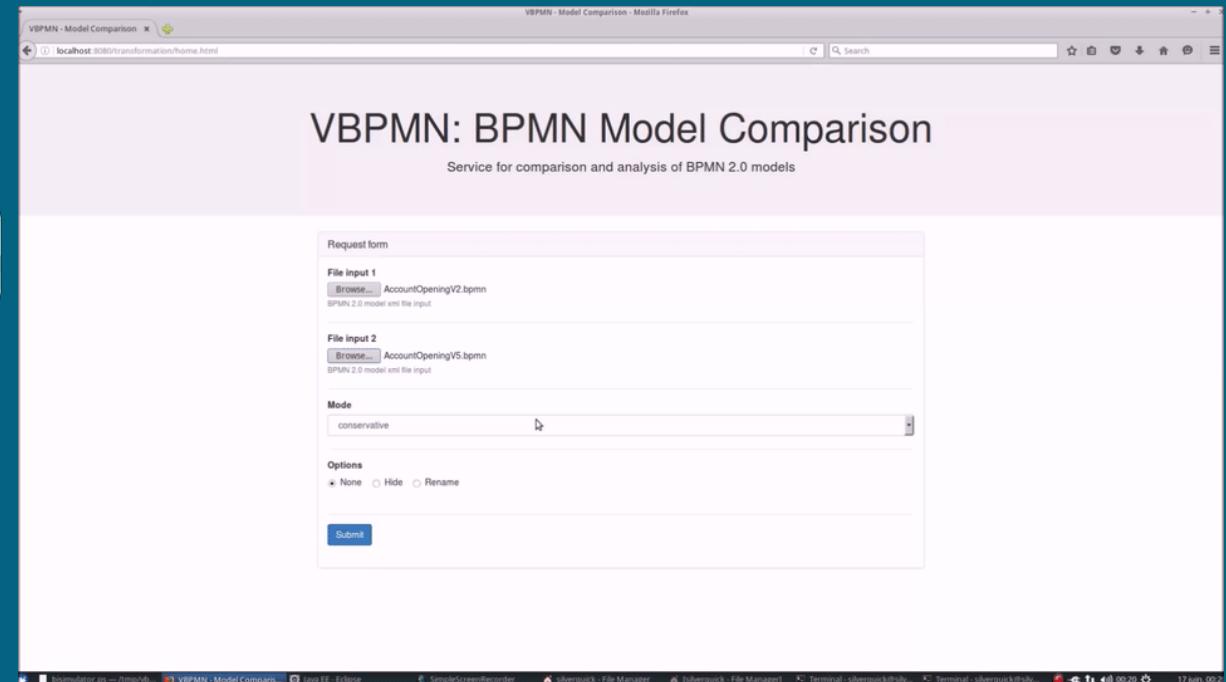
Hosted on Tomcat server



Python scripts



CADP Backend



A photograph of a chessboard with three pieces: a black king on the left, a white king in the center, and a white knight on the right. The board has a light-colored square in the foreground.

Validation

Functional

Unit tests

Manual verification

Integration tests

20+

Tests

19

Models

7

Evolutions

Non Functional

Java Profiling using SLF4J

0.696 seconds

Transformation time

15.08 seconds

Verification time

Process with 16 tasks, 9 gateways
and 32 flows

A black and white photograph of a man performing a handstand on a white, textured surface. He is wearing a light-colored t-shirt and dark shorts. His body is straight, and his hands are firmly planted on the ground. The background is blurred, suggesting an outdoor setting.

Challenges

Informal and expressive nature of BPMN specification

538

Page specification



BPMN 2.0 XMLs of Different Modelers

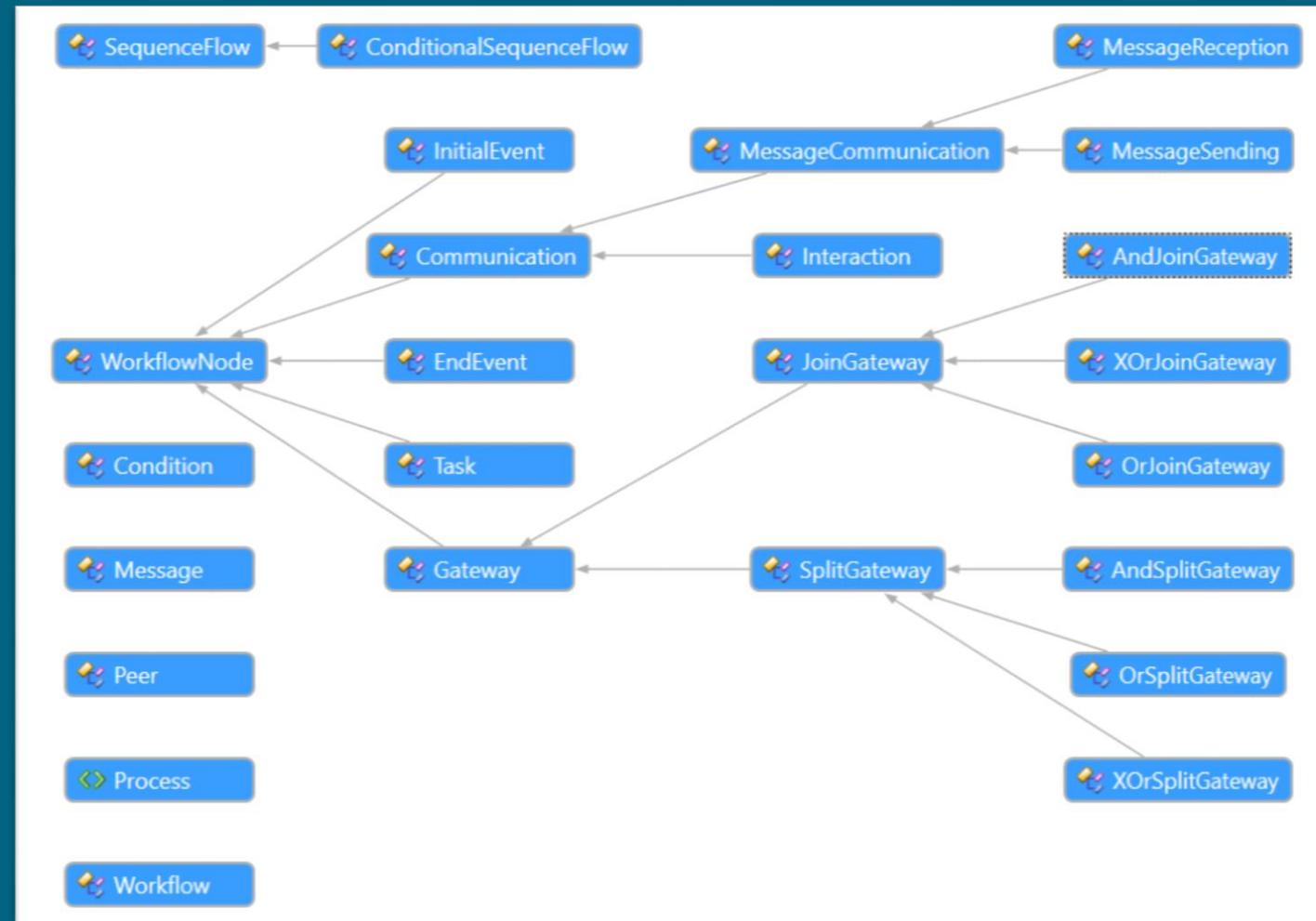
```
<semantic:process isExecutable="false" id="SimpleProcess">
  <semantic:startEvent name="" id="StartProcess">
    <semantic:outgoing>flow1</semantic:outgoing>
  </semantic:startEvent>
  <semantic:task completionQuantity="1" isForCompensation="false"
  startQuantity="1" name="Manual Task" id="manualtask1">
    <semantic:incoming>flow1</semantic:incoming>
    <semantic:outgoing>flow2</semantic:outgoing>
  </semantic:task>
  <semantic:endEvent name="end" id="endevent1">
    <semantic:incoming>_6-552</semantic:incoming>
    <semantic:terminateEventDefinition/>
  </semantic:endEvent>
  <semantic:sequenceFlow id="flow1" sourceRef="startevent1" targetRef="manualtask1"/>
  <semantic:sequenceFlow id="flow2" sourceRef="manualtask1" targetRef="endevent1" />
</semantic:process>
```

Trisotech BPM

```
<bpmn:process id="myProcess" name="My process" isExecutable="true">
  <bpmn:startEvent id="startevent1" name="Start"/>
  <bpmn:manualTask id="manualtask1" name="Manual Task"/>
  <bpmn:endEvent id="endevent1" name="End"/>
  <bpmn:sequenceFlow id="flow1" sourceRef="startevent1" targetRef="manualtask1 "/>
  <bpmn:sequenceFlow id="flow2" sourceRef="manualtask1" targetRef="endevent1" />
</bpmn:process>
```

Bonita

PIF Constraints



```

<process id="myProcess" name="My process" isExecutable="true">
    <startEvent id="startevent1" name="Start"/>
    <endEvent id="endevent1" name="End"/>
    <manualTask id="manualtask1" name="Manual Task"/>
    <sequenceFlow id="flow1" sourceRef="startevent1" targetRef="manualtask1"/>
    <sequenceFlow id="flow2" sourceRef="manualtask1" targetRef="endevent1"/>
</process>

```

BPMN 2.0

```

<pif:Process xmlns:pif="http://www.example.org/PIF"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <pif:name>myProcess</pif:name>
    <pif:documentation>Sample My Process</pif:documentation>
    <pif:behaviour>
        <pif:nodes id="startevent1" xsi:type="pif:InitialEvent">
            <pif:outgoingFlows>flow1</pif:outgoingFlows>
        </pif:nodes>
        <pif:nodes id="endevent1" xsi:type="pif:EndEvent">
            <pif:incomingFlows>flow2</pif:incomingFlows>
        </pif:nodes>
        <pif:nodes id="manualtask1" xsi:type="pif:Task">
            <pif:incomingFlows>flow1</pif:incomingFlows>
            <pif:outgoingFlows>flow2</pif:outgoingFlows>
        </pif:nodes>
        <pif:sequenceFlows id="flow1" source="startevent1" target="manualtask1"/>
        <pif:sequenceFlows id="flow2" source="manualtask1" target="endevent1"/>
        <pif:initialNode>startevent1</pif:initialNode>
        <pif:finalNodes>endevent1</pif:finalNodes>
    </pif:behaviour>
</pif:Process>

```

PIF

Integration Challenges

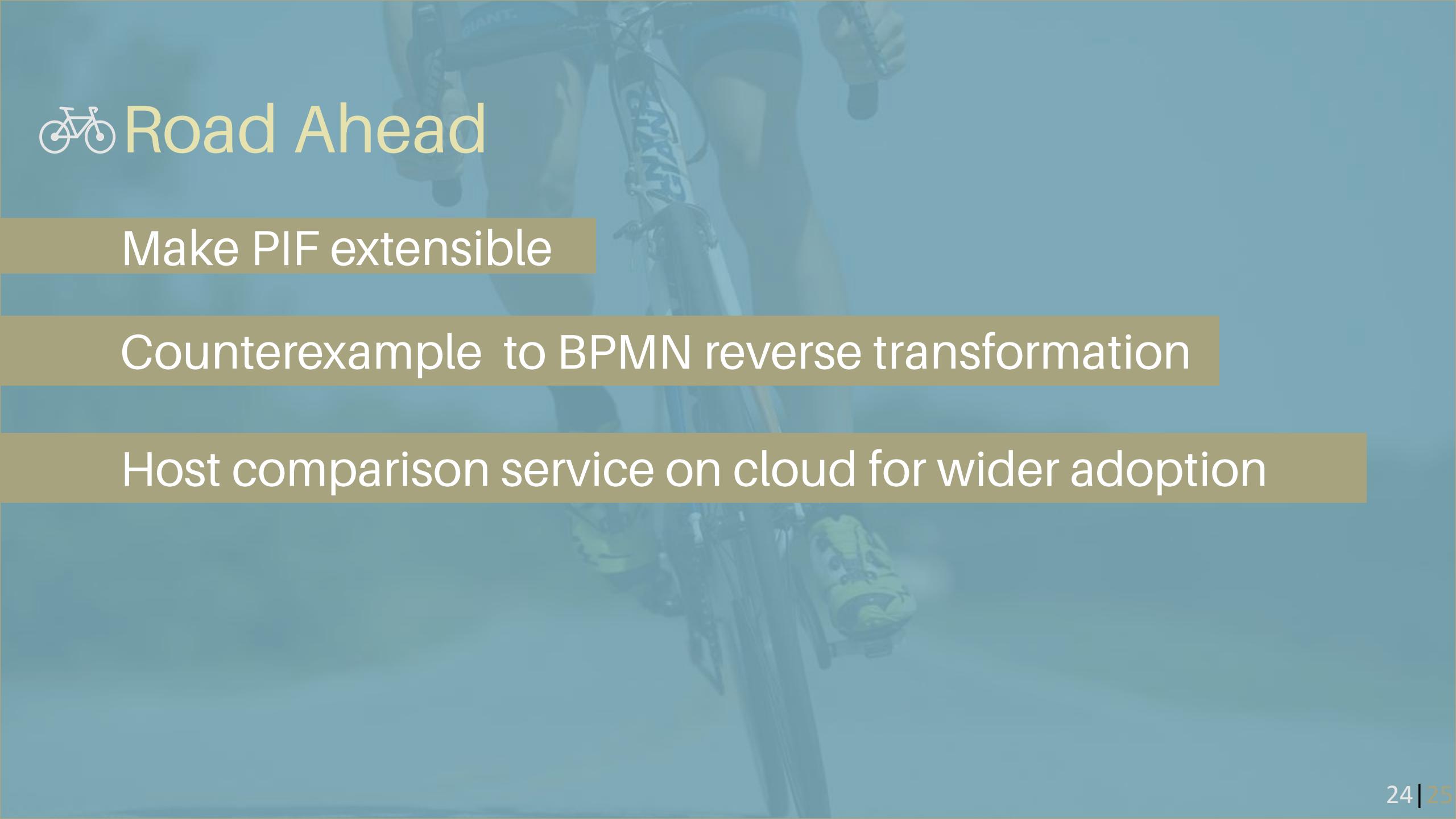
Components built on different platforms

OS Compatibility issues

30+

Modelling tools



A cyclist in motion, blurred background

Road Ahead

Make PIF extensible

Counterexample to BPMN reverse transformation

Host comparison service on cloud for wider adoption



Recap Goals

- Study of existing modelers
- Develop an automated transformation from modeler format to PIF
- Integrate transformation and analysis to a GUI
- Validate the approach through real world examples

Thank you!

References

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