Application and Testing of Business Processes in the Energy Domain

Kristof Böhmer, Florian Stertz, Tobias Hildebrandt, Stefanie Rinderle-Ma
University of Vienna

Günther Eibl, Cornelia Ferner, Dominik Engel, Sebastian Burkhart
FH Salzburg

kristof.boehmer@univie.ac.at
Agenda

Overview
Method
Evaluation
Contribution
Future Work
Q: Why to test process executions?

Ensuring stability and correctness is crucial

Enables to verify dynamic runtime behaviour

Existing work is limited

Process testing is a growing research topic
Q: How to improve process testing?

- Support diverse process perspectives
- Enable dynamic extension of expected behavior
- Flexible integration of external services and partners
- Testing for negative behavior (negative testing)
Q: Energy domain focus?

General Applicability

However: Novel Challenges in the energy domain

Tackled with standardized processes

Security & correctness is important for organisations but also for the society
Agenda

Overview

Method

Evaluation

Contribution

Future Work
Key Idea

Flexible Process execution engine
+
Existing Process Mining Approaches
↓ ↓ ↓
Testing & production process models
=
Identify deviations to identify failures and false specifications
Toolchain - Overview

Process Engine: Cloud Process Execution Engine
Process Mining: Process Mining framework (ProM)
Definition of Processes

Test & Production Process are equal except the external resources (mocking) mixture of production and mocked resources.

Ensures that test results are valid Generated based on production standards and requirements Executed with the production execution engine Enables a quick transition from testing and development to production
Definition of Processes

CPEE based modeled process

Data Elements

- status ⇒ inkasso
- zaehlerid ⇒ af38f9d176e85184b529feef6091a312
- zaehler_status ⇒ inkasso
- wartefrist ⇒ ok
- guthaben ⇒ 3000

Endpoints

- status: inkasso
- zaehlerid: af38f9d176e85184b529feef6091a312
- zaehler_status: inkasso
- wartefrist: ok
- guthaben: 3000

Graph

Description

Log

- Element: call
- ID: a20
- Endpoint: customer
- Parameters:
  - Label: "Generate Customer"
  - Method: :post
Based on test cases and test data

Executing production and test process simultaneously

Logging both executions into XES format

Extendable (e.g., data and resources)

Fine granular
Application of existing tools, i.e., ProM

Process Mining
  Multiple application areas
  Here:
    Conformance Checking and
    Model Mining

Identify (automatic) and assess (manual) deviations, i.e., faults or negative testing
Exemplary correctness verification result

```xml
<log xmlns="1.0" xmlns:features="nested-attributes" xmlns:openxes="1.0RC7">
  <string key="concept:name" value="log"/>
  <trace>
    <string key="concept:name" value="Instance 104"/>
    <event>
      <string key="lifecycle:transition" value="start"/>
      <string key="concept:name" value="Generate Customer"/>
      <string key="id:id" value="a20"/>
      <string key="concept:instance" value="http://promise.wst.univie.ac.at:9301/customer"/>
    </event>
    <event>
      <string key="concept:instance" value="http://promise.wst.univie.ac.at:9301/sreminder/1"/>
      <date key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
      <string key="concept:name" value="Sent first Reminder"/>
      <string key="lifecycle:transition" value="start"/>
      <string key="id:id" value="a10"/>
    </event>
    <event>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
    </event>
    <event>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
    </event>
    <event>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
      <string key="time:timestamp" value="2016-11-25T07:22:31.000+01:00"/>
    </event>
  </trace>
</log>
```
Agenda

Overview
Method
Evaluation
Contribution
Future Work
Evaluate the applicability and performance of the proposed process testing approach

Utilized Technology:

Cloud Process Execution Engine (CPEE)
Process Mining framework (ProM)

Utilized Data:
Smart Metering Use-Cases für das Advanced Meter Communication System - Oesterreichs Energie
Motivating Example

Smart Meter supported payment process
Evaluation

Generation/Execution of test and real instances
Evaluation

Experimental results

Sufficient testing performance

Support for non-control flow focused aspects is limited

Easy integration in existing modeling tools
Agenda

Overview
Method
Evaluation
Contribution
Future Work
Contribution to the Field

Flexible and extensible approach

Supports negative testing

Novel application of process mining approaches

Seamless transition from testing\development to production
Agenda

Overview
Method
Evaluation
Contribution
Future Work
Future Work

Performance Improvements

Testing multiple dimensions/perspectives

Application in the security domain

Test case and data generation
Kristof Böhmer, Florian Stertz, Tobias Hildebrandt, Stefanie Rinderle-Ma
University of Vienna

Günther Eibl, Cornelia Ferner, Dominik Engel, Sebastian Burkhart
FH Salzburg