Business Activity Monitoring
Master Seminar

BPT Group

Summer Semester 2011
Agenda

- Official Information
- Seminar Timeline
- Tasks Outline
- Topics
Title: Business Activity Monitoring

Credit Points: 6

SWS: 4

Registration Deadline: 27 April 2011
Seminar Timeline

- **Today**
  - 19 Apr: Introduction to research
  - 28+12 Apr: Topics presentation submission
  - 5 May: Short presentation
  - 9 Jun: Technical presentation
  - 22 Jun: Paper draft submission
  - 30 Jun: Review submission
  - 8 Jul: Final paper + prototype submission
  - 22 Jul: Final presentation

- **Topics**
  - April: Introduction to research
  - May: Topics presentation, short presentation
  - June: Technical presentation, paper draft submission
  - July: Review submission, final paper + prototype submission, final presentation
Topic Distribution

three topics ranked by preference
+ name, student ID number

sergey.smirnov@hpi.uni-potsdam.de
Grading System

- **technical presentation**
- **short presentation**
- **review submission**
- **final presentation**
- **final paper + prototype submission**
Outline Presentation

Short presentation

5-10 min

Problem outline
Possible solutions
Technical Presentation

~ 15 min talk
+10 min discussion
technical aspects
A Semantic Approach for Business Process Model Abstraction

Sergey Smirnov1, Heiko A. Hofreiter2, and Matthias Wolter3

1 Hasso Plattner Institute, University of Potsdam, Germany
2 University of Technology, The Netherlands
3 Radboud University Nijmegen, The Netherlands

Abstract. Models of business processes can easily become large and difficult to understand. Abstraction has proven to be an effective means to present a model's high-level core of a business process model. A process model abstraction is an abstraction layer in the model hierarchy which allows for modeling high-level, non-functional information, such as domain-specific concepts and high-level actors. We propose an approach to compare the approach with existing modeling techniques, showing a clear advantage to our approach.

1 Introduction

Business process models are used within a wide range of business and non-business applications. However, business models are far from being complete and detailed. They are often used as a basis for human and computer-mediated activities. The main focus of this paper is to present an approach for modeling business process models.

key words: business process modeling, model management, business process model abstraction, activity tracing

2 review submission

min 10 pages
max 16 pages
LNCS style
PDF

2 peer reviews

paper draft
submission
Final Presentation

~ 20 min talk
+ 10 min discussion
overview of the whole work

If relevant:
prototype (proof of concept)
demo
Final Paper Submission

PAPER: max 16 pages LNCS style PDF

PROTOTYPE: source code executable application

final paper + prototype submission
Introducing KPIs to BPMN 2.0

Matthias Kunze

Matthias.Kunze@hpi.uni-potsdam.de
BPMN 2.0 has, for the first time, a metamodel formally defined by means of the Meta Object Facility (MOF). This opens the field to extend the language through well defined methods.

The student shall introduce the definition of KPIs to BPMN 2.0. For this, they need to (1) understand how KPIs are correlated with process instances, which KPIs are useful in the context of BPM, and how they can be captured. They will also (2) need to study the BPMN specification and how it can be formally extended. Finally, and as the main contribution of this topic (3), the student shall extend BPMN 2.0 with means to capture KPIs in process models.

This includes to extend the BPMN metamodel, including a specification of notation (concepts and graphical representation), syntax (properties of valid models), and semantics (esp. transformation semantics towards XSD and operational semantics of KPIs).
Introducing KPIs to BPMN 2.0

Literature

- BPMN 2.0 specification: http://www.omg.org/spec/BPMN/2.0/
- https://github.com/codahale/metrics
Design of a Process Data Warehouse

Matthias Kunze

Matthias.Kunze@hpi.uni-potsdam.de
Welche Produkte haben 2009 den größten Umsatz gemacht?

```
SELECT Fact_Sales.ProductID, Dim_Product.Name, sum(Fact_Sales.Amount) AS sum
FROM Fact_Sales
JOIN Dim_Product ON Dim_Product.ProductID = Fact_Sales.ProductID
JOIN Dim_Time ON Dim_Time.TimeID = Fact_Sales.TimeID
WHERE Dim_Time = 2009
GROUP BY Fact_Sales.ProductID
ORDER BY sum DESC
```
Design of a Process Data Warehouse

Business Activity Monitoring (BAM) provides a wide range of opportunities, including analysis, interpretation, controlling, optimization. The basis for them is a warehouse that stores process data and process related data. Such a warehouse can answer short-term questions to support operational decisions as well as long-term questions to improve process quality or support strategic decisions, if it has been well designed with regard to fast query processing. Similar work has long been done for general business data: Data Warehouses (OLAP).

The student shall (1) review literature towards data warehousing, architectures, best practices, etc to get an understanding of the basics. (2) explore questions that are relevant in terms of BAM and Business Process Intelligence shall be explored and discussed---these questions will guide the design of a data warehouse. Finally (3), the student shall design a process data warehouse (formally) that stores history of processes (logs) and related data. An example shall support the theoretic concerns.
Design of a Process Data Warehouse

Literature:

- Activity warehouse: Data management for business activity monitoring. ICEIS 2007:137-144
- https://github.com/codahale/metrics
What do you want to know about your processes (running)?
A user study

Matthias Kunze

Matthias.Kunze@hpi.uni-potsdam.de
What do you want to know about your processes (running)? – A user study

Business Activity Monitoring (BAM) and Business Process Intelligence (BPI) address insights about processes that are currently running or have been run in the past. Many interesting questions already exist from a scientific point of view, however, we lack understanding of the desires of the prospected users of these methods, i.e., process designers, process owners, management, controlling, etc.

The student shall (1) get in contact with several business process experts in organizations and discuss with them the topic of BAM/BPI. These interviews shall give a direction for an online survey (2) that shall be conducted by the student. The result (3) shall be analyzed and aggregated to get an overview of topics currently relevant to companies.
What do you want to know about your processes (running)? – A user study

Literature:


• https://github.com/codahale/metrics
Techniques for Mining Medical Processes from Unstructured Data

Andreas Rogge-Solti

Andreas.Rogge-Solti@hpi.uni-potsdam.de
Techniques for Mining Medical Processes from Unstructured Data

Setting:
- In most cases no structured process logs exist
- Instead various sources of data (EPR-systems, radiology, billing information systems, ...)
- Identification of processes and performance desired

Techniques to investigate:
- Methods for clustering data
- Algorithms used to derive process models
- Required extensions to enable business activity monitoring
Literature


(3) Álvaro Rebuge, Diogo R. Ferreira, **Business process analysis in healthcare environments: A methodology based on process mining,** Information Systems, 2011
Business Activity Monitoring
A Technology Review

Alexander Lübbe

Alexander.Luebbe@hpi.uni-potsdam.de
Context
Business Activity Monitoring can be realized by system experts that dig deep to extract the KPIs. But what are the chances for users and savvy admins to monitor process instances and tailor the view to their specific needs?

Task
Find BAM scenarios in the literature. Identify the main use cases for business activity monitoring. Derive a framework of requirements for BAM. Evaluate available BPMSs for their BAM capabilities.

Literature
• Business Activity Monitoring (thesis, J Kolár)
• Torsten Greiner, Willy Düster, Francis Pouatcha, Rainer von Ammon, Hans-Martin Brandl, David Guschakowski: Business activity monitoring of norisbank taking the example of the application easyCredit and the future adoption of Complex Event Processing (CEP). PPPJ 2006:237-242
• Some easily available engines: ActiveVOS, Activity/jBPM, apache ODE, YAWL
Monitoring of Activity Cardinality Constraints

Matthias Weidlich

Matthias.Weidlich@hpi.uni-potsdam.de
Setting

- Process model describes intended operations
- Events reflect actual execution
- Event-based monitoring of activity execution
  - Order of execution and exclusiveness
  - Cardinality constraints
Monitoring of Activity Cardinality Constraints (2/2)

Task

- Extract cardinality constraints from model
- Formulate CEP queries to check these constraints

Related Work

- Communication Fingerprints [1]
- CEP-based monitoring of ordering constraints [2]

Business Goals Modeling

Andreas Meyer

Andreas.Meyer@hpi.uni-potsdam.de
**Context**

In Requirements engineering, goal modeling became much attention during the last decade. Generally, these goals are reflected in business processes and drive process control there.

**Task**

Allow modeling and monitoring of business goals taken from a goal model in business processes. A solution is expected at least for BPMN 2.0 and EPCs, but a general solution is also accepted.
Examples of questions to answer

- How can goals be mapped from a goal model to a process model?
- How can goal completion be identified within a process?
- How to escalate if goals are not accomplishable in the current instance?
- How to escalate if goals are not accomplishable due to taken process routing decisions?
- How to steer process control by goal priority, number goals accomplished, and further aspects?
- Which further aspects may influence process control?

References

- Lapouchnian - Goal-Oriented Requirements Engineering: An Overview of the Current Research
- Lamsweerde and Letier - From Object Orientation to Goal Orientation: A Paradigm Shift for Requirements Engineering
- Yu - Towards Modeling and Reasoning Support for Early-Phase Requirements Engineering
Data Object State Related KPI Measuring

Andreas Meyer

Andreas.Meyer@hpi.uni-potsdam.de
Context

KPIs can be observed by BAM. They may also relate to data objects which are affected by state changes over time. Following, KPIs may be measured by state changes, e.g. the duration of a delivery is maximum three days. Therefore, the time allowed to pass between the states "order confirmed" and "product delivered" is maximum three days.

Task

Link KPIs to data object states and provide useful statistics about the KPI’s usage within business scenarios. For this task, think about single and multiple process instances, single and multiple data objects, as well as single and aggregated KPIs.
Examples of questions to answer

- What KPIs can and should be linked to data objects?
- How to link the identified KPIs to data objects and their states?
- Can the linkage be automated? What are the requirements for it?
- How to aggregate KPIs?
- Which results and statistics do you consider useful?
- How to visualize the results and statistics in a dashboard?

References

- Ortega et al. – Defining Process Performance Indicators: An Ontological Approach
- Steiner - Applying an operational Dashboard to a Customer Support Process (Master Seminar on Process Intelligence, Summer Semester 2010)
Business Activity Monitoring
Case Study Public Administration

Rami-Habib Eid-Sabbagh

Rami.EidSabbagh@hpi.uni-potsdam.de
**Business Activity Monitoring**

- Monitoring
  - State of business operations
- Discovering
  - Process performance
  - Bottlenecks
- Align processes
- Decision Support

**Context:**

- Case Study: Point of Single Contact Berlin
- Modernization of administration processes (G2B, G2C, G2G)
- BAM not explored in the public sector
- Different aims in operation
- Processes based on Laws and regulations
Checkliste Unterlagen
Bitte bringen Sie die folgenden Unterlagen bei. Sie können Ihr Anlegen einreichen, wenn alle Unterlagen vollständig sind.

<table>
<thead>
<tr>
<th>Unterlage</th>
<th>Status</th>
<th>Ihre Aufgabe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antragstellung: namilo</td>
<td>Wird nachgereicht</td>
<td></td>
</tr>
<tr>
<td>Gewerbeanmeldung</td>
<td>vorhanden</td>
<td>Bearbeiten</td>
</tr>
<tr>
<td>Meisterbrief oder Abschlusszeugnis</td>
<td>fehlt noch</td>
<td>Hochladen Nachreichen</td>
</tr>
<tr>
<td>Alle Unterlagen</td>
<td></td>
<td>Jetzt einreichen</td>
</tr>
</tbody>
</table>

Verfahrensablauf und zuständige Stellen

<table>
<thead>
<tr>
<th>Verwaltungsdiensstleistung</th>
<th>Status</th>
<th>Frist</th>
<th>Gebühr</th>
<th>Zuständige Stelle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallmanagement</td>
<td>Wartel auf Unterlegen</td>
<td></td>
<td></td>
<td>Erhaltlicher Ansprechpartner Berlin</td>
</tr>
<tr>
<td>Gewerbeanmelung</td>
<td>Wartel auf Freigabe</td>
<td>26.04.2010</td>
<td></td>
<td>Ordnungsamt Friedrichshain-Kreuzberg</td>
</tr>
<tr>
<td>Ausweisdokument</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erstprüfung Gewerbeanmeldung</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prozess des Eintrags in die Handwerksrolle</td>
<td>Wartel auf Freigabe</td>
<td></td>
<td></td>
<td>Handwerkskammer Berlin</td>
</tr>
<tr>
<td>Ausweisdokument</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eintragung in die Handwerksrolle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meisterbrief oder Abschlusszeugnis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bestätigung zur Handwerkskarte</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Task:

- Research Business activity monitoring aspects from literature
- Identify the requirements for performing BAM
- Identify key areas for the use of BAM
- Design a framework for analysis
- Compare your findings to a real world scenario, Berlin point of single contact
- Evaluate and elaborate on your findings
Literature:


Monitoring Web-Application Interaction on the Example of the National Process Library

Rami-Habib Eid-Sabbagh

Rami.EidSabbagh@hpi.uni-potsdam.de
Task

- Research on monitoring web-application interaction activities
- Create a general research setup
- Implement and apply scenario to the national process library
- Analyze user performance
- Derive usage patterns in form of process models
- Evaluate and elaborate on the findings of your research

Literature


Sheard, J.; Ceddia, J.; Hurst, J. & Tuovinen, J., Inferring Student Learning Behaviour from Website Interactions: A Usage Analysis Education and Information Technologies, Springer Netherlands, 2003, 8, 245-266
From Compliance Patterns to ECA Monitoring Rules

Ahmed Awad

Ahmed Awad@hpi.uni-potsdam.de
Business Processes

1. Register new claim
2. Check for fraud
3. Evaluate claim
4. Initiate fraud investigation
5. Pay
6. File and update history
7. Close
Compliance Requirements

- Cases must be processed within two weeks
- Every fraudulent claim must be investigated
- The same clerk cannot check for fraud and evaluate it
Objectives

- Generate Monitoring Rules from high level rules
- Input
  - Compliance patterns
  - Activity lifecycle
- Output
  - Identification of all intermediate (business) event
  - Event condition action (ECA) rules for monitoring
State Consistency of Process Models Belonging to Different Abstraction Levels

Sergey Smirnov

Sergey.Smirnov@hpi.uni-potsdam.de
State Consistency of Process Models Belonging to Different Abstraction Levels

abstract model, $m_a$

initial model, $m$

- Receive email
- Request data gathering
- Record request
- Receive data
- Prepare data for quick analysis
- Prepare data for full analysis
- Handle data
- Perform quick analysis
- Perform full analysis
- Generate forecast report
- Perform analysis
- Perform simulation
- Consolidate results
- Generate forecast report
- g$_1$
- g$_2$
- g$_3$
- g$_4$
- g$_5$
abstract model, $m_a$

initial model, $m$

Receive forecast request [running]

Receive email [terminated]  Request data gathering [running]  Record request [init]
State Consistency of Process Models Belonging to Different Abstraction Levels

abstract model, $m_a$

initial model, $m$

Diagram:
- $g_1$: Receive email $\rightarrow$ Request data gathering $\rightarrow$ Record request $\rightarrow$ Receive data
- $g_2$: [init] $\rightarrow$ Prepare data for quick analysis
- Handle data $\rightarrow$ [running] $\rightarrow$ [running] $\rightarrow$ Prepare data for full analysis

Symbols:
- $[\text{terminated}]$
- $[\text{running}]$
- $[\text{init}]$

Notes:
- $[\text{terminated}]$, $[\text{running}]$, $[\text{init}]$ indicate the state of the processes.
Task

investigate the reasons for inconsistencies, provide their classification, and possibly suggest methods to resolve them

Examples of questions to answer

■ Which formalism suits inconsistency description?
■ Which inconsistency types are observed?

References

Using Value Chain Models to Monitor Process Execution Progress

Sergey Smirnov

Sergey.Smirnov@hpi.uni-potsdam.de
Using Value Chain Models to Monitor Process Execution Progress

abstract model, $m_a$

initial model, $m$
Task

get acquainted with existing abstraction methods and choose one. extended this method towards value chain model generation. suggest: 1) a method for evaluation of current value chain activity duration and 2) a method for evaluation of remaining value chain activity duration.

Examples of questions to answer

- Which formalism is suitable for this task?
- Which activity non-functional properties can be evaluated?

References

Benchmark for Comparison of Execution and Monitoring Capabilities of Structured vs. Unstructured Process Models

Artem Polyvyanyy

Artem.Polyvyanyy@hpi.uni-potsdam.de
Benchmark for Comparison of Execution and Monitoring Capabilities of Structured vs. Unstructured Process Models

Initial benchmark available at http://code.google.com/p/bpstruct/
**Context:** A process model is structured, if and only if every node with multiple outgoing arcs (a split) has a corresponding node with multiple incoming arcs (a join), such that the set of nodes between the split and the join induces a single-entry-single-exit (SESE) region; otherwise the process model is unstructured. We claim a hypothesis that structured process models are better suited for optimizations at runtime (e.g., parallelization of independent fragments) and monitoring execution information.

**Task:** Create a benchmark for evaluation of execution and monitoring capabilities of process models of different structural classes: develop benchmark criteria, collect and organize structured and unstructured process models according to the developed benchmark criteria, define evaluation parameters, conduct experiments.

**Literature:**
Abstraction of Workflows: Formal Foundations for Monitoring Cases at Different Levels of Granularity

Artem Polyvyanyy

Artem.Polyvyanyy@hpi.uni-potsdam.de
Task: Define a formal relation of abstraction on workflows (a class of process models) as an extension of a bisimulation relation with a formal notion of granularity. Investigate benefits of using your new relation when monitoring execution of a process model at different levels of abstraction.
Context: Abstraction is one of the core concepts of process modeling. Abstraction mechanisms allow hiding unimportant details in process models while stressing on the important ones, and selecting granularity at which important details must be captured in a model (either as a single task or as a subprocess which specifies the task). In practice, there might exist several variants of the same process model at different levels of abstraction, e.g., one detailed for execution and one high-level for managerial decisions.

Task: Your task is to contribute to the understanding of a concept of abstraction in process models by investigating its behavioral aspects. Define a formal relation of abstraction on workflows (a class of process models) as an extension of a bisimulation relation with a formal notion of granularity. Investigate benefits of using your new relation when monitoring execution of a process model at different levels of abstraction. The task at hand is inspired by a formal approach in [1] and our investigations on abstraction of process models in [2].

Literature:
Business Activity Monitoring
Master Seminar

Contact
sergey.smirnov@hpi.uni-potsdam.de

Summer Semester 2011