Process Mining in der Praxis

Erfahrungen und Praxisbeispiele

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Introduction OPITZ CONSULTING

- Founded in 1990 near cologne
- Approx. 390 employees; 11 Locations in Germany and Poland
- Provide solutions from Strategy, Planing to Implementation and Maintenance
- Specialist in Business IT Alignment, BPM, SOA and system integration, Application development, IT Infrastructure Management

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Agenda

1. Application Areas
2. Claim Management
3. Process Mining and Adaptive Case Management
4. Adaptivity (today)
5. Case Management Modeling Standards
6. Process Mining on a Project Management Tool
7. Process Mining in Banking
Application Areas
Application Areas

- **Most common use case:**
  - Identification and Analysis of existing processes

- **Typical Industries**
  - Industrial Enterprise, Public Authorities, Banking, Parcel Delivery, Hospitals, Airports and Insurances

- **Examples:**
  - Flow and Speed of manufacturing processes
  - Weak-Point Analysis of Business Processes
  - Airport Copenhagen (Luggage: from Check-In to the Plane)

- **More under IEEE CIS Task Force on Process Mining**
Claim Management
Modernize Claim Management

Project Example (1) [under development]

COMPANY OVERVIEW
- Insurance software solutions provider
- Global partner network of more than 1250 implementation specialists
- Solution is used by over 60 insurance companies representing more than 100,000 daily users across 40 countries

CHALLENGES/OPPORTUNITIES
- Trade-off between rigid und flexible processes
- Reduction of process costs and higher information quality
- Transparency as to where a claim is now and what is the next step
- Efficient Case Handling – with “One Click Access” to any needed function

SOLUTION
- Design and implementation of an Adaptive Case Management (ACM) approach
- Using ACM & BPM to handle claim activities
- Rule based decisions and execution

RESULTS
- Build to change: Define and change which activities are available in the different phases of a claim case
- Business user empowerment – both at design time and runtime
- Easy upgrade through controlled customizations and extensions
- Process automation
- Management visibility: Business decisions based on measurable facts
New ways in Claim Management
Project Example (2) [PoC]

COMPANY OVERVIEW
- System house for federal insurances in the German market (approx. 210 emp.)
- Enhancement and support of IT-landscapes for several clients (e.g. property insurances, building insurances, life insurances, ...)
- Guaranty of confidentiality, availability and integrity of data and applications

CHALLENGES/OPPORTUNITIES
- Many different claim types with specifics in regulation
- Hidden knowledge from experienced workers
- Many parallel requests through different channels in case of a natural disaster
- Limited tracability and lack of reporting

SOLUTION
- Used a combination of BPMN (to standardize specific working steps) and ACM (to provide flexibility in case processing) in order to modernize the existing claim management platform
- Customer departments involved: Claim department (Business), IT

RESULTS
- Guided Navigation: reduced training of unskilled employees
- Event-driven: easily adaptable system and flexible claim management possibilities
- Predictive Working: Provided suggestions in order to find the „best“ decision
- Increased customer satisfaction due to higher process transparency and shorter processing times
- **Damage to Persons**
- **Material Damage**
- **Financial Loss**

- **Natural Hazard**
- **Storm Loss**
- **Lightning Damage**
- **Fire Damage**
- **Explosion Loss**
- **Breakage of Glass**
- **Accidental Damage**
- **Housebreaking**
- **Damage by Water**
The View of the Customer

Damage by Hail!

Car is damaged

Roof of the house is damaged

What should I do now?

Call insurance

I need help!

Damage by Hail!

Car is damaged

Roof of the house is damaged

What should I do now?

Call insurance

I need help!
The View of the Claim Handler
Challenges in Claims Management

- Many different claim types with specifics in regulation
- Missing user guidance
- Hidden knowledge from experienced workers
- Many different systems and independent solutions
  - Telephone, Email, Correspondence
  - Integration of different partners
  - Task Management
- Many requests through different channels in case of a natural disaster (in parallel)
- Limited tracability and lack of reporting
What the Customer wants…

- Straightforward Support
- Direct Contact
- Rental Car
- Repair Shop Suggestions
- Craftsman Recommendation
What is needed?
Or: What do we expect from an ACM solution?

- More flexibility
- Situation-Driven work
- Integration of different systems
- Suggestions and continuous decision improvement – what is the next best action?
- Guidance - faster enablement of new colleagues

What is needed?
Or: What do we expect from an ACM solution?
Expected benefits by the company

- Trace claim management across system boundaries
- Improvement of the data quality
- Statistical analysis in order to develop new business models
- Improvement of decisions
- Identification of potential work step automations
- Integration of new systems
- Faster enablement for new employees
Main steps in Claim Management
Simplified and Structured

Claim Initialization
- Get customer details
- Select relevant contract
- Identify responsibilities
- Enter base information
- Request missing documents

Claim Assessment
- Request missing documents
- Accept Claim
- Reject Claim

Claim Handling
- Further inquiry to third-party insurance
- Request estimate of costs
- Commission an appraiser
- Request missing documents

Claim Regulation
- Create claim acceptance document
- Create booking entry for claim payment
- Perform payment
- Notify client

...
Reality Check
Daily challenges knowledge workers face

- Lack of Visibility Into the Current State or Status of Others’ Work Supporting Your Own: 71% 60%
- Difficulty Tracking "To Do" Items or Tasks Lists: 45% 46%
- Difficulty Organizing and Assembling the Right Team: 51% 31%
- Difficulty Managing Documentation and Information Needed for a Given Project: 57% 57%
- Difficulty Finding Co-workers/ Collaborators With the Right Expertise: 53% 46%
- Difficulty Determining the Next Step or Course of Action: 36% 37%

Source: 2011 - 2013 Case Management Survey

© Empowering knowledge Workers, Palmer, Swenson, Carlsen
Work patterns of knowledge workers
Percent of the day spent in different modes

Purely Ad-Hoc, Never Happens the Same Way Twice
- 35%
- 31%

Consistent, Defined Goals; Varying Means to Achieve
- 28%
- 30%

Documented and Managed, but Not Automated
- 20%
- 20%

Partially Automated, but Frequent Exceptions
- 15%
- 17%

Fully Automated, Lack of Opportunity to Change
- 9%
- 9%

Roughly 1/3 is Structured, Predictable, Automated or Automatable

2/3 of a Knowledge Worker’s Day is Spent in Unstructured & Often Unpredictable Work Patterns

Source: 2011 - 2013 Case Management Survey

© Empowering knowledge Workers, Palmer, Swenson, Carlsen
Emerging Paths

- Suggest Next Best Order:
  - Customer also bought…

- Suggest Next Best Action:
  - Recommendation System
  - No rigid control of the user

- Ratingsystem vs. Social
  - Credibility
  - Trust 2000 customer ratings or better to 2 friends?

http://www.nature.com/nature/journal/v388/n6637/fig_tab/388047a0_F1.html
Claim Management is context-based …

… with many exceptions

Claim Initialization

- Exception for Customer X
- Exception for claim below X $

Claim Assessment

- Exception for natural disaster

Claim Handling

- Exception for physical injury
- Exception for fraud suspicion

Claim Regulation

- Exception for financial damage
- Exception for long term customers with no claim history

Claim Management is context-based… with many exceptions.
More Exceptions

Claim Initialization

- Related contract not found
- Information is missing, (not filled out)
- Responsibilities not automatically assignable

Claim Assessment

- Pictures of very bad quality, request new ones
- Assessor not available
- Requested docs incomplete

Claim Handling

- Expert's report fragmentary
- Estimated costs not reproducible

Claim Regulation

- Letter returned due to unknown sender

© Gartner
Is the exception the rule?

Claim Initialization  Claim Assessment  Claim Handling  Claim Regulation

© Gartner
More exceptions than default paths

Claim Initialization  Claim Assessment  Claim Handling  Claim Regulation

© Gartner
Is everything modeled?

- **Processes or subprocesses with:**
  - Activities may be executed more than once
  - Some activities are mandatory, some are optional
  - There are manual and automated activities
  - Activities from different phases can relate to each other
  - Going back to preceding activities or phases is possible
  - During runtime there may be need for ad hoc activities, e.g. when a colleague has to be involved

- **Activities are executed by different roles:**
  - A security concept controls, if an activity can be executed.
  - For better scaling, work has to be distributed
"Sometimes the applicant receives a callback by phone to answer additional questions within a medical questionnaire.

The clerk decides whether this is possible or not – based on his experience and his skills.

If the clerk called the applicant the resulting protocol has to be reviewed by one of his colleagues.

In case of any abnormalities the doctors of the applicant can be consulted. This always happens by fax. The doctor is answering back by Fax as well. A clerk evaluates the examination. This can affect the underwriting result."
Modeling Exercise „Underwriting“
Different people / different results
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Different people / different results
Modeling Exercise „Underwriting“

Different people / different results
Ad-Hoc, Unstructured and Unpredictable

What does that mean?

- Healthcare
  - 24,331 events
  - 627 patients
  - 376 different activities

Source: W. van der Aalst et al., “Process Mining Manifesto: Toward Real Business Intelligence”
L* Lifecycle Model

Figure 5: The L* life-cycle model describing a process mining project consisting of five stages: plan and justify (Stage 0), extract (Stage 1), create a control-flow model and connect it to the event log (Stage 2), create an integrated process model (Stage 3), and provide operational support (Stage 4).

Source: W. van der Aalst et al., “Process Mining Manifesto: Toward Real Business Intelligence”
Plan and Justify – Important Questions

- Which process should be investigated?
- What are the key areas of interest?
- Which activities are important?
- Which IT systems and actors are involved?
- How are the data of the individual systems designed?
- Can multiple systems share a system-wide unique ID Case?
Demo: Unstructured Processes
3

Process Mining and Adaptive Case Management
Process Mining and Adaptive Case Management

ACM User Interface

Process Mining Result
Anatomy of an ACM Solution (Example)
Case UI – Navigation and Search
Case UI - Documents
Case UI – Data
Details about the claim and it's related entities
Case UI – Milestones & History

Where I am?
Case UI – Activities

What can I do next?
Case Management Solution Components

- **Task Engine**
- **DMS**
- **Case / Process Engine**
- **System Integration**
- **Knowledge Area**
  - Central entity
  - Related entity (1)
  - Related entity (2)
  - Related entity (3)
- **Audittrail / Analytics**
- **Suggest Next Step**
- **History**
- **Related Docs**
- **Navigation**
Case Management in Combination

- CaseTask
- Human Task
- Process Task (BPMN)
Adaptivity (today)
What is meant with „adaptive“?

<table>
<thead>
<tr>
<th>Type (level of adaptivity)</th>
<th>Systems / languages / means</th>
<th>Example</th>
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<tbody>
<tr>
<td>adaptive</td>
<td>Ontologies, Semantic models, ACM redefined</td>
<td>Learning knowledge, changes on the fly, one vocabulary</td>
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<td>guiding</td>
<td>CDM, Social BPM</td>
<td>Others have done ABC in your current context, rules bases reasoning</td>
</tr>
<tr>
<td>dynamic</td>
<td>BPM(N), ACM.current</td>
<td>Finite set of activities, take one, rules integration</td>
</tr>
<tr>
<td>static</td>
<td>BPEL / workflow engine</td>
<td>Static workflow – a priori activities</td>
</tr>
</tbody>
</table>

© Clemens Utschig-Utschig
## Dynamic and „build to change“

What has to be defined during design-time?

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</tr>
</tbody>
</table>

Defintion of: Activities, Milestones, Rules, Events, Data, Stakeholders
The value of Dynamic Case Management

- Change the „flow“ of the case without re-deployment
- Define and change which activities are available in the different phases of a case without re-deployment (adjust pre-/post-conditions)
- Define automatic triggering of e.g. case activities based on milestones, outcomes and events
- Move milestones without re-deployment (e.g. milestone „Assessment finished“ requires the execution of additional activities)
- Add an additional activity call
  - Without re-deployment: possible, if the activity already exists
  - With re-deployment: if the activity didn‘t exist before (might require instance migration)
5 Case Management Modeling Standards
Case Requirements | CMMN

- Defined by the OMG as a new standard for Case Modeling
- Released in May 2014
- Is a notation for modeling and graphically expressing a case
- Is an interchange format for exchanging Case Models among different tools
- Vendors like Oracle, IBM, SAP, Kofax, Cordys and Tibco have contributed to this standard

- Download our CMMN / ACM Poster from http://acmcommunity.com
The complete behavior model of a Case is captured in a CasePlanModel.

It comprises both:
- all elements that represent the initial plan of the Case,
- and all elements that support the further evolution of the plan through run-time planning by case workers.
Stages do have run-time representations in a Case (instance) plan. Instances of Stages are tracked through the CMMN-defined Stage lifecycle. They may be considered “episodes” of a Case, though Case models allow for defining Stages that can be planned in parallel also. A Stage is depicted with a marker in the form of a “+” (collapsed) or “−” (expanded) sign in a small box at its bottom center.
A Milestone represents an achievable target, defined to enable evaluation of progress of the Case. No work is directly associated with a Milestone, but completion of set of Tasks or the availability of key deliverables (information in the CaseFile) typically leads to achieving a Milestone. A Milestone may have zero or more entry criteria, which define, when a Milestone is reached.

In CMMN an event is something that “happens” during the course of a Case. Events may trigger, for example, the enabling, activation and termination of Stages and Tasks, or the achievement of Milestones. Instances of TimerEventListener are used to catch predefined elapses of time. A UserEventListener enables direct interaction of a user with the Case.
# CMMN | Decorators

<table>
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<th>Planning Table</th>
<th>Entry Criterion</th>
<th>Exit Criterion</th>
<th>Auto Complete</th>
<th>Manual Activation</th>
<th>Required</th>
<th>Repetition</th>
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<tbody>
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<td>Case Plan Model</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Stage</td>
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<td>✓</td>
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<td>✓</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CMMN | Stage and Task Lifecycle

![Diagram of stage and task lifecycle]
Case Requirements | CMMN + UI

We’ve made our best experiences with a UI-first approach and CMMN

CMMN Model

User Interface
Teiltrenner

- Layout für Trennseiten zwischen Teilen in einer Präsentation
- Titel: 1 - 2zeilen
- Bitte den Titel immer auf die Agenda abstimmen.
- Bitte die Teile gemäß Agenda nummerieren.
- Eine Grafik ist auf dieser Seite nicht vorgesehen.
Bringing them all together
Demo: Case Implementation
6

Process Mining on a Project Management Tool
Aufgaben und Möglichkeiten

- Prozesserkennung
- Übereinstimmungsprüfung
- Verbesserung/Erweiterung
- Erkennen von Netzwerken
- Produktionsunterstützung
Prozessmodelle

- Transition systems
- Petrinetze / WF-Netze
- BPMN
- YAWL (Yet another workflow language)
- EPC (Event driven process chain)
- Kausale Netze
- Fuzzy models
Vorgehensweise

- Datenextraktion und -aufbereitung
- Erstellung eines Eventlogs
- Analyse mit Disco
- Export nach XES
- Analyse mit Prom
Ausgangspunkt: vorhandene Projekthistorie

- Eintrag bei Erfassung/Änderung am Projekt
- Daten von 2012 bis 2014
- Erfasst am, Erfasst von, Geändert am, Geändert von
- Weitere Felder:
  Angebotsdatum, Auftragsdatum, Abrechnungs-KZ, Niederlassung, Projekt, Kundenkategorie, Portfoliokomponente, Geschäftsfeld
- Einfache Anonymisierung mit Hash-Algorithmus
- Betrachtung der Projektakquisition bis zur Auftragserteilung
Erzeugung des Event-Logs

- Projekte ohne Auftrag werden nicht berücksichtigt
- Erfasst am oder Angebotsdatum vor 2012
- Eliminierung doppelter Einträge (gleich außer Geändert am)
- Benötigt: Case-ID, Activity, Timestamp
- Case-ID: Projekt
- Activity: Anlage, Angebot, Auftrag, Bearbeitung
- Timestamp: Erfasst am (Anlage), Angebotsdatum, Auftragsdatum, Geändert am (Bearbeitung)
- Resource (Rolle/Status): Erfasst von (Anlage), Geändert von
Eigenschaften des Event-Logs

- Startevents: Anlage, Angebot, Auftrag
- Endevents: Auftrag, Anlage
- Anlage und Auftrag treten genau einmal auf
- Angebot und Bearbeitung treten 0- bis n-mal auf
- 2464 Cases
- 10931 Events
Analyse mit Disco: Absolute Häufigkeit
Analyse mit Disco: Statistik der Rollen

Resource

<table>
<thead>
<tr>
<th>Resource</th>
<th>Frequency</th>
<th>Relative frequency</th>
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<tr>
<td>PL</td>
<td>3071</td>
<td>28.09%</td>
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<tr>
<td>AN</td>
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<td>Status QA</td>
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<td>0.03%</td>
</tr>
<tr>
<td>Status QA</td>
<td>2</td>
<td>0.02%</td>
</tr>
</tbody>
</table>

Median frequency: 146.4
Mean frequency: 496.60
Maximal frequency: 5071
Frequency std. deviation: 777.71
Analyse mit Prom: Abspielen des Logs

Anonymous log imported from expert_fuer_prom_ohne_Filter.xes

Analyse mit Prom: Abspielen des Logs

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Analyse mit Prom: Flower Miner
Analyse mit Prom: Inductive Miner
Analyse mit Prom: Fuzzy Miner
Analyse mit Prom: Soziales Netzwerk
Analyse mit Prom: Zeitliche Abfolge
Ergebnisse

- Datenqualität -> bessere Plausibilisierung möglich? Auftragsdatum < Angebotsdatum
- Bearbeitung durch ein breites Spektrum von Rollen
- Verschiedene Arten der Nutzung (Anlage des Projekts bei Beginn der Akquise oder erst nach Auftrag)
- Nutzung variiert mit Geschäftsfeld (MSI vs. Projektgeschäft)
- Projekte für ungewöhnliche Zwecke (interne, externe Verrechnung)
7

Process Mining in Banking
Ziele (1/2)

- Prozesse aus proprietärer Workflow Engine erkennen und visualisieren
- Bottlenecks aufdecken
- Ist die Performance der Engine zufriedenstellend?
- Welche verschiedenen Variationen der Prozesse gibt es?
- Verweildauer (maschinell bedingt oder durch Prozessverantwortlichen initiiert)
- Sind Wartezstände Fehler, SW Fehler oder Fehler durch Prozessverantwortliche?
Ziele (2/2)

- Künstlich erzeugte Nebenläufigkeiten und Variationen (gleiche Timestamps und somit falsche Reihenfolge) sollten eliminiert werden.
- Eventuelle Abweichungen z.B. in der Abendverarbeitung aufdecken
- Eventuell Clusterbildungen identifizieren
- *helicopter view* auf die bestehenden Systeme
Herausforderungen

- Das Extrahieren der richtigen und wichtigen Daten
- Daten sollten so granular wie möglich sein
- Mindestvoraussetzungen für Process Mining – Case ID, Activity und Timestamp
- Trade-, Settlement- und Block-Objekte in der Datenhaltung hierarchisch angeordnet
- Ein Block besteht aus mehreren Settlements, und ein Settlement aus mehreren Trades
- Ein Settlement kann in mehreren Blöcken enthalten sein
- Historische Daten mit einbinden
Vorrausetzungen für das Process Mining

- Klärung: Welche Ziele sollen erreicht werden?
- Kenntnis über Datenhaltung und Applikation
- Daten so granular wie möglich und nötig
- Case ID
- Activity
- Timestamp
  - Problem Hibernate-Timestamp Typ Date
- Datenbankabfrage darf die Daten durch JOINS und UNIONS nicht künstlich verfälschen
- Wichtige Attribute identifizieren und in die Abfrage mit aufnehmen
Chancen / Lessons Learned

- Timestamps wurden geändert
- Methoden wie `sendConfirmation()` könnten überarbeitet werden
  - Zusätzliche Methode `stornoSendConfirmation()`
- Produktiv-System lässt sich überwachen, z.B. welche Events zu welchen Zeiten durch welche Geschäftsvorfälle gehäuft auftreten
- Erkennung von Bottlenecks, Schleifen oder evtl. Systemschwachstellen
- User- oder System(-fehler)
Tooling

- Disco: einfach benutzbare, idealer Einstieg
- Prom: kostenfrei, viele Plugins, erfordert Expertenwissen, XES-Format
- Rapid Miner: Data Mining, Prom-Plugin
- Celonis: Data Mining, Process Monitoring (www.celonis.de)
- Process Analyzer: Excel-Integration (www.qpr.com)
- Perceptive (www.perceptivesoftware.de)
Questions?
Contact

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Solution Architect  | Oracle Ace Director

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