



Process Mining in der Praxis

Erfahrungen und Praxisbeispiele

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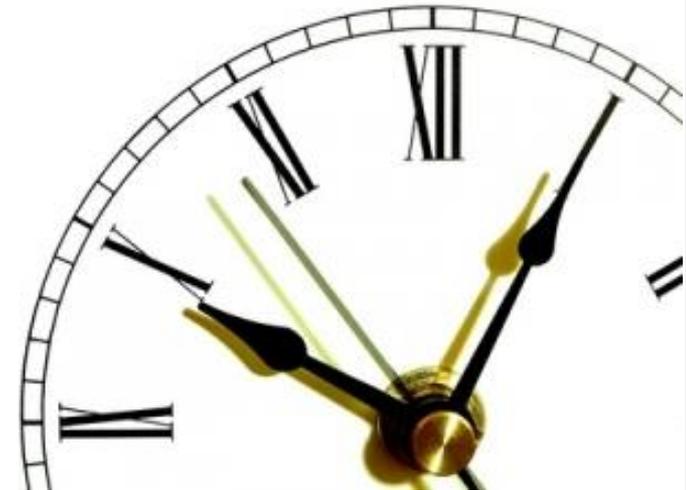
Introduction OPITZ CONSULTING

- **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**



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**



1

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**

http://www.win.tue.nl/ieeetfpm/doku.php?id=shared:process_mining_case_studies

2

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

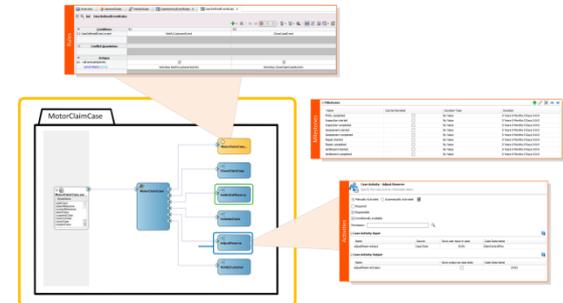
- Trade-off between rigid und flexible processes
- Reduction of process costs and higher information quality
- Transparency as to where a claim is now and what is the next step
- Efficient Case Handling – with “One Click Access” to any needed function

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

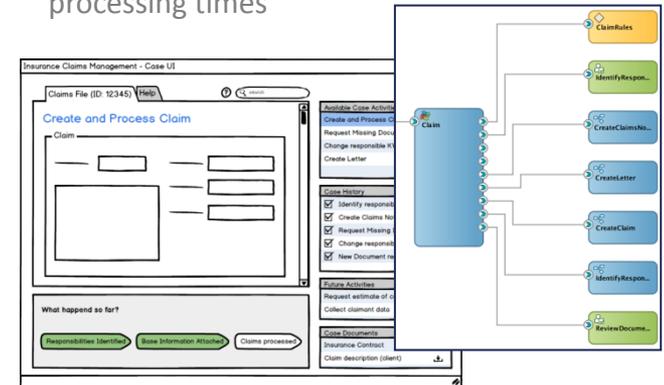
- Many different claim types with specifics in regulation
- Hidden knowledge from experienced workers
- Many parallel requests through different channels in case of a natural disaster
- Limited tracability and lack of reporting

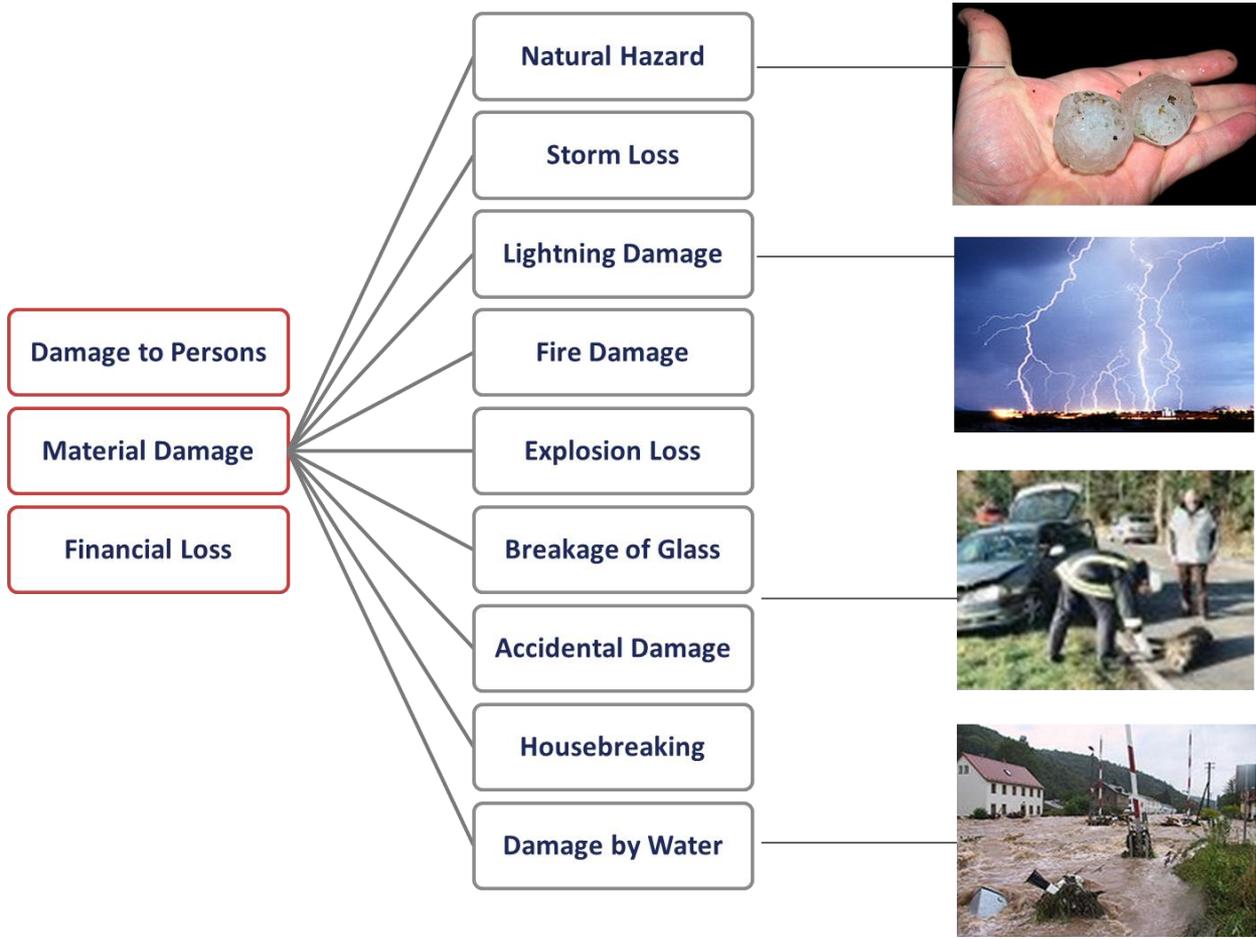
SOLUTION

- 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





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!



The View of the Claim Handler

Applikationen Schaden Stammdaten Hilfe Fenster
Schadenshauptmaske 9.155 SVIDIALOG 16.01.2013

Schadensnr.: []
Bearbeiter: [] Durchw.: []
Tarifbündel: []
Sch.-Index: []
Riskob.: []
Vertrag: [] Ver: []
V.Status: []
V.Beginn: []
VN: []
Kto.: []
BLZ: []
Ereignis: []
S.Datum: [] Ort: []
M.Datum: [] Anz. Verl.: []
S.Status: []
Vermittler: []
RSchaden: []
ID/AD-Kz.: []
Vorschäden: []
Anz. Einzelschäden: []
Meld. RV: []
Rückst.datum: []
Ersparnis Betrag: []
Ersparnis Z: []
Deckung: [] AST [] VN [] Hinweise []
Objekt: []
OBJ-Nr.: []
D Block: []
Prämiegrundlage: []
AVB: []
LO: []
SB: []
HE: []
S-Schein: [] geprüft [] Verzicht SA []
Saison: [] von: [] bis: []
Neben-/Konkurrenzversicherer vorh.: []
AVB-Treffer VN/Risiko: []
Prüfdatum: []

Schadensabrechnungen
Abrechnungsposten

Abrechnungsposten	Abrechnungsposten	Abrechnungsposten	Abrechnungsposten	Abrechnungsposten	Abrechnungsposten
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

Schadenspartner

Partnernr.	Rolle	Partnernr.	Rolle	Partnernr.	Rolle
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30

Schadenszahlungen

Zahlungsweg	Buchungstyp	Zahlungsbetrag	Sch.Betrag
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100

Challenges in Claims Management

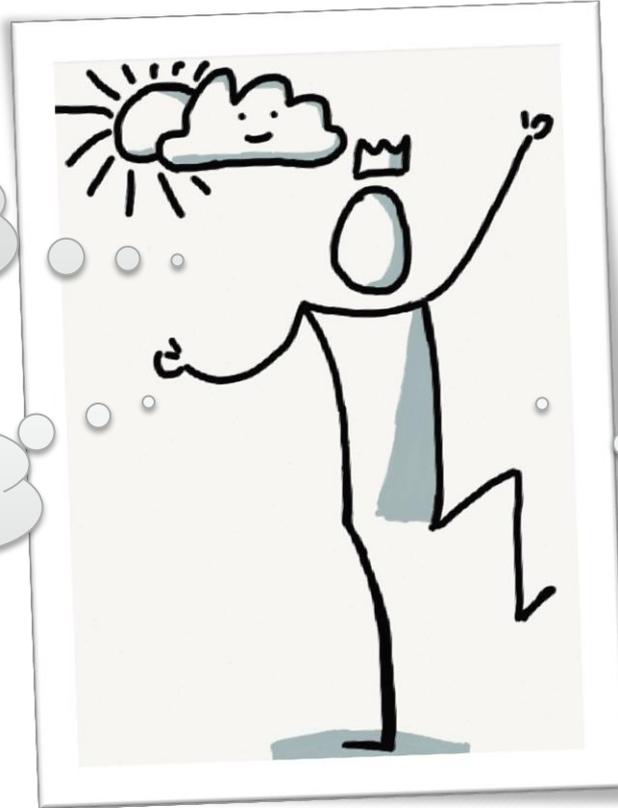
- **Many different claim types with specifics in regulation**
- **Missing user guidance**
- **Hidden knowledge from experienced workers**
- **Many different systems and independent solutions**
 - Telephone, Email, Correspondence
 - Integration of different partners
 - Task Management
- **Many requests 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



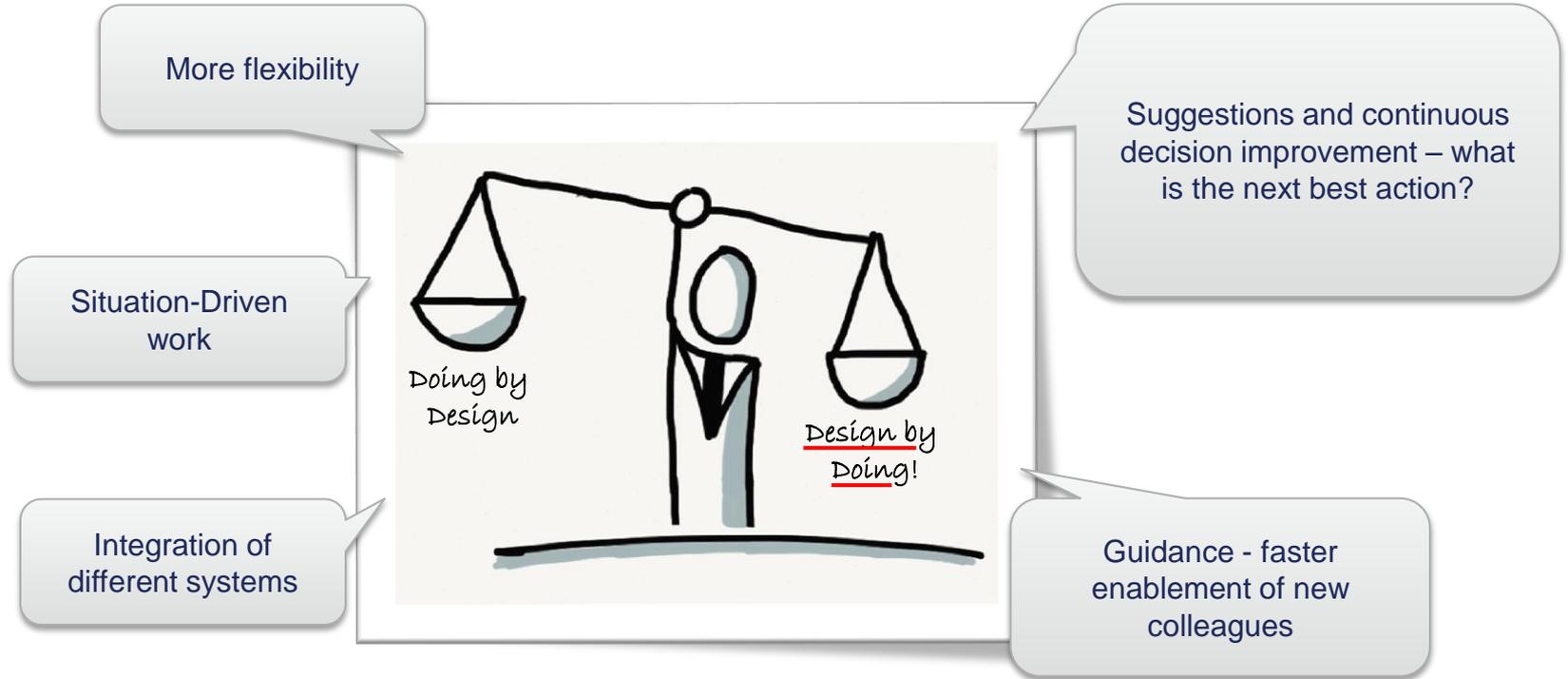
Rental Car

Repair Shop
Suggestions

Craftsman
Recommendation

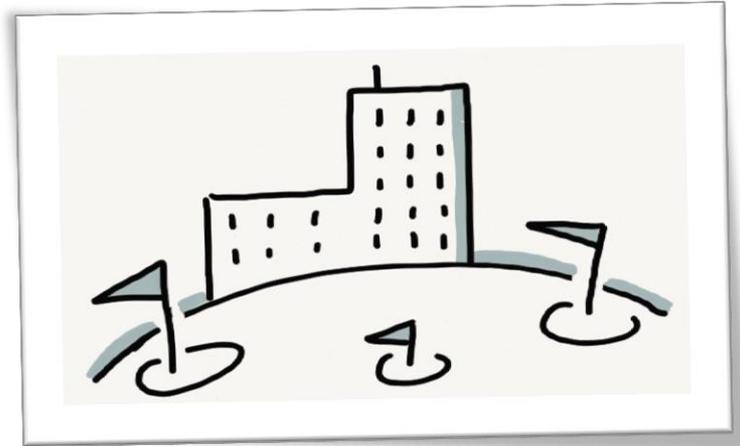
What is needed?

Or: What do we expect from an ACM solution?



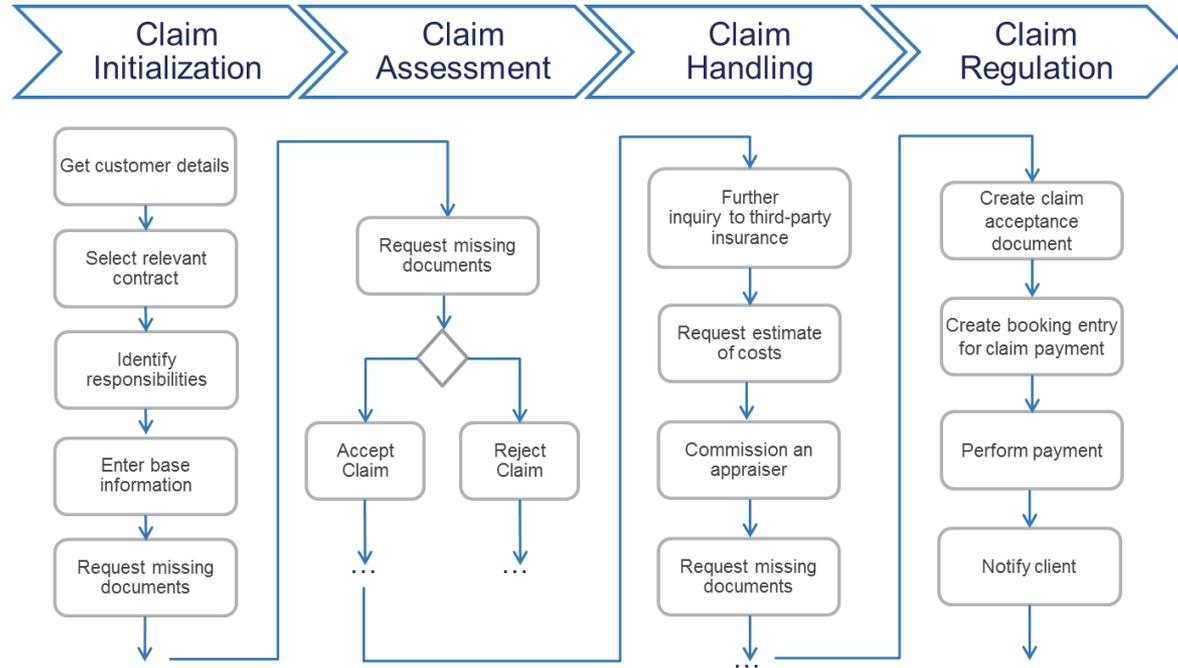
Expected benefits by the company

- 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



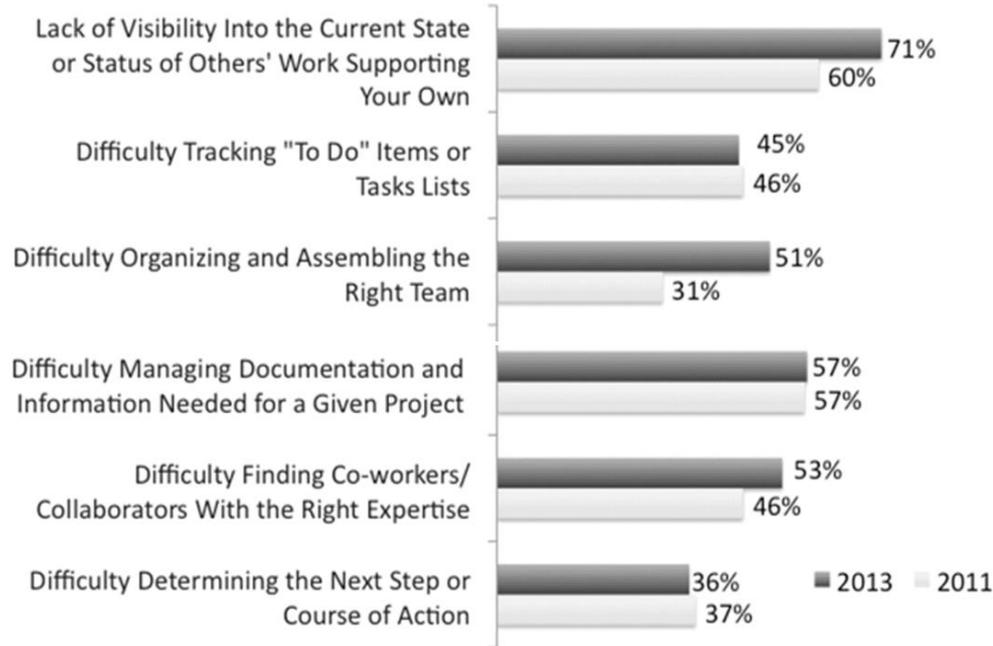
Main steps in Claim Management

Simplified and Structured



Reality Check

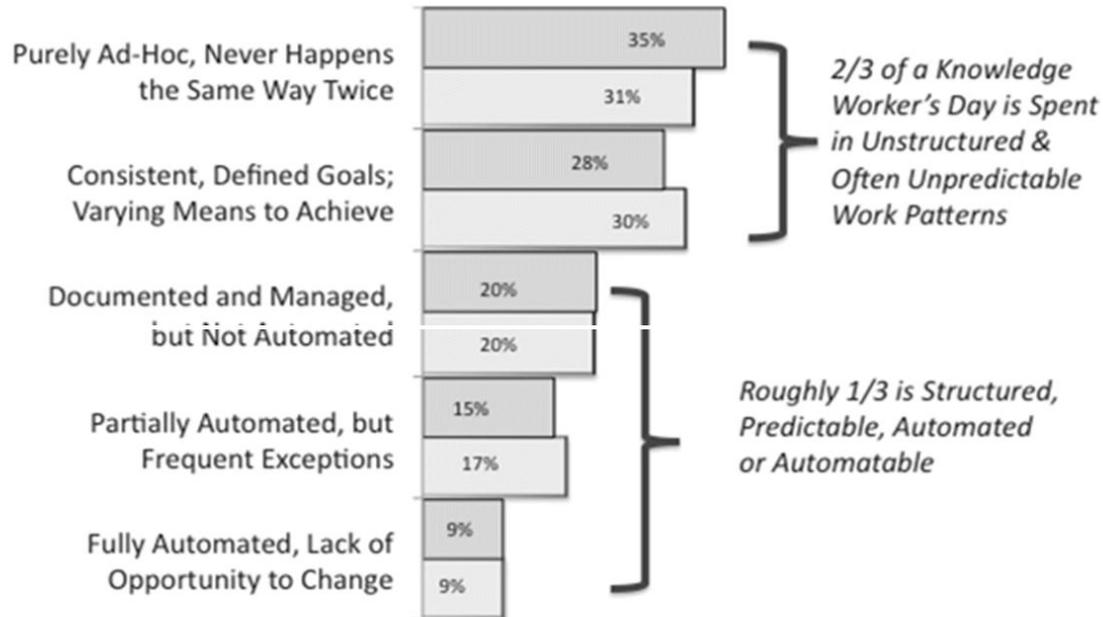
Daily challenges knowledge workers face



Source: 2011 - 2013 Case Management Survey

Work patterns of knowledge workers

Percent of the day spent in different modes



Source: 2011 - 2013 Case Management Survey

Emerging Paths

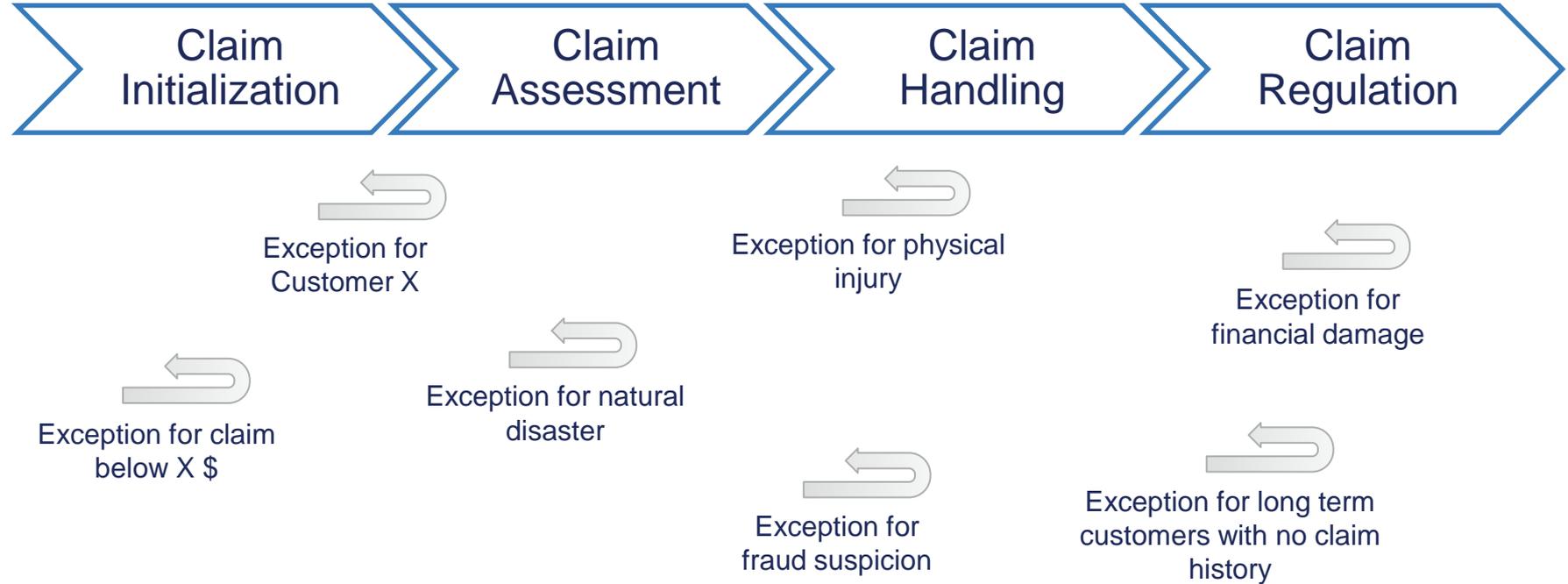


- **Suggest Next Best Order:**
 - Customer also bought...
- **Suggest Next Best Action:**
 - Recommendation System
 - No rigid control of the user
- **Ratingsystem vs. Social**
 - Credibility
 - Trust 2000 customer ratings or better to 2 friends?

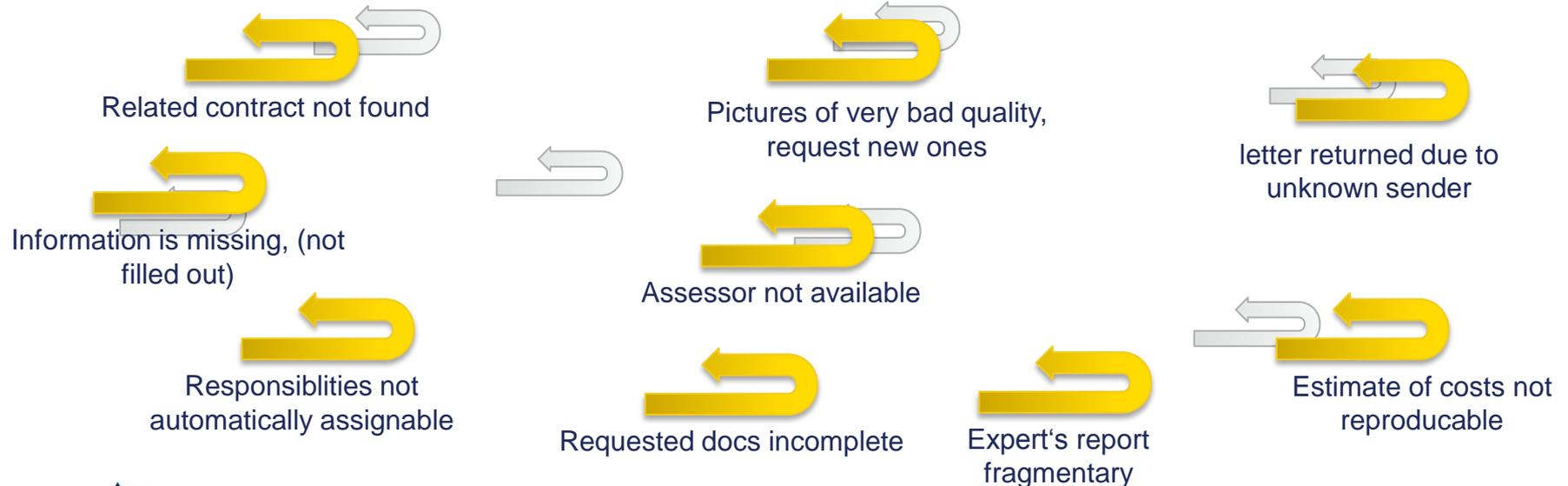
http://www.nature.com/nature/journal/v388/n6637/fig_tab/388047a0_F1.html

Claim Management is context-based ...

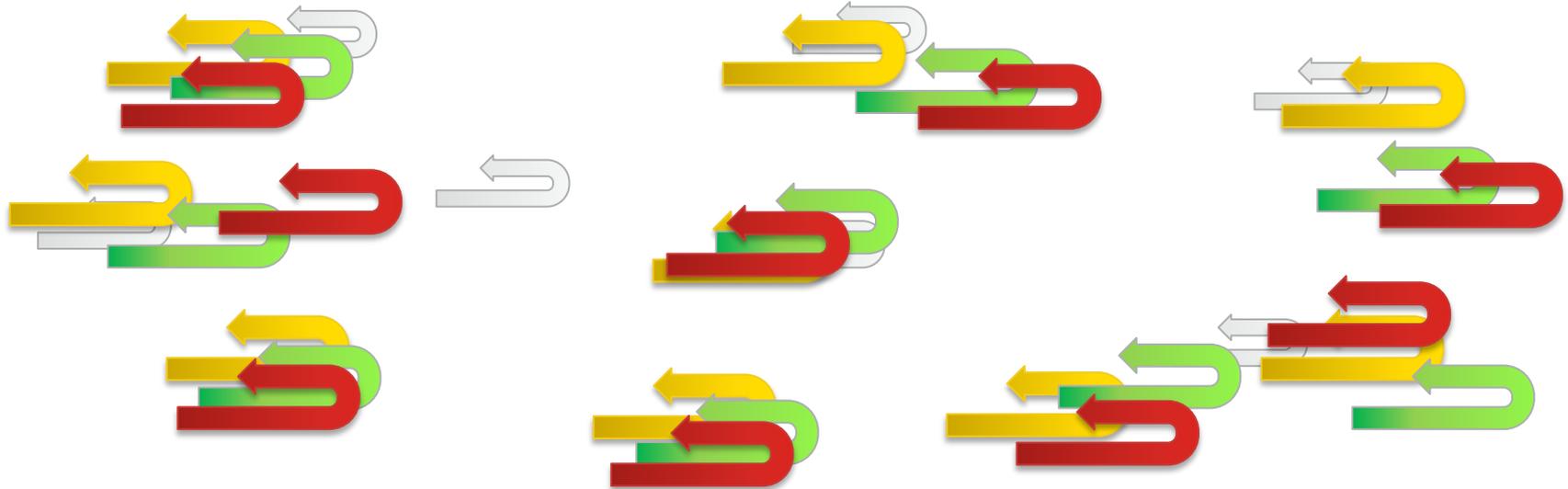
... with many exceptions



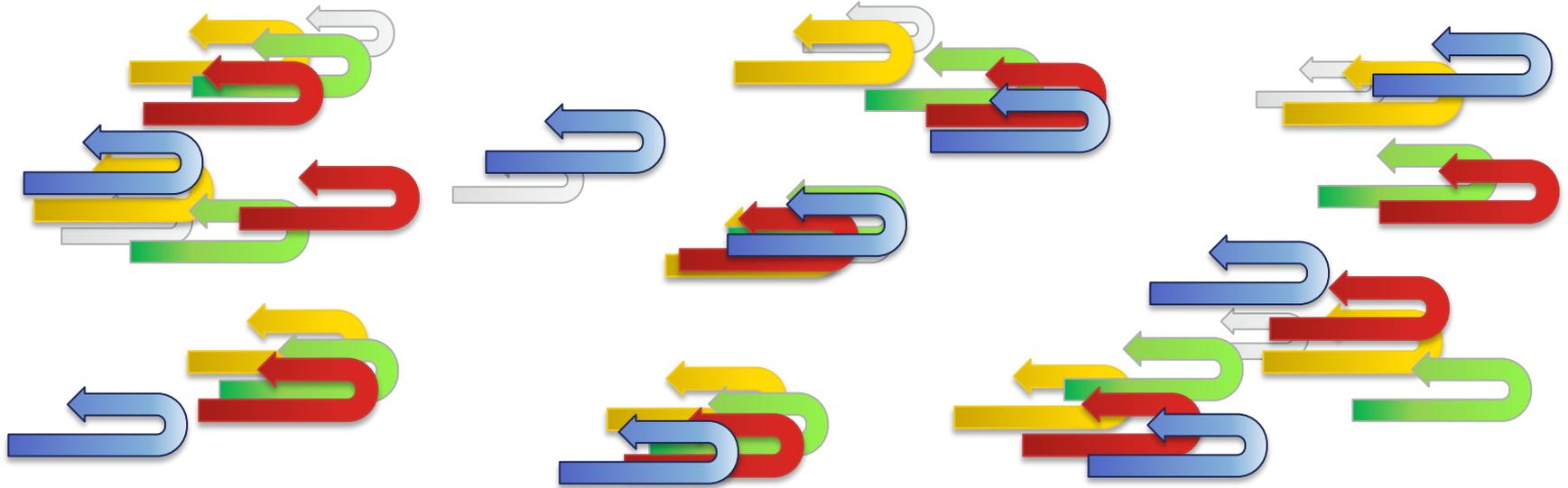
More Exceptions



Is the exception the rule?

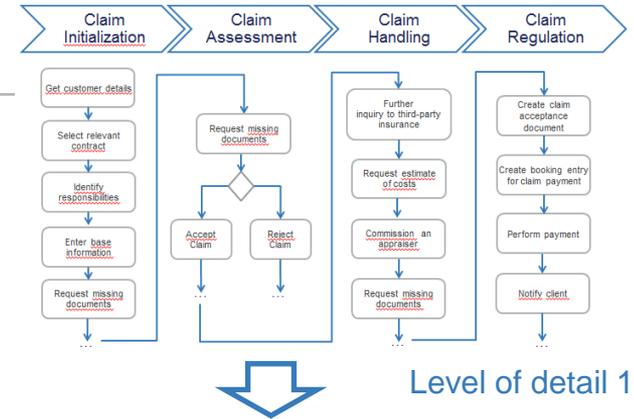


More exceptions than default paths

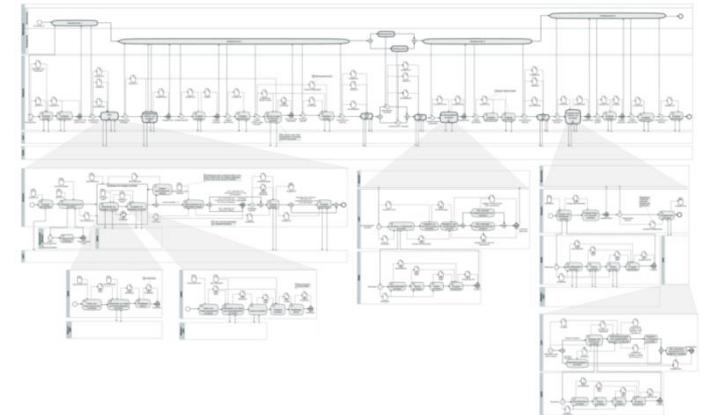


Is everything modeled?

- **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



Level of detail 1



Level of detail 2

Modeling Exercise „Underwriting“

Text-to-Model

„Sometimes the applicant receives a callback by phone to answer additional questions within a medical questionnaire.

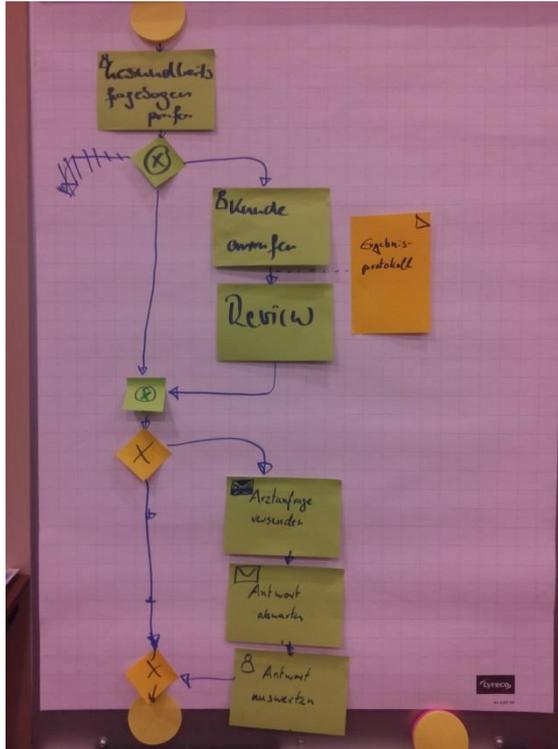
The clerk decides whether this is possible or not – based on his experience and his skills.

If the clerk called the applicant the resulting protocoll 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.“

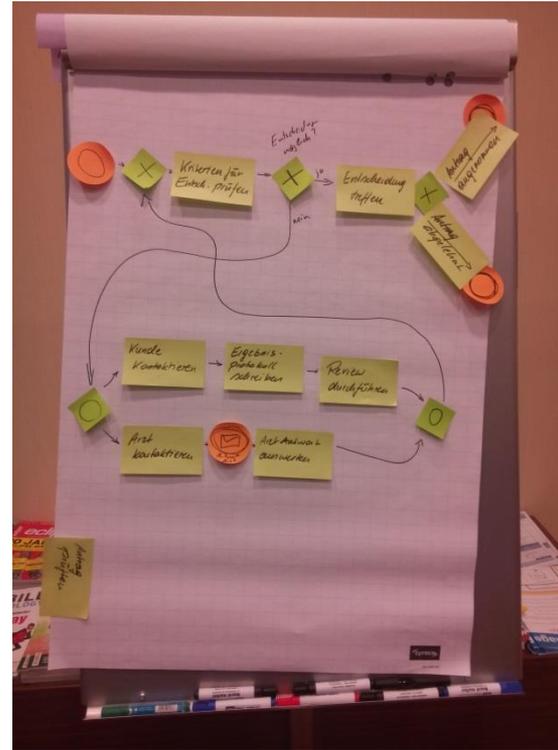
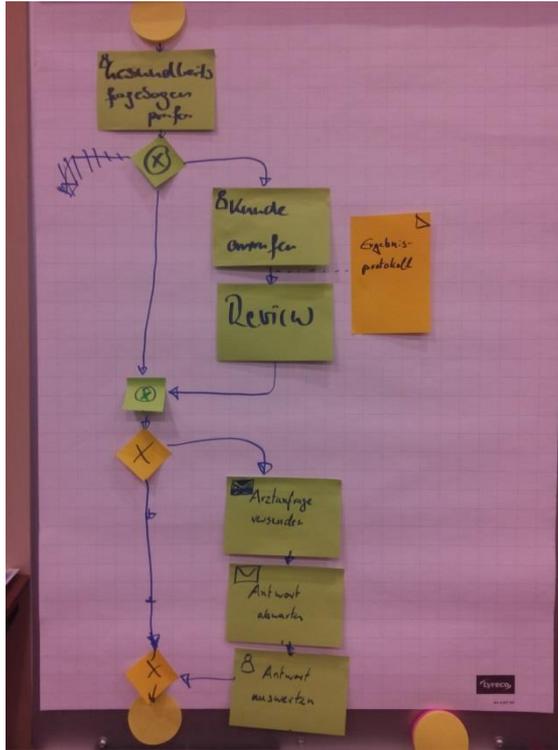
Modeling Exercise „Underwriting“

Different people / different results



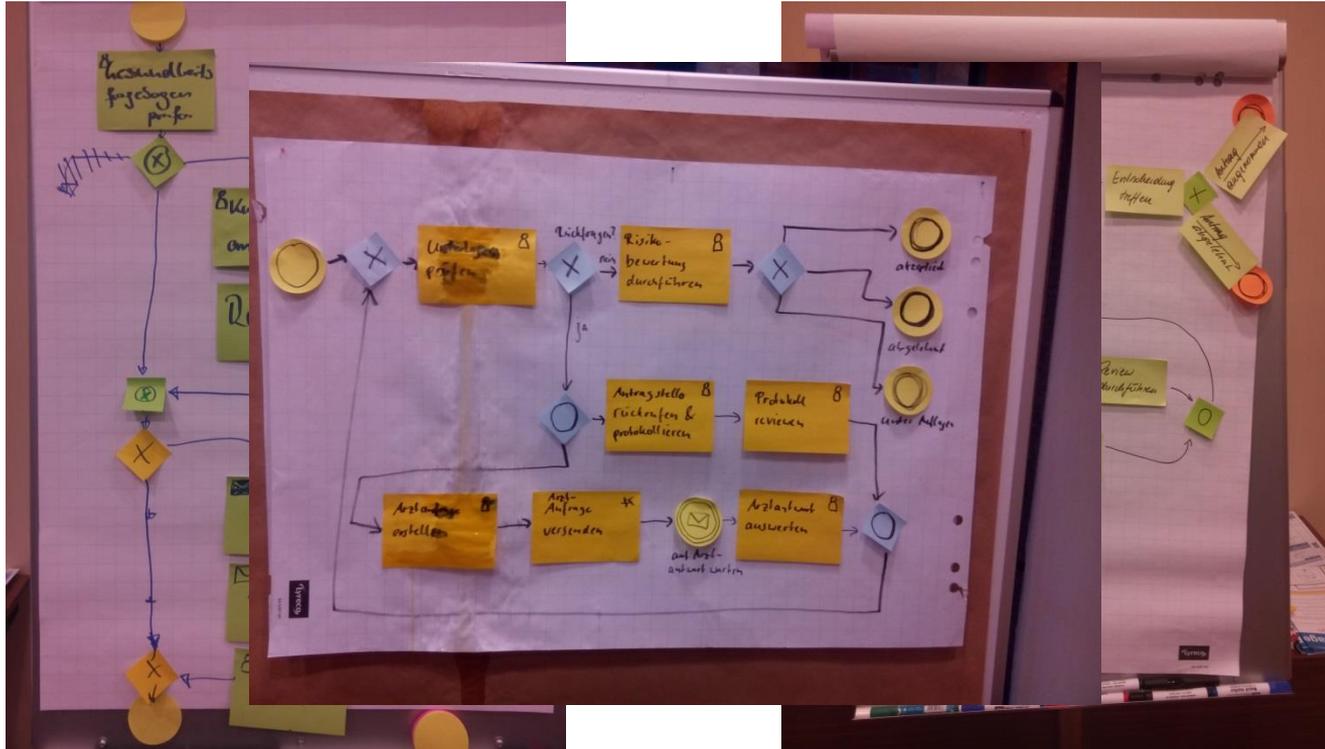
Modeling Exercise „Underwriting“

Different people / different results



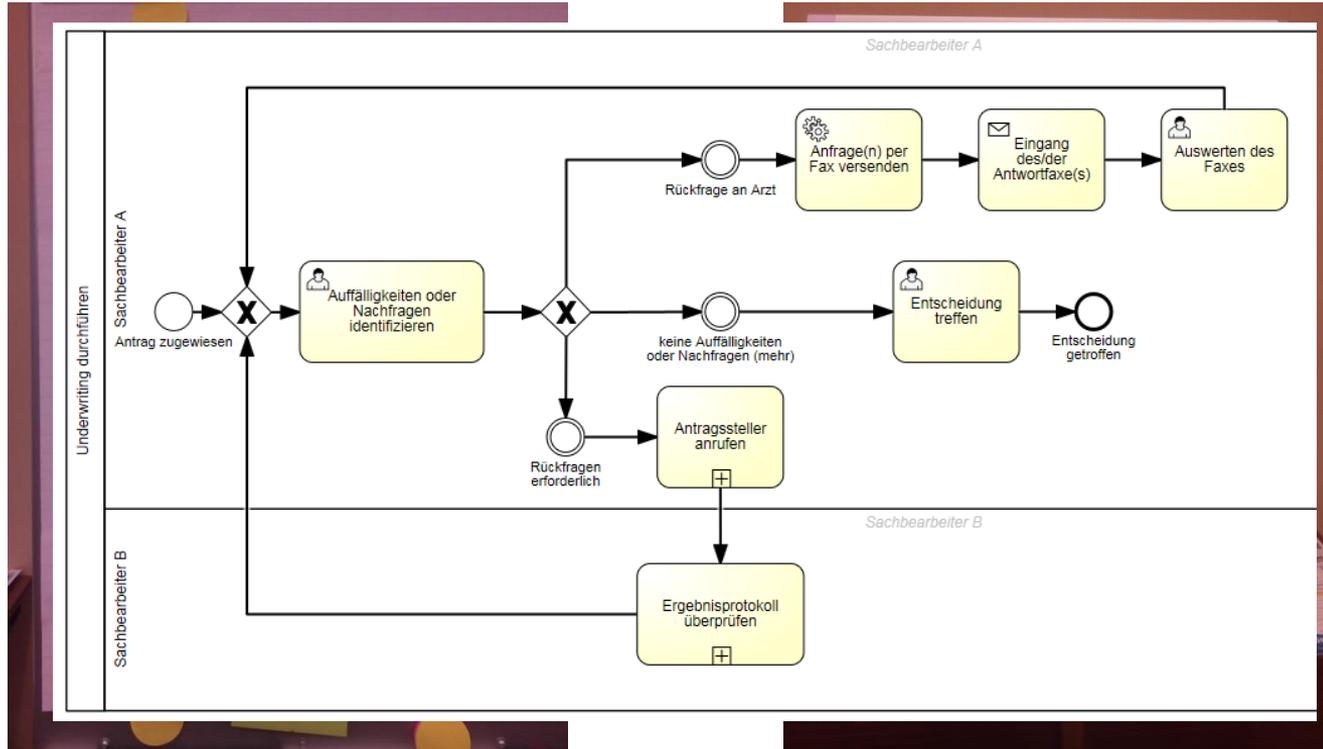
Modeling Exercise „Underwriting“

Different people / different results



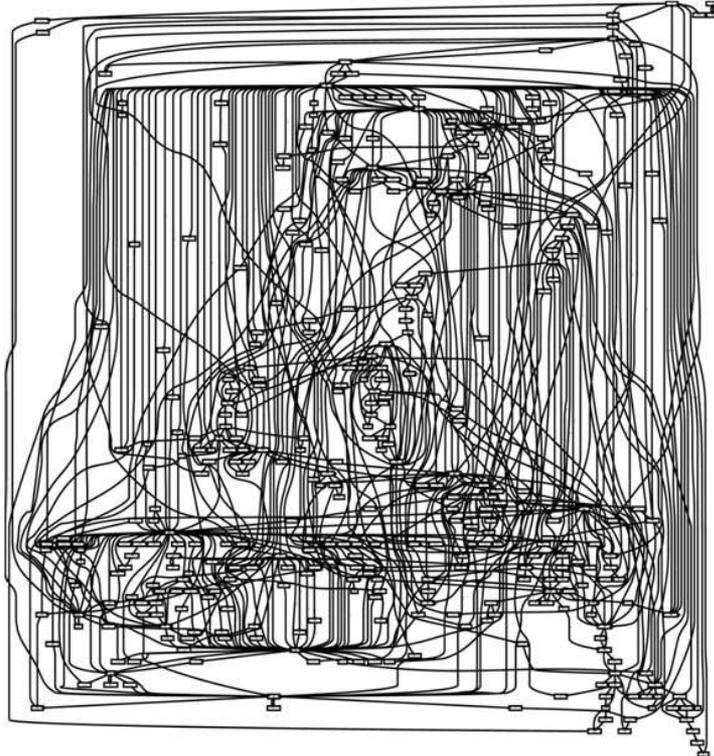
Modeling Exercise „Underwriting“

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

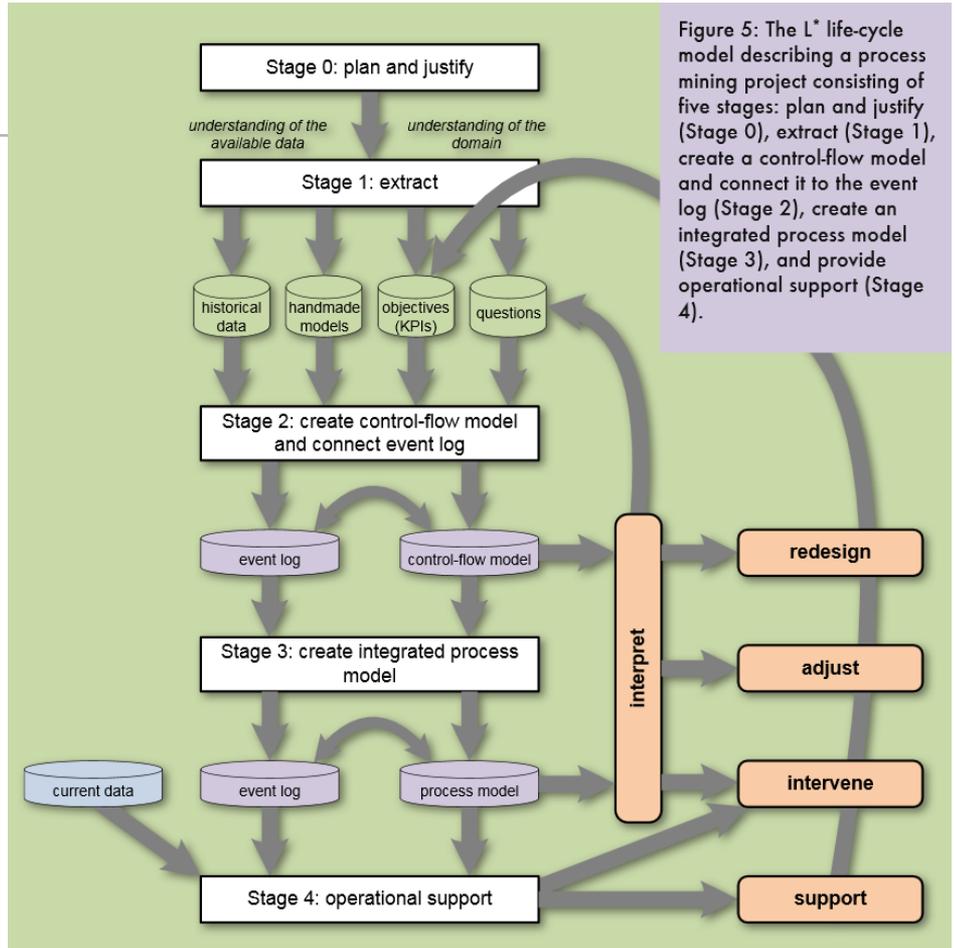


Figure 5: The L* life-cycle model describing a process mining project consisting of five stages: plan and justify (Stage 0), extract (Stage 1), create a control-flow model and connect it to the event log (Stage 2), create an integrated process model (Stage 3), and provide operational support (Stage 4).

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

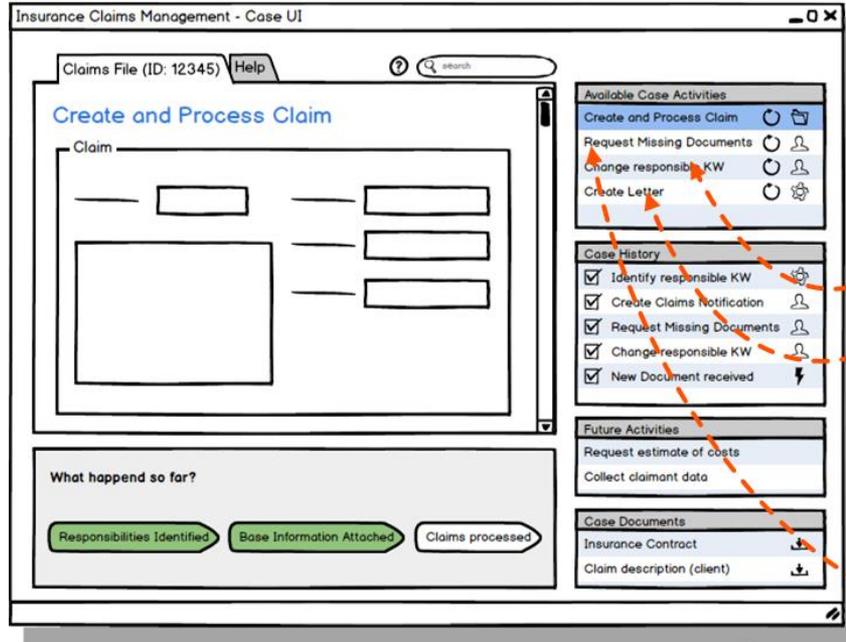
3

Process Mining and Adaptive Case Management

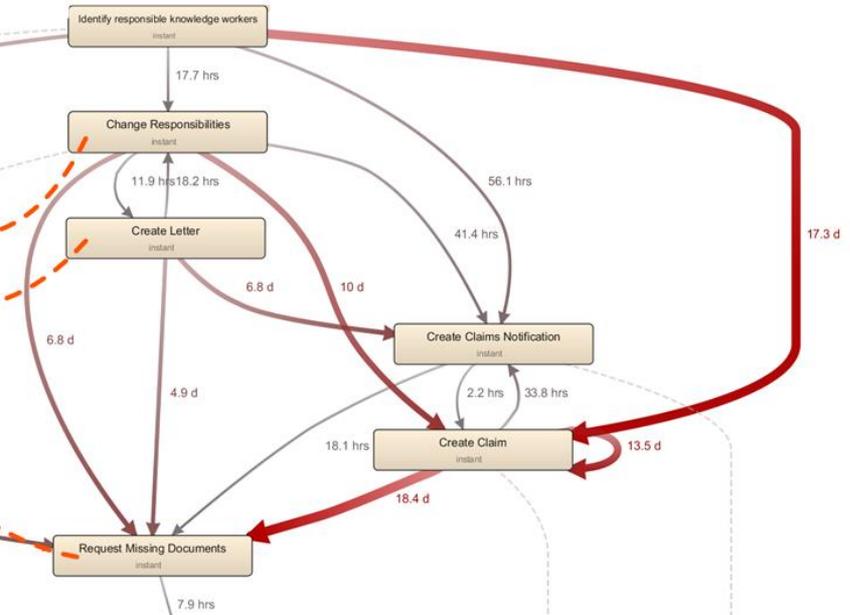


Process Mining and Adaptive Case Management

ACM User Interface



Process Mining Result

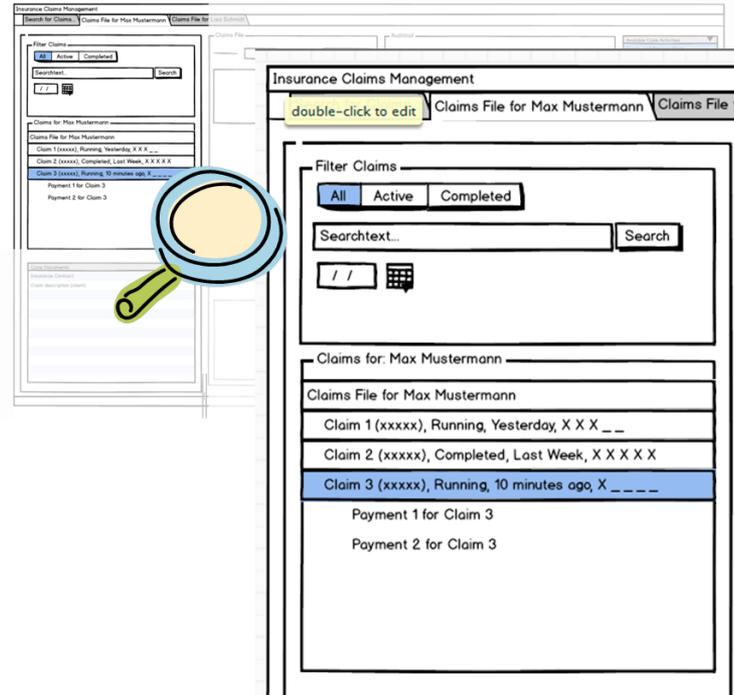


Anatomy of an ACM Solution (Example)

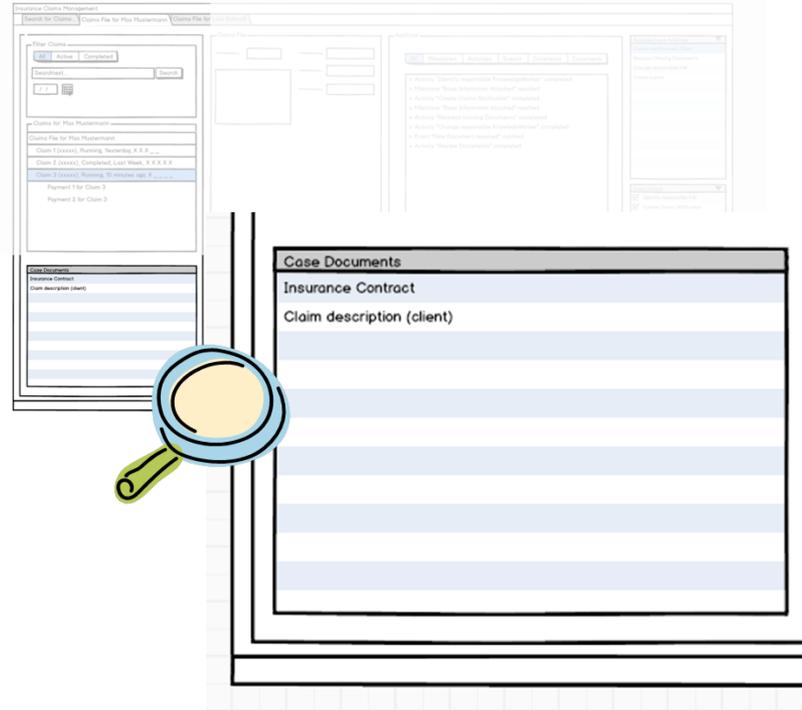
The screenshot displays the 'Insurance Claims Management' application interface. At the top, there are tabs for 'Search for Claims', 'Claims File for Max Mustermann', and 'Claims File for Lisa Schmidt'. The main area is divided into several functional panels:

- Filter Claims:** Includes buttons for 'All', 'Active', and 'Completed', a search text input, and a search button.
- Claims for Max Mustermann:** A list of claims with details such as 'Claim 1 (xxxxx), Running, Yesterday, X X X _ _', 'Claim 2 (xxxxx), Completed, Last Week, X X X X X', and 'Claim 3 (xxxxx), Running, 10 minutes ago, X _ _ _ _'. Below this list are 'Payment 1 for Claim 3' and 'Payment 2 for Claim 3'.
- Case Documents:** A table with columns for 'Insurance Contract' and 'Claim description (client)'. The first row contains 'Insurance Contract' and 'Claim description (client)'. Below the table are several empty rows.
- Claims File:** A panel with a header 'Claims File' and several input fields and buttons for managing claims.
- Audit Trail:** A panel with a header 'Audit Trail' and tabs for 'All', 'Milestones', 'Activities', 'Events', 'Comments', and 'Documents'. It displays a list of activities: '> Activity "Identify responsible KnowledgeWorker" completed', '> Milestone "Base Information Attached" reached', '> Activity "Create Claims Notification" completed', '> Milestone "Base Information Attached" reached', '> Activity "Request missing Documents" completed', '> Activity "Change responsible KnowledgeWorker" completed', '> Event "New Document received" caught', and '> Activity "Review Documents" completed'.
- Claim / Payment:** A panel with a header 'Claim / Payment' and several input fields and buttons for managing payments.
- What happened so far?:** A vertical timeline of process steps: 'Responsibilities Identified', 'Base Information Attached', 'Evaluation', 'Handling', 'Regulation', and 'Claims processed'. The first two steps are highlighted in green.
- Available Case Activities:** A dropdown menu showing a list of activities: 'Create and Process Claim', 'Request Missing Documents', 'Change responsible KW', and 'Create Letter'.
- Case History:** A dropdown menu showing a list of activities with checkboxes: 'Identify responsible KW', 'Create Claims Notification', 'Request Missing Documents', 'Change responsible KW', and 'Review Documents'. All checkboxes are checked.
- Future Activities:** A dropdown menu showing a list of activities: 'Request estimate of costs' and 'Collect claimant data'.

Case UI – Navigation and Search

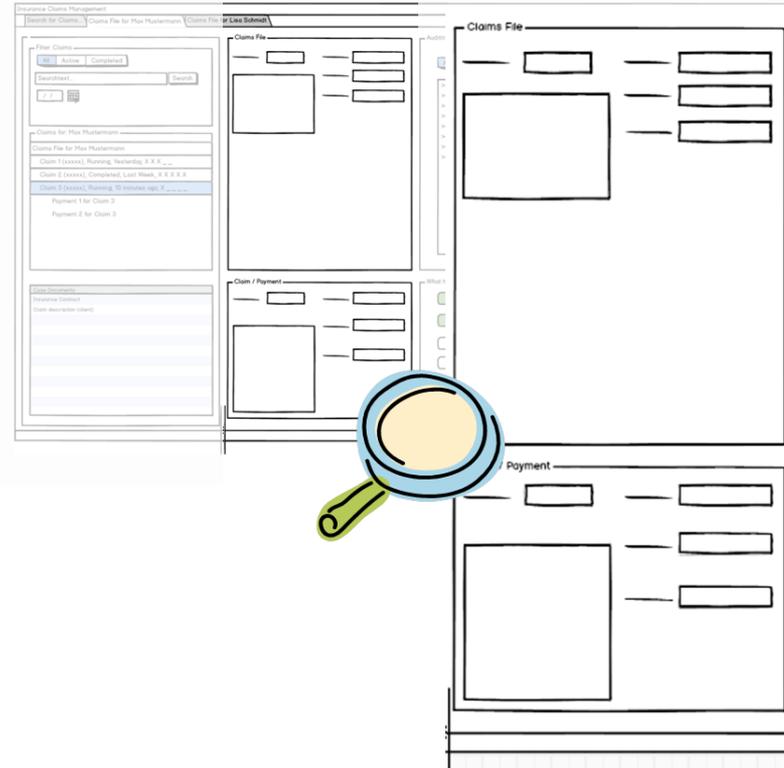


Case UI - Documents



Case UI – Data

Details about the claim and it's related entities



Case UI – Milestones & History

Where I am?

The screenshot shows a web application for 'Insurance Claims Management'. The main content area is divided into several sections:

- Search for Claims:** Includes a search bar and a list of claims with columns for status (e.g., 'Open', 'Completed', 'Lost') and dates.
- Claims File:** A section for viewing details of a specific claim.
- Audit Trail:** A section with tabs for 'Milestones', 'Activities', 'Events', 'Comments', and 'Documents'. It displays a list of events such as 'Activity "Identify responsible KnowledgeWorker" completed' and 'Milestone "Base Information Attached" reached'. A magnifying glass is positioned over this section.
- What happened so far?:** A vertical timeline of process steps: 'Responsibilities Identified', 'Base Information Attached', 'Evaluation', 'Handling', 'Registration', and 'Claims processed'. The first two steps are highlighted in green.

The magnified 'Audit Trail' window shows a detailed list of events:

- > Activity "Identify responsible KnowledgeWorker" completed
- > Milestone "Base Information Attached" reached
- > Activity "Create Claims Notification" completed
- > Milestone "Base Information Attached" reached
- > Activity "Request missing Documents" completed
- > Activity "Change responsible KnowledgeWorker" completed
- > Event "New Document received" caught
- > Activity "Review Documents" completed

The 'What happened so far?' section below the magnified view shows a vertical timeline of process steps:

- Responsibilities Identified
- Base Information Attached
- Evaluation
- Handling
- Registration
- Claims processed

Case UI – Activities

What can I do next?

The screenshot displays a web-based Case Management interface. The main content area is divided into several panels: 'Enter Claims' with search and filter options, 'Claims File for Max Mustermann' with a list of claim entries, 'Claim 1 Payment' with input fields, and 'What happened so far?' with a timeline of events. A sidebar on the right contains three sections: 'Available Case Activities', 'Case History', and 'Future Activities'. A magnifying glass icon is positioned over the 'Available Case Activities' list.

Available Case Activities

- Create and Process Claim
- Request Missing Documents
- Change responsible KW
- Create Letter

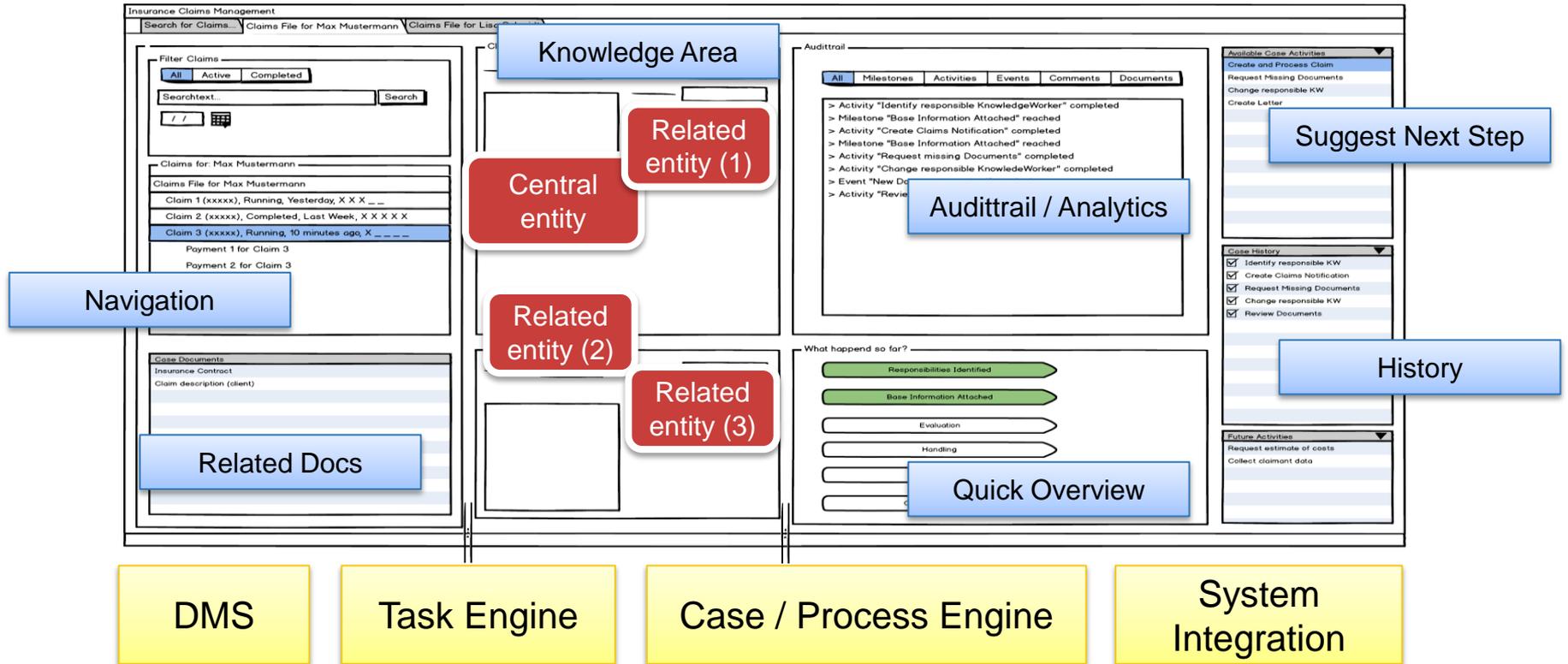
Case History

- Identify responsible KW
- Create Claims Notification
- Request Missing Documents
- Change responsible KW
- Review Documents

Future Activities

- Request estimate of costs
- Collect claimant data

Case Management Solution Components



Case Management in Combination

CaseTask
Human Task
Process Task
(BPMN)

Insurance Claims Management

Search for Claims: Claims File for Max Mustermann Claims File for Lisa Schmidt

Filter Claims: Filter by Status (All, Active, Completed), Search, 77

Claims File for Max Mustermann

- Claim 1 (xxxxx), Running, Yesterday, X X X ...
- Claim 2 (xxxxx), Completed, Last Week, X X X X X
- Claim 3 (xxxxx), Running, 10 minutes ago, X ...

Payment 1 for Claim 3
Payment 2 for Claim 3

Claims Documents

Instance Context
Claim description (stand)

Claims File for Lisa Schmidt

Claim / Payment

Audit Trail

- Milestones: Activity "Identify responsible KnowledgeWorker" reached, Milestone "Base Information Attached" reached, Activity "Create Claims Notification" completed, Milestone "Base Information Attached" completed, Activity "Request missing Documents" completed, Activity "Change responsible KnowledgeWorker" completed, Event "New Document received" caught, Activity "Review Documents" completed

Available Case Activities

- Create and Process Claim
- Request Missing Documents
- Change responsible KW
- Create Letter

Claim History

- Identify responsible KW
- Create Claims Notification
- Request Missing Documents
- Change responsible KW
- Review Documents

Pending Activities

- Request estimate of costs
- Collect claimant data



4

Adaptivity (today)



What is meant with „adaptive“?



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

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Dynamic and „build to change“

What has to be defined during design-time?



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

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Defintition 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>



CMMN | Case Plan Model

Case Name

- 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.

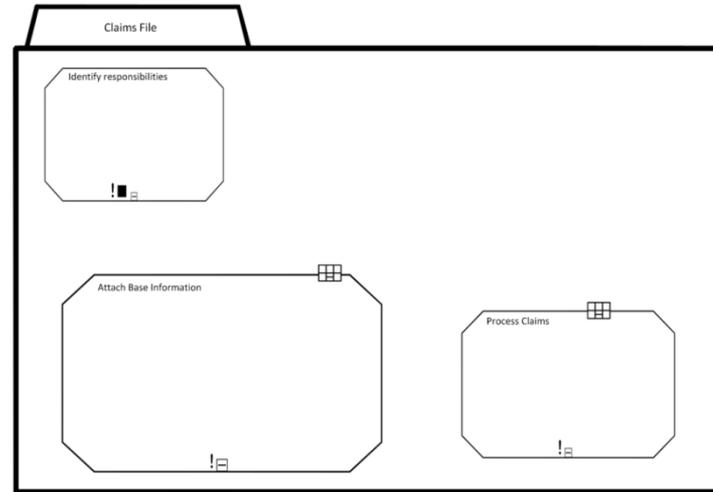
CMMN | Plan Model Elements

Stages

Stages



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.



CMMN | Plan Model Elements

Milestones & Event Listeners

Milestones



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.

Event Listeners

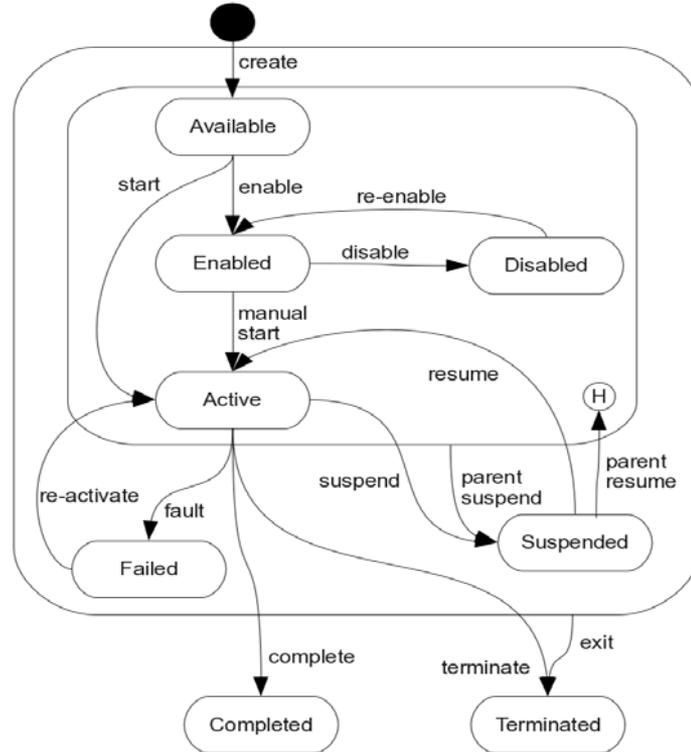


In CMMN an event is something that “happens” during the course of a `Case`. Events may trigger, for example, the enabling, activation and termination of `Stages` and `Tasks`, or the achievement of `Milestones`. Instances of `TimerEventListener` are used to catch predefined elapses of time. A `UserEventListener`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

CMMN | Decorators

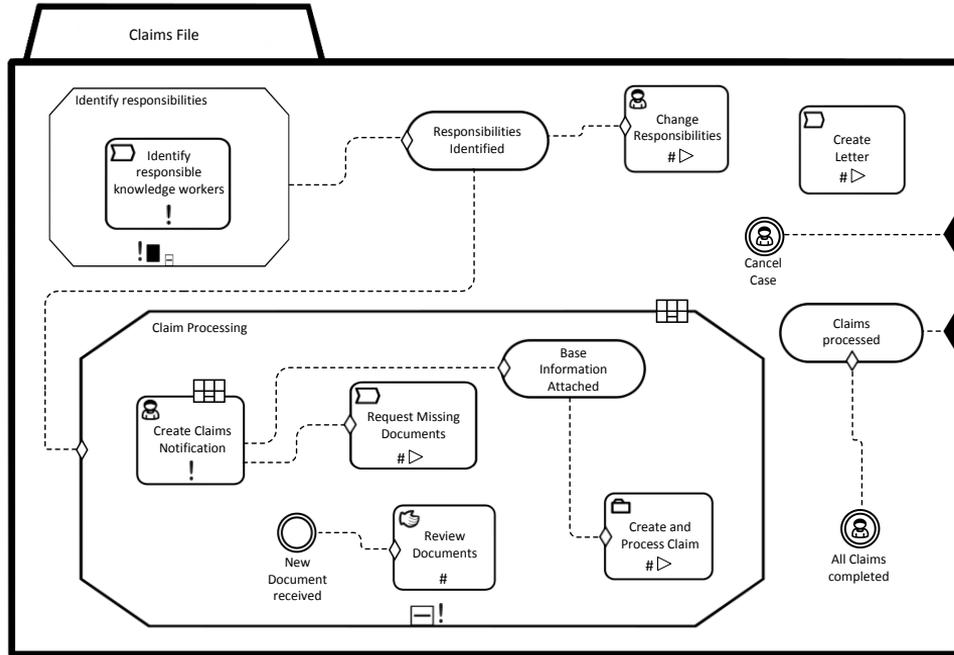
	 Planning Table	 Entry Criterion	 Exit Criterion	 Auto Complete	 Manual Activation	 Required	 Repetition
 Case Plan Model	✓		✓	✓			
 Stage	✓	✓	✓	✓	✓	✓	✓
 Task	Human Task only	✓	✓		✓	✓	✓
 Milestone		✓				✓	✓
 Event Listener							
 Case File Item							

CMMN | Stage and Task Lifecycle

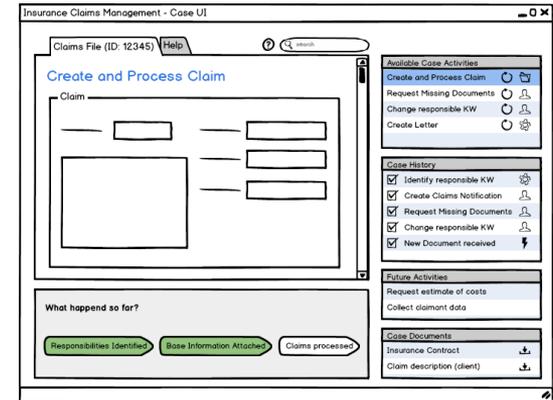


Case Requirements | CMMN + UI

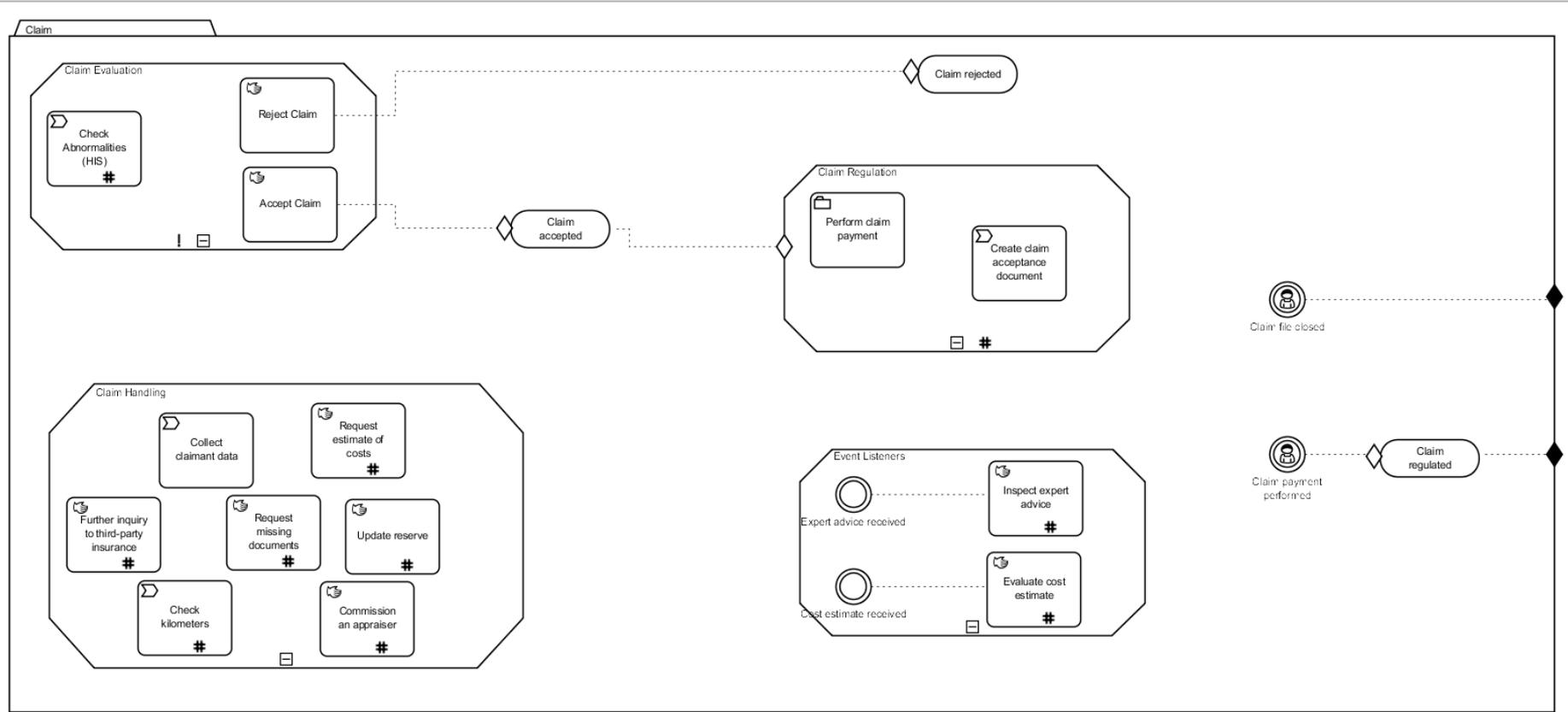
We've made our best experiences with a UI-first approach and CMMN



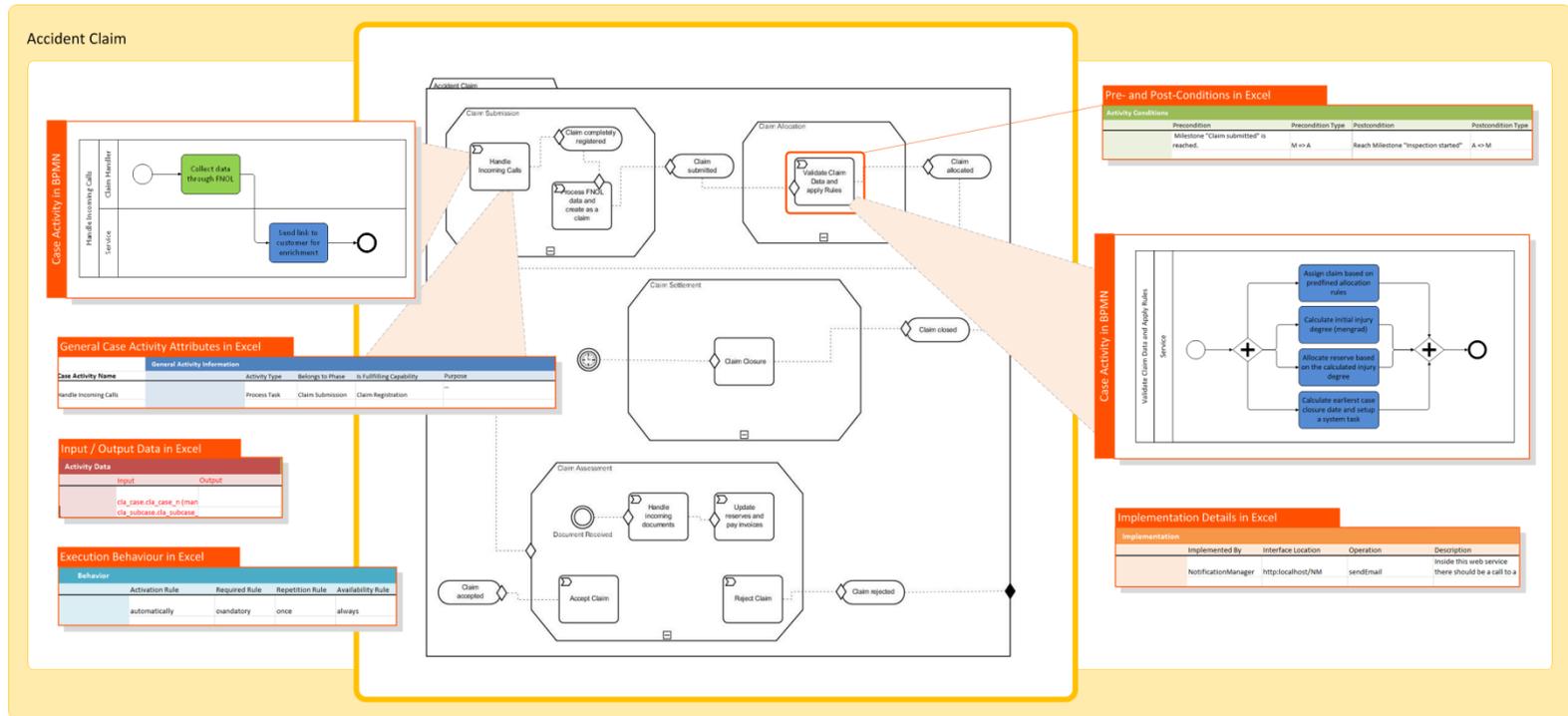
CMMN Model



User Interface



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

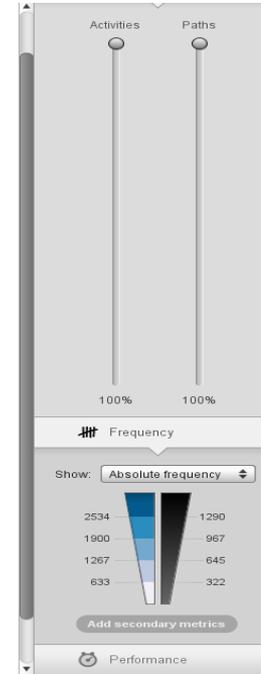
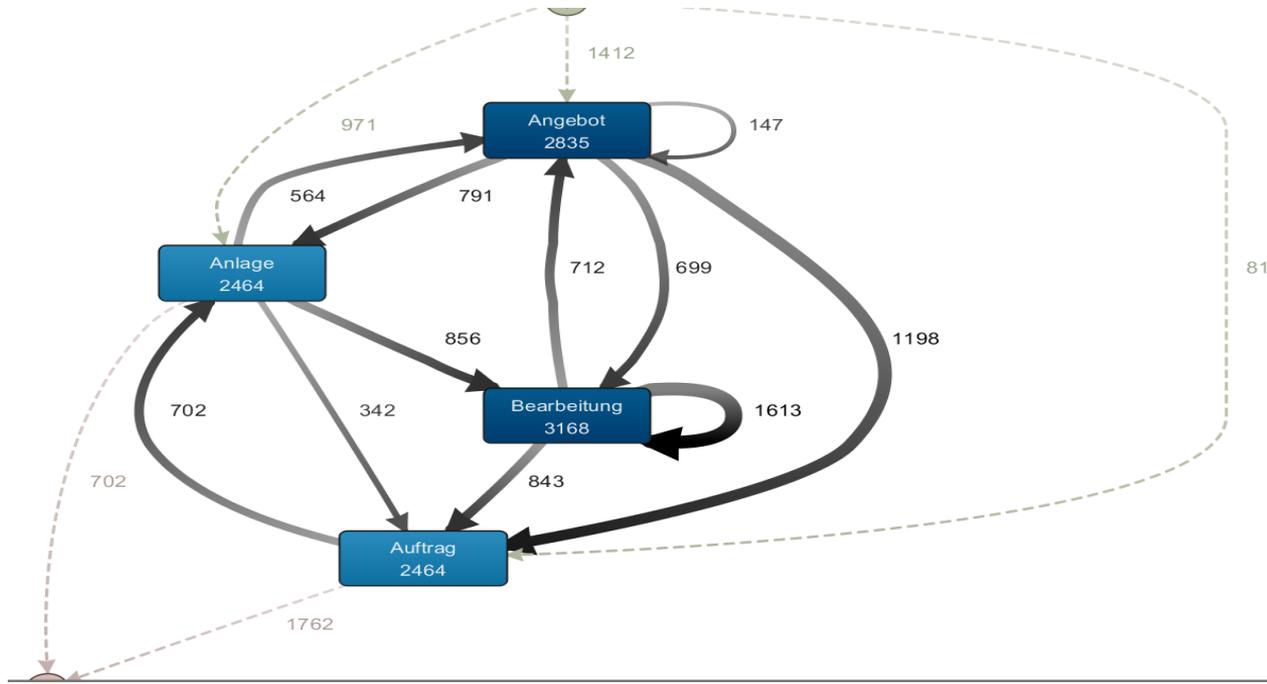
- **Projekte ohne Auftrag werden nicht berücksichtigt**
- **Erfasst am oder Angebotsdatum vor 2012**
- **Eliminierung doppelter Einträge (gleich außer Geändert am)**
- **Benötigt: Case-ID, Activity, Timestamp**
- **Case-ID: Projekt**
- **Activity: Anlage, Angebot, Auftrag, Bearbeitung**
- **Timestamp: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

^ -

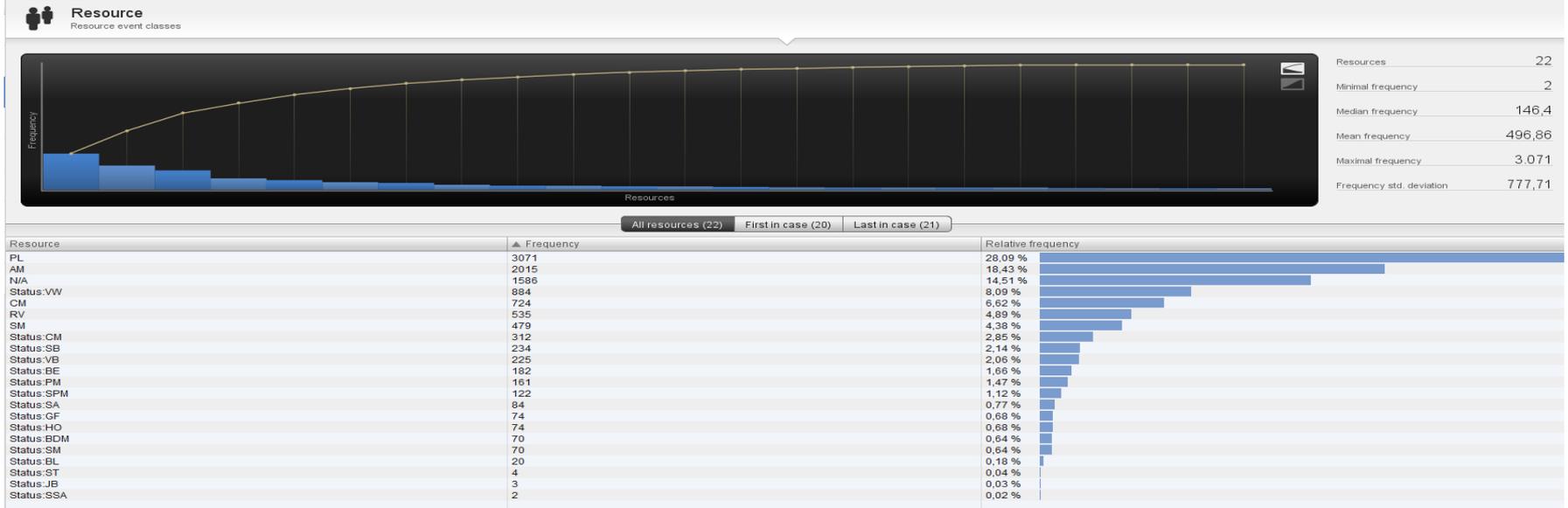
Eigenschaften des Event-Logs

- **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**

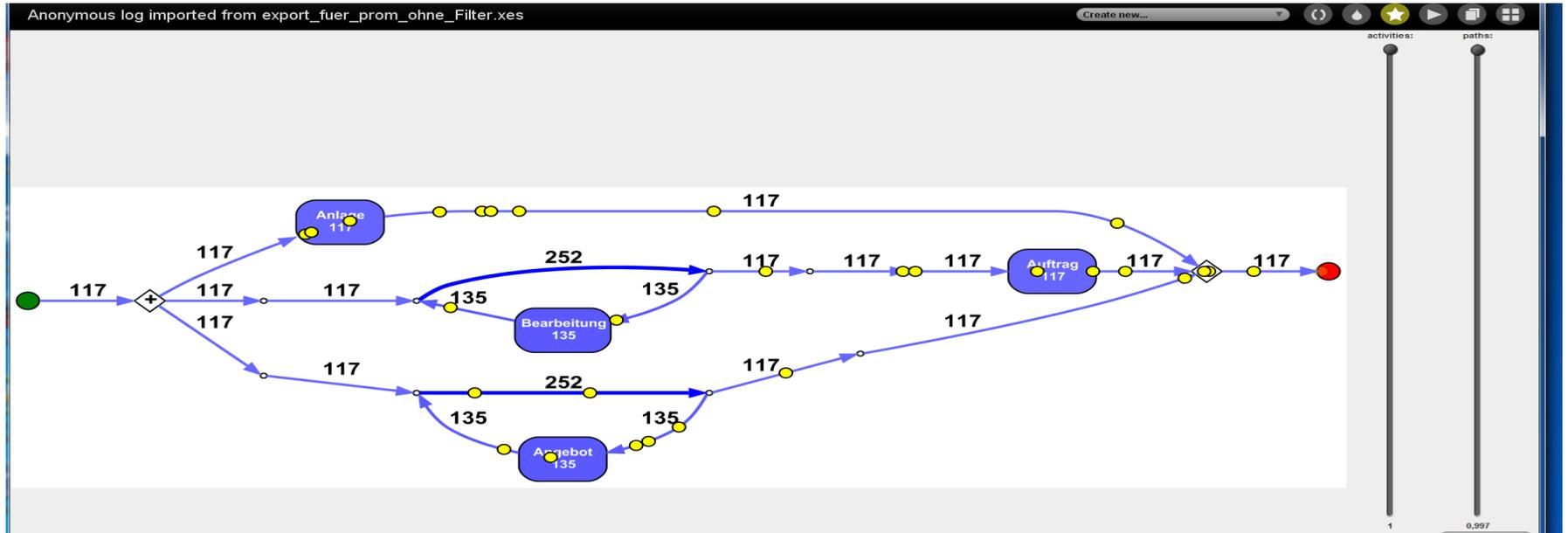
Analyse mit Disco: Absolute Häufigkeit



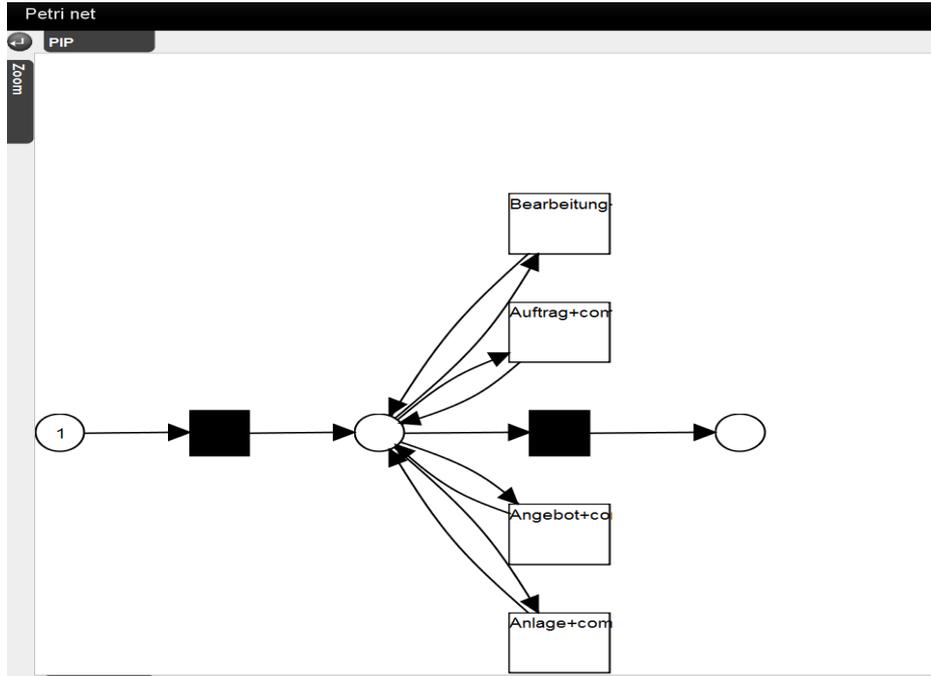
Analyse mit Disco: Statistik der Rollen



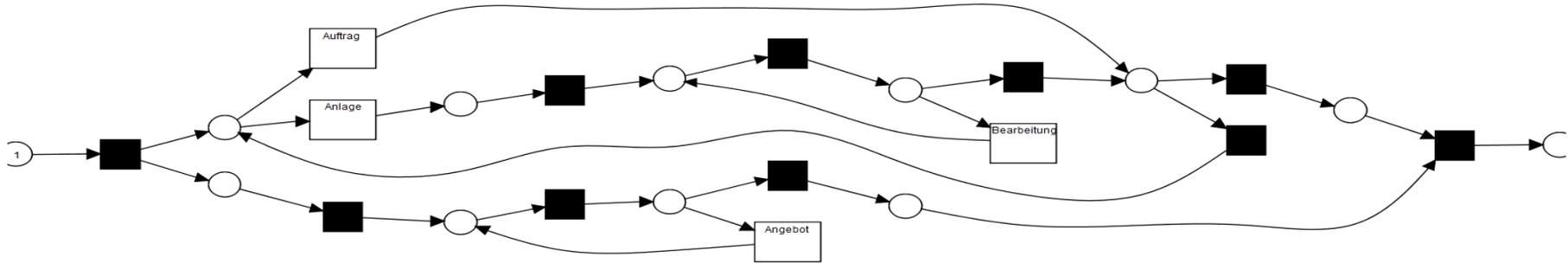
Analyse mit Prom: Abspielen des Logs



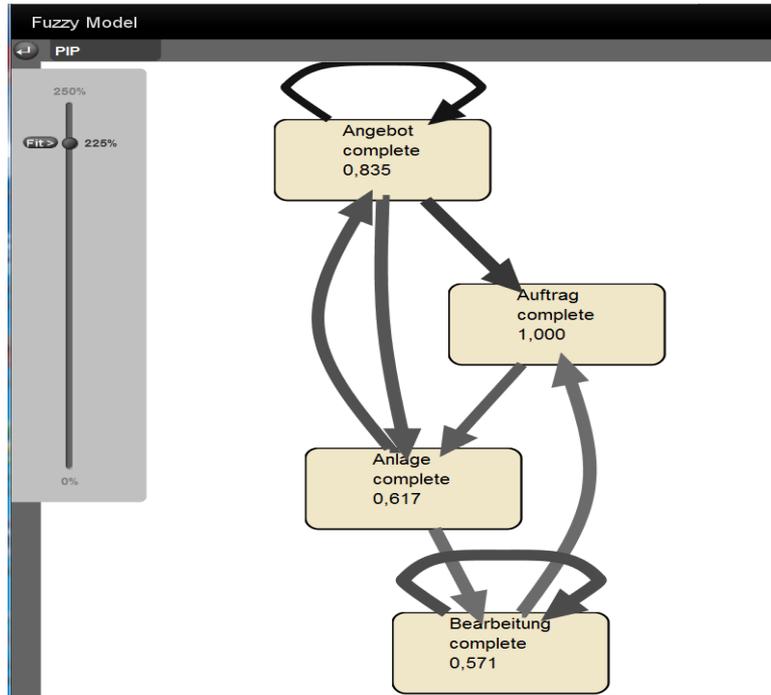
Analyse mit Prom: Flower Miner



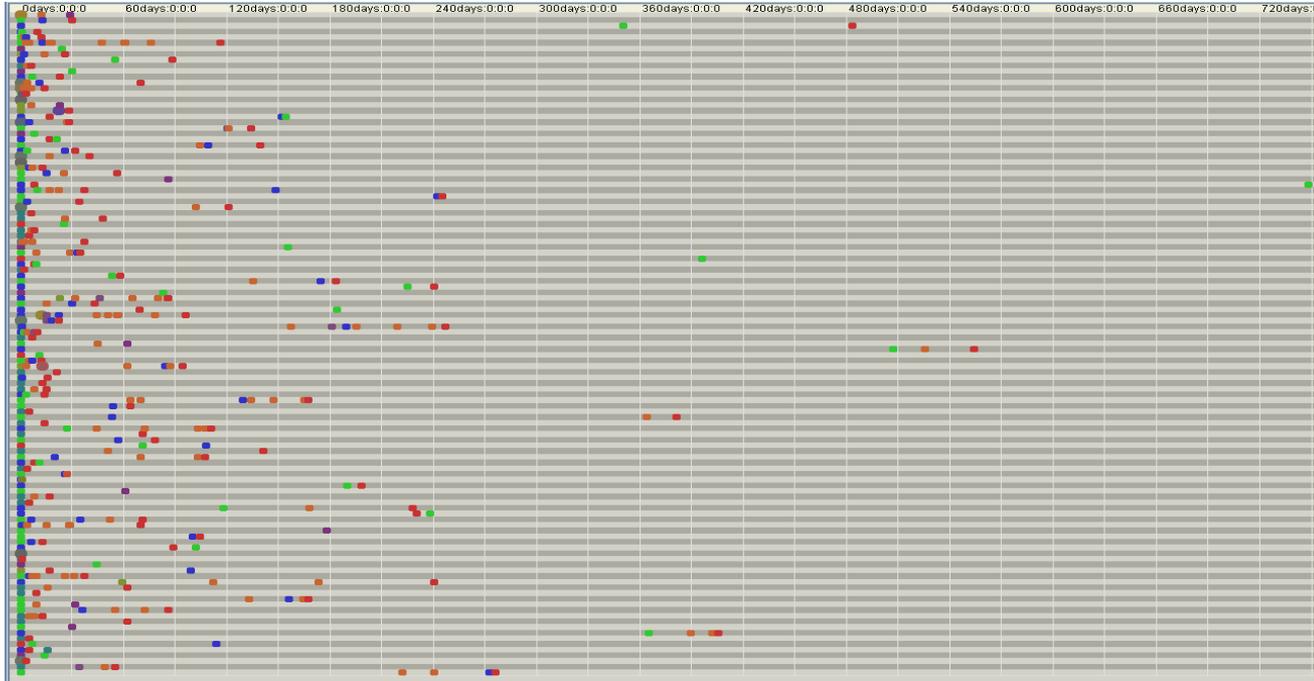
Analyse mit Prom: Inductive Miner



Analyse mit Prom: Fuzzy Miner



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 Wartezustände 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**

Vorraussetzungen 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 benutzbar, 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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