FAKULTÄT
FÜR !NFORMATIK

Faculty of Informatics

A Generic User Interface Concept for Adaptive Case Management considering CSCW Research

DIPLOMARBEIT

zur Erlangung des akademischen Grades

Diplom-Ingenieur

im Rahmen des Studiums

Medieninformatik

eingereicht von

Gustav Messany-Oberwandling, BSc, BSc

Matrikelnummer 0649460

an der
Fakultät für Informatik der Technischen Universität Wien

Betreuung: Univ.Prof. Dr. Geraldine Fitzpatrick

Wien, 28.09.2015

_____   _____
(Unterschrift Verfasser)   (Unterschrift Betreuung)

Technische Universität Wien
A-1040 Wien ▪ Karlsplatz 13 ▪ Tel. +43-1-58801-0 ▪ www.tuwien.ac.at

A Generic User Interface Concept for Adaptive Case Management considering CSCW Research

MASTER'S THESIS

submitted in partial fulfillment of the requirements for the degree of

Diplom-Ingenieur

in

Media Informatics

by

Gustav Messany-Oberwandling, BSc, BSc

Registration Number 0649460

to the Faculty of Informatics
at the Vienna University of Technology

Advisor: Univ.Prof. Dr. Geraldine Fitzpatrick

Vienna, 28.09.2015

_____   _____
(Signature of Author)   (Signature of Advisor)

Erklärung zur Verfassung der Arbeit

Gustav Messany-Oberwandling, BSc, BSc

Zagorskigasse 3/1/1, 1160 Wien

Hiermit erkläre ich, dass ich diese Arbeit selbständig verfasst habe, dass ich die verwendeten Quellen und Hilfsmittel vollständig angegeben habe und dass ich die Stellen der Arbeit - einschließlich Tabellen, Karten und Abbildungen -, die anderen Werken oder dem Internet im Wortlaut oder dem Sinn nach entnommen sind, auf jeden Fall unter Angabe der Quelle als Entlehnung kenntlich gemacht habe.

_____   _____

(Ort, Datum)   (Unterschrift Verfasser)

Acknowledgements

At this point I would like to thank everyone supported me with while writing this thesis. Particularly I want to thank Univ. Prof. Dr. Geraldine Fitzpatrick for kindly supervising this work and providing always valuable feedback and direction in difficult situations.

At this point I would like to express my sincere appreciation to my colleagues at ISIS Papyrus who supported me during the design process by elaborating new thoughts and perspectives.

I would like to thank my parents and my family for offering me the opportunity to study and finding my own place in this world.

Many thanks also to all of my friends for keeping me on and off the track. To my cats for letting me *never* alone. To my newborn son Constantin for hugging me and whining while writing the last pages and especially to my wife Sabine for the warm-hearted support and the space to gather energy and to catch my own breath.

Abstract

Adaptive case management (ACM) arose as an agile concept to support knowledge workers in their unpredictable work. The focus is on the goal and the data, instead of tasks and processes. The objective of this thesis is to create a user interface concept for adaptive case management considering previous computer-supported cooperative work (CSCW) research and following the user-centered design principles. To understand the needs and requirements of such a concept the reader gets introduced into the concept of adaptive case management, their core principles and components. The computer-supported cooperative work research is mainly following related workflow management approaches and comparing them with adaptive case management. Based on generic use cases *account creation* and *update account information* and two personas a user interface has been created and tested through a usability study. Finally the results of the study are discussed and reflected in the context of adaptive case management and computer-supported cooperative work. The usability evaluation shows that the perceived ease of use and usefulness of the proposed approach is positively received by the users and they feel empowered by the system. Critical facets are also discussed for the user interface design as well for the adaptive case management approach in the specific domains.

Kurzfassung

Adaptives Case Management (ACM) wurde entwickelt ,um als agiles Konzept Wissensarbeiter in ihrer unvorhersehbaren Arbeit zu unterstützen. Der Fokus liegt dabei dabei auf den Ziel und den Daten anstatt auf den Aufgaben und den Prozessen. Das Ziel dieser Arbeit ist ein Oberflächenkonzept für adaptives Case Management zu erstellen, welches die Forschungsergebnisse der computerunterstützen Gruppenarbeit (CSCW) berücksichtigt und den Prinzipien des benutzerzentrierten Designs folgt. Um die Anforderungen und Bedürfnisse eines solchen Konzeptes zu verstehen, wird der Leser eingeführt in das Konzept des adaptiven Case Management, dessen Kernprinzipien und Komponenten. Die Forschung aus dem Bereich der computerunterstützen Gruppenarbeit berücksichtigt hauptsächlich die Ansätze des Workflow Managements und vergleicht diese mit dem adaptiven Case Management. Basierend auf den allgemeinen Use Cases *Kontoerstellung* und *Aktualisierung der Kontoinformationen* sowie zwei Personas, wird eine Oberfläche erstellt und getestet mittels einer Usabilitystudie. Schlussendlich werden die Resultate diskutiert und reflektiert im Kontext des adaptiven Case Managements und computerunterstüzten Gruppenarbeit. Die Usability-Evaluation zeigt, dass die wahrgenommene Benutzerfreundlichkeit und -Nützlichkeit des vorgestellten Ansatzes als positiv wahrgenommen wird und die Benutzer das Gefühl haben mächtigere Werkzeuge bedienen zu können. Kritische Facetten werden diskutiert sowohl im Sinne des Oberflächendesigns als auch des adaptiven Case Management-Ansatzes in diversen Industrien.

Contents

CHAPTER 1

Introduction

Adaptive case management is a workflow approach arose in 2009 within an expert meeting [57]. It supports knowledge worker in their unpredictable work and brings increased agility and collaboration into the enterprise world. Knowledge workers have to complete complex set of steps which are mostly unique processes [21]. Adaptive case management is an approach combining process management and document management focusing on the required flexibility of knowledge workers. Managing cases is not new, but in response to today's business process challenges the requirements have been evolved [17]. Pre-defined processes are not enough to support knowledge-intensive work and this type of work is getting more and more important in the First World. Having a look at the numbers of knowledge-intensive work: Between 30% and 40% of all work in the USA and EU is done by knowledge workers. Between 1996 and 2004 in Germany the employment rate of knowledge-intensive services increased by 12.4% [61], and within the European Union an average increase of 6.8% between 2008 and 2014 [24].

> **Example:** *What is a knowledge worker? How he works in practice? A typical situation described by BITKOM [99] is Leona: she is working in the development department of a middle-sized company, creating new function-ality for a telephone installation. She has to gather requirements from the hardware providers and request new software updates from her own team. Sometimes like this week she has to do second-level support. She doesn't*
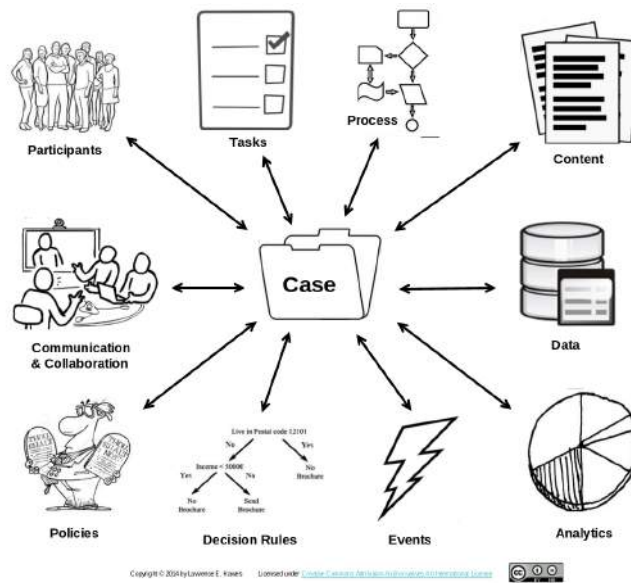
Figure 1.1: Adaptive case management components [37]

like it, but she knows it is important to solve the tough problems.

Leona often gets a call from customers ask about the status of a requested solution. Those calls interrupt her work and it takes a lot of time to get the requested information. Especially for those cases her colleague has created; then she has to go to the development department, find someone who is working on that problem, if there is any. Even more time-consuming is getting information from the hardware providers. She thinks it is lost time and she would like to change it, but sometimes her change requests don't meet the expectations. She is wondering if collaboration tools like Google Docs, Microsoft SharePoint or Dropbox might be a solution.

Additionally to the flood of mails, she creates task lists, but they are growing so fast that she is not able to handle them, reminders are not helpful. She discovered that a project management approach helps her in some cases, but not in all - the work is too flexible as she doesn't know what happens next week. She would like to delegate her work to her team member Jonas, but he often completes the tasks in a different way than she expected.

2

At the start of the day she wants to focus on the important tasks, meet deadlines and working on the new developments. In the evening she would like to have her work under control and be able to see her work results.

Leona is part of several teams: her development team as well as some project teams. One is a standardizing project with members throughout the world. She asks herself if those teams have a clear idea of their work and is afraid of that they lost their focus. Then her phone rings, a customer describes the problem of call forwarding in the current telephone system in certain conditions. Leona asks when the problem occurs, which conditions lead to the error and if it is reproducible. Her knowledge guides her. In this situation the knowledge worker has to be flexible and react creative on the customer's request.

Adaptive case management supports Leona in her work by providing the required flexibility by changing the workflow during run-time and predefined workflows for guidance. A user interface between Leona and the system assures that Leona can easily complete her tasks.

Which software could knowledge worker use? In 2015 companies using non-process supporting software products, custom software products or business process management software products 2. Non-process supporting software products have high flexibility but it is hard to reuse parts of processes or enforce regulations like laws or business objectives. Custom software products can fit all needs of a specific set of requirements, but they are not generic enough and hardly reusable in other contexts. Existing business process management approaches don't provide enough flexibility or don't provide as much structure as adaptive case management is able to provide. Overall adaptive case management is an approach which provides as much flexibility and structure as any environment requires. This for instance helps to reduce costs by getting new employees faster on the train and increases customer and employee satisfaction by providing the ability to react appropriate within the system.

When we look at the current literature and implementations of adaptive case management they are focusing on how adaptive case management works, what are the key elements, role

models and requirements, but nobody targets the user interaction. Questions like is it possible to use adaptive case management without knowing the concept? How could a user interface looks like supporting adaptive case management? Most scientific researchers in this area cooperate with enterprise companies. The access to enterprise software products is very limited for testing purposes. ISIS Papyrus offered the possibility to have a closer look at their adaptive case management solution. Another wiki-based prototype has been created by Hauder et al to combine adaptive case management and enterprise application management [70]. Available adaptive case management user interfaces are not following modern user interface concepts and they are not optimized for mobile devices.
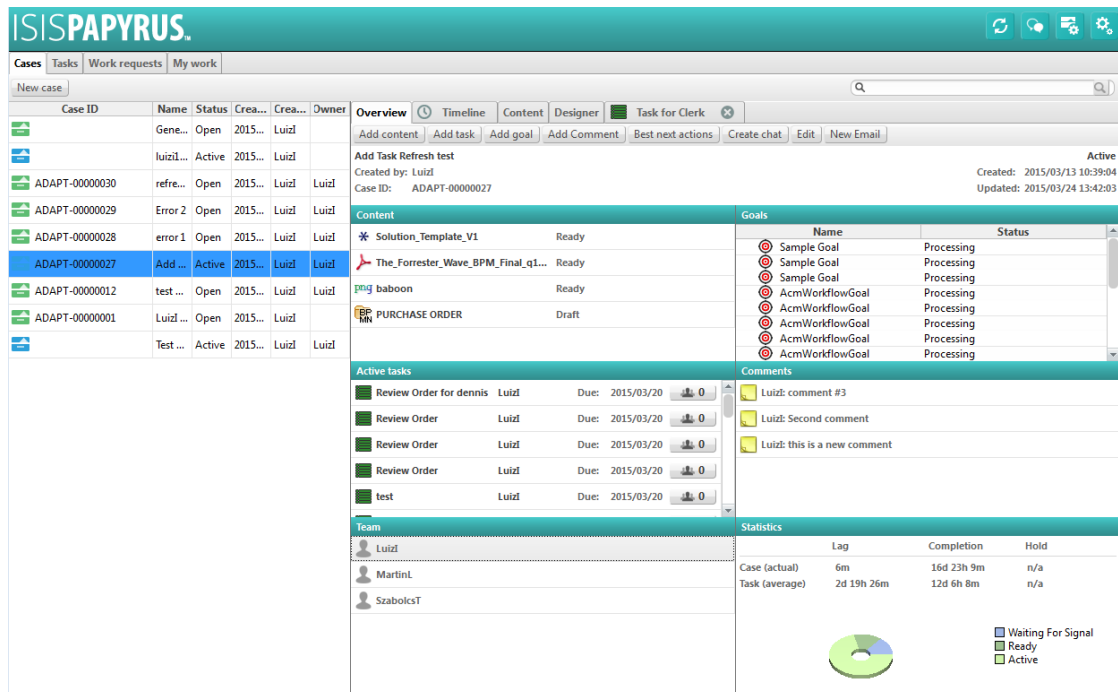

Figure 1.2: Screenshot of the adaptive case management solution of ISIS Papyrus
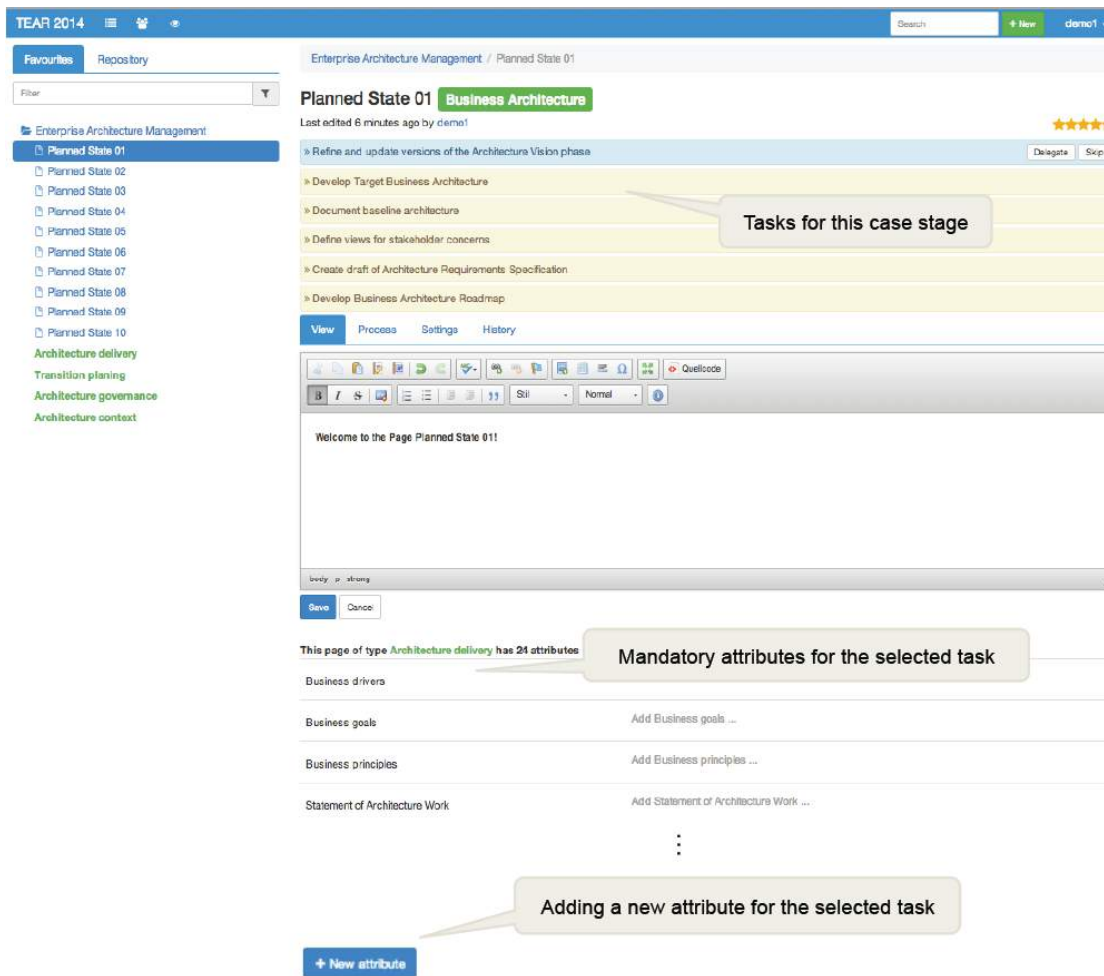
Figure 1.3: Screenshot of a case in the prototype of Hauder et al [70]

The result of this thesis is a generic user interface concept based on two requirement categories: First, a literature research as focuses on a comprehensive understanding of the field of adaptive case management covered by the user interface. Additionally a literature research were done in the research field of computer-supported cooperative work, one root of adaptive case management. It helped to identify related issues and supported the creation of the generic user interface. Second, a user research revealing the users' needs and beliefs to structure and prioritize the user interface elements. The research is based on the principles of user interface design, user-centered design and usability engineering. For the chosen scenario unnecessary features of

adaptive case management has been skipped, based on the requirements gathered from the users. The results of the user research are transformed in personas and use cases.

Based on those requirement categories sketches and wireframes has been created. They were interactively reviewed with the users and based on the wireframes a user interface element specification has been created. Finally a user study has been conducted to verify the usefulness and ease of use of the concept evaluated with a standard questionnaire. High user acceptance is a major goal of this thesis. A pre-study has been conducted to smooth out flaws of the user study beforehand. An area of conflict was the creation of a generic user interface concept for various domains while designing the user interface based on the principles of user-centered design. An assumption of this thesis is that getting the requirements for a generic area of work provides substantial information to create a generic adaptive case management user interface concept so that the findings of the study discover most important usability problems. To raise the odds to get meaningful feedback the generic area of work 'create and manage accounts' will be analyzed. 'Create and manage accounts' are common in various industries like bank, telecommunication, health and more. As assumed and confirmed during the personas interviews they are usually start at the very beginning of a process and can have no system preconditions.

Based on this motivation and the state of the art following research questions should be answered:

Is it possible to design a generic user interface concept of adaptive case management focusing on usability and get a good user acceptance?

What insights of the CSCW research are useful for creating an adaptive case management user interface?

The outcome: a generic user interface concept follows the design process described in the methods chapter 4. Starting with a literature research on adaptive case management and exploring related approaches in the CSCW research area. Followed by the methods: personas, use cases and mockups, a element specification will be presented in this thesis. Based on the specification a usability study has been conducted and the results, which supports a high user acceptance, as well as critical reflections were made in the end of the thesis. A generic user interface can be adapted to the specific requirements in various domains.

6

Adaptive Case Management

Adaptive case management is an approach combining process management and document management while supporting knowledge workers doing their work. Managing cases is not new, but in response to today's business process challenges the requirements have been evolved [17]. In knowledge intensive environments predetermined workflows are not always possible even if they are sometimes forced to follow business guidelines or adhere to the law. Adaptive case management provides flexibility by changing the workflow during run-time or using a predefined workflow for determined parts. It supports to bring agile, lean and collaborative processes into enterprise applications [70].

Adaptive case management (in short ACM) arose 2009 within an expert meeting. They realized that business process management(BPM) is not enough to support knowledge work nowadays [71]. Based on this meeting the expert team wrote a book with major impacts: Mastering the unpredictable [57] and as a follow-up Taming the unpredictable [60], both supervised by Keith Swenson. In scientific literature ACM is closley related to "dynamic case management" [17] or simply "case management" [17, 35, 86, 95]. In the enterprise context several name variants exists like "advanced case management", "agile processes" or "dynamic case management" which mostly follows the same principles as ACM, but not all in every single detail. ACM itself is driven by several parties and so far no uniform ACM framework exists. Palmer [78] and Matthias [54] proposes a slim domain specific framework whereas Pucher [72] is following a

domain independent ACM approach. This thesis is based on the domain independent ACM approach, but the theoretical part tries to cover all aspects of all ACM frameworks.

ACM tries to combine concepts from different research areas like *business process management*, *Enterprise-Content Management*, *case management*, agile software development and CSCW [71, 99]. This thesis will focus on an ACM user interface concept related to previous CSCW research. Commonly ACM advocates compares ACM with BPM to carve out the conceptual advantages of the ACM approach. Van der Aalst describes BPM as "Supporting business processes using methods, techniques, and software to design, enact control and analyze operational processes involving humans, organizations, applications, documents and other sources of information" [94]. While in BPM the focus is on the process. ACM experts noticed inflexibility in this approach and established a system which puts the data in the center, while the processes are built around. This product-driven case handling [92] allows the knowledge worker to really fulfill the needs to reach the goal, instead of being limited by the system to do, what the system allows.
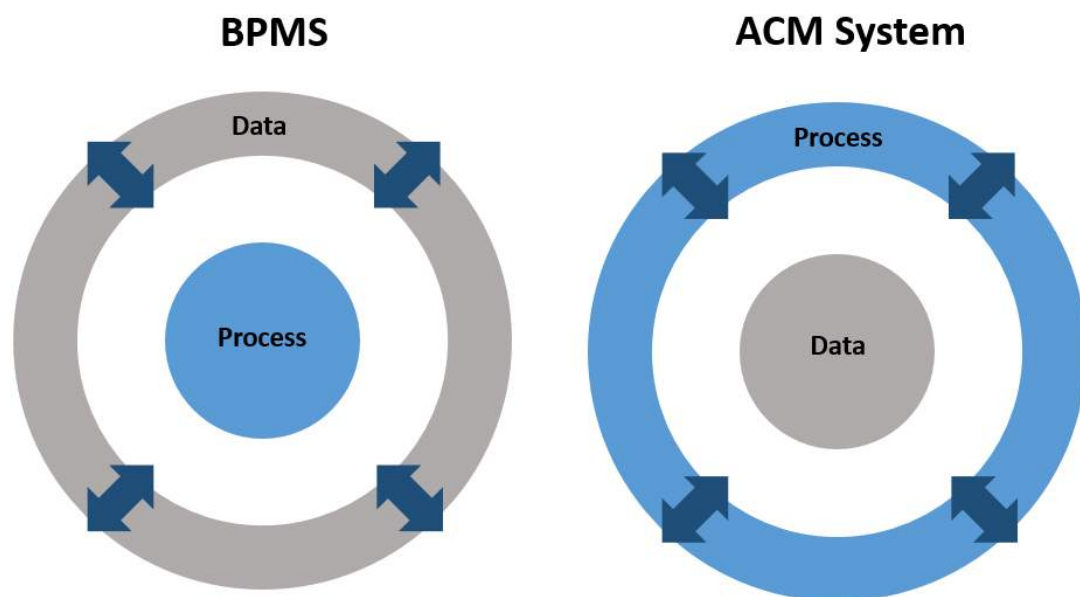

Figure 2.1: ACM: data is in the middle, based on [58]

The flexibility provided by this approach has also it shortcomings: employees and companies are used to rigid processes and a controlling unit is overloaded at the beginning. A major research topic within ACM is to improve guidance to newcomers by collecting data of previous cases [90]. Additionally collaboration is assisted by ACM: In complex cases there are always multiple parties involved and they need to collaborate to successfully reach the goal.

Altogether this leads to reduced costs, cycle time and an increased value [99]. In the following the key elements of an ACM system will be described.

2.1 Knowledge Worker

Davenport has written: "Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms." [91] In short: "You can't manage knowledge. Knowledge is between two ears, and only between two ears", the origin of the quote is uncertain, but usually it is granted to Peter Drucker, a pioneer of management theories and practices [83].

Mostly every action of a human being is based on their knowledge, but what is knowledge work all about? McCauley described knowledge work as managing "complex set of steps from the start of a case through to its completion" [21]. He describes following key characteristics of knowledge work within an ACM framework:

- **Goal Driven:** Every case must have a purpose, without a goal a case could never be closed, it would be directionless.

- **Knowledge Intensive:** As the name concludes knowledge work needs skilled and trained staff working on the process. With experience they get familiar with the tacit and explicit rules how to manage cases.

- **Highly Variable Processes:** Cases have a general structure in common, but they particular path is unpredictable. Knowledge workers need to act flexible and in ad hoc way.

- **Long Running:** A lifetime of a case can run for months or years. Because of the long time span the system might change, different people work on different aspects. Usually no one has a persistent holistic view over the case.

- **Information Complexity:** A various set of diverse documents and records are involved: Emails, meeting notes, forms, documents and more. It is difficult to handle that every single case related piece of information is stored in the same location and retrievable afterwards.

- **Highly Collaborative:** Complex tasks have different stakeholders. A knowledge worker needs to coordinate between all of them. This task is even more difficult since of the rise of social networks.

- **Multiple Participants and Fluid Roles:** Organizations are not stable systems and employees change often position or role. At different times multiple people are involved with the same or different roles.

- **Inter-related Cases:** The outcome of separate cases may impact another. A common example is the relation between members of a family. If a woman doesn't get accepted by a company, it influences the decision for the acceptance of her husband.

- **Juggling Fixed and Flexible Timescales:** A case consists of fixed parts like milestones and flexible parts in which knowledge workers might speed up to reach the deadline successfully.

- **Sensitivity to External Events:** External events may change the process of a case (e.g. a phone call from the lawyer that the basic legal requirements have been changed).

- **Cross-Organizational Visibility:** Supervisors can lose sight of the case when it moves to different departments within the organization.

- **History:** Every single piece of information, decision and action has to be tracked. Both for guidance of future cases and providing a complete view of the case to make decisions.

- **Demanding Security Requirements:** Protection of sensitive information is necessary. Because of the amount of data and involving various parties this is a tough challenge.

- **Isolated Pockets of Automation:** ACM processes have to be visualized and prepared in a way that knowledge workers can get into a case very quick. They need to control the case, stepping forward and backwards manually is essential. In general the knowledge worker should always have full control of the case.

The term knowledge worker was introduced in the 1950s by Peter Drucker [82]. The main goal of adaptive case management is to support knowledge workers in their work, to get things done - as the subtitle of the book 'Mastering the Unpredictable' [57] emphasize. The number of knowledge workers seem to raise continuously in the last centuries. Depending on the source and classification of what 'knowledge work' means, between 30% [40] and 40% [24] of all work in the U.S.A. and EU is done by knowledge workers. Between 1996 and 2004 knowledge work in Germany is increased by 12.6% [61]. Between 2008 and 2014 knowledge work in the EU (28 countries) is increased by 6.8% [24]. The increase of knowledge workers is an indicator for the need of more flexible approaches like ACM.

2.2   Case

A case is the central element of adaptive case management, both literally and figuratively. A case is similar to a container which includes all related data to achieve the case goal. Each case has at least one goal [27]. E.g. the case for the user study of this thesis is *account creation*, when completed it might contain:

- **Goals:** Account created, filled-out form stored, identification stored, checked by supervisor

- **Artifacts:** Application form, identification card, mails

- **Tasks:** Write mail to customer, upload form, upload identification card, create account, print hard-copy, check by supervisor

- **Actors:** Clerk, customer, supervisor

Templates

Under the premise that predictable, semi-predictable and unpredictable cases exist, it makes sense to create templates for the first two. Like in the workflow management it will be distinguished between case templates and case instances [99]. Case templates are default cases describing what is expected to happen, they are used to reduce initial work when creating a case. As soon as an instance is created from a template, case owner and case members will fit the case to the actual needs. This can be done immediately after creation or during work progress, to react quickly on deviations and external events.

As soon as several completed case instances are available for one case template, they can be analyzed to improve the case template. A shared environment for knowledge workers is a valuable resource for the company. The constant template improvement in the template library is an important aspect of ACM [28].

2.3 Goals

So far no ACM specific goal definition exists. One of the most common goal definitions in the project management area is S.M.A.R.T. [29], which is related to Drucker's management by objectives [88]. It is a mnemonic acronym with different meanings to different authors. The definition by Doran is:

- **S** - Specific: What specifically has to be improved?

- **M** - Measurable: What is the indication of progress? When is the goal reached?

- **A** - Achievable: Are they reachable?

- **R** - Realistic: Can the goal be realistically reached given available resources?

- **T** - Time-related: When can the result be achieved?

The time-related part is the only one formally addressed by using milestones. All other parts has to be verified during creation of the goal by knowledge workers themselves.

One case has at least one goal, but each goal can have multiple sub-goals. In case of "account creation": "filled-out form stored" and "identification stored" are sub-goals and therefore has to be reached before "checked by supervisor" can be completed. "Checked by supervisor" is again a sub-goal for the case goal *account created.*

2.4   Tasks

Tasks, also called activities or steps, represent the actual work [19]. Each task is related to a goal of a case [48]. A task is defined by the status (not-started, in progress, waiting, completed, etc.) and an associated action. After completion of a task it is known which worker has done what, where and when [56]. If tasks have to be done by another actor, the task has to be articulated properly in advance includes information like what, where, when, how, how soon or the level of quality [6]. Khoyi differentiate three types of tasks for ACM [19]:

- **Manual Task** refers to an activity outside of the case management system, it serves as a reminder.

- **Process Task** initiates a new process. E.g. a vote for the team if they would like to invite the applicant for the open job position in their team.

- **Script Task** is performed by the system and the action is done automatically as soon as it is triggered. E.g. updating the database.

All tasks can already be part of the template or the knowledge worker can add them as an ad hoc task. If not predefined, tasks can be completed in any order, but constraints can be used to enforce a sequence. Even in full knowledge work some processes must be done in a fixed order, as an example the supervisor has to successfully check the account data before the account can be created.

Tasks can either be mandatory or optional. Preferred are optional tasks to enable more flexibility. Sadly by this flexible approach users can easily lose orientation, especially if they

don't know exactly what they should do, like in the case for newcomers. To provide guidance users are supported with two concepts: case templates and pattern recognition.

Pattern Recognition

Pattern recognition systems basically observe all actions in the system and use this data to predict the best next action in a certain context [1]. To improve the learning process a proper set of domain specific features has to be selected, if measurable also company's key performance indicators should be considered. ISIS Papyrus developed a user-trained-agent, which rates the best next actions with a confidence level from 0 to 5, whereas 0 is no confidence and 5 is best confidence. Tran showed that negative learning reduces the time to get maximum confidence from 33 iterations to 10. This means that a user has to tell the system, that a proposed action is definitely nothing he would like to do in this context [90].

Pattern recognition within ACM is in an early stage and little products support such a feature. Still it offers some guidance to new users and it is expected that in a well-established predictable system it is quite reliable.

2.5 Artifacts

Artifacts are the content of a case, they can be links to objects outside or inside of the case management system. The type of an artifact can reaches from mails and notes to forms and images. The number of artifacts vary widely between types of cases [19]. Artifacts needs to be easily accessible through the related case in the ACM system.

2.6 Procedure Model

The previous sections described generic elements and their functionality, which led to several different implementations of ACM systems [60]. A theoretical framework is described by Kurz: a procedure and role model for ACM closely based on his BPM 2.0 process and role model [71].

This iterative approach is based on agile software development [99]. Mandatory for agile software development are iterations and incremental improvements. Each iteration includes a
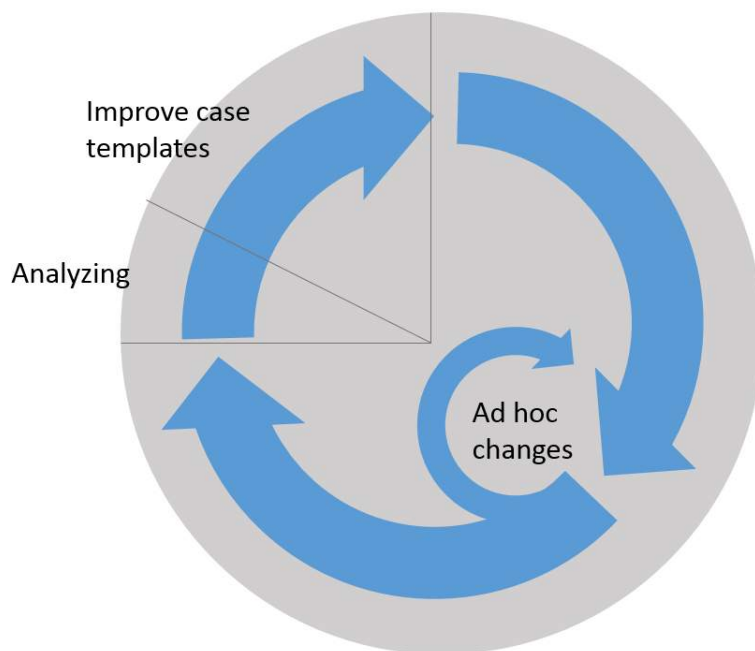
14

Figure 2.2: ACM procedure model. Based on [71]

phase of analysis, design, implementation, test and integration as well as cross-sectional tasks [12]. ACM is based on the same frame conditions as agile software development [20].

On creation of a new case a case template is used, which maps the requirements best. During the run-time changes on the case can be made. In general all knowledge workers can do structural changes like adding new tasks. In Kurz's procedure and role model everyone can discuss and contribute case changes, but they always have to be agreed by the case owner, as only he has a broad overview to estimate the impact of the changes.

After the case is completed business analysts can analyze and improve the case template according to their key performance indicator. Especially if several cases were completed, by different actors with different approaches. Implicit this is done by a proper pattern recognition system, but it seems to be worth to do the explicit work by an analyst as well.

2.7 Role model

Kurz developed a role model based on his own BPM 2.0 role model which is tight connected to the procedure model. This model describes the different roles of a knowledge worker within an organization. Several roles can be held by one and the same person, this is naturally common in small environments [71].

Role	Tasks and Qualifications
Case member	• is knowledge worker doing single tasks within a case. • has the needed knowledge to complete assigned tasks.
Case contributor	• is a case member, which is involved in the enhancement through informal contributions. • has elementary comprehension of the design of cases.
Case innovator	• is an employee picks up suggestions from other contributors and changes the case accordingly. • has basic skills to do simple case modifications.
Modelling expert	• proofs the formal and syntactical correctness of case or case template changes. • has know-how of syntax and semantics of case template or case component.

Method expert	- supports the structuring of case templates. - is an expert of structuring complex case templates and case components. - knows best practices, guidelines and rules of designing case instances by heart. - can estimate how single enhancements effects the ACM system and compliance guidelines and how they integrate in the complete ACM framework.
Domain expert	- verifies technical correctness. - evaluate relevance and impact of single enhancements and prevents local optima by his domain knowledge. - has knowledge across cases within a domain, knows all templates and components for a specific domain.
Case owner	- is responsible for the achievement of goals and advancement of a case. - can estimate how changes of a case impacts the achievement of goals.

Case controller	- checks completed cases for achievement of goals and derives improvements. - has know-how of process-oriented controlling methods and tools.
ACM manager	- develops the complete ACM system further and provides a macro-structure of cases. - own substantial influence in the company as well as management responsibilities.

Table 2.1: Role model [99]

This role model introduces several different roles, which on the one hand clears the responsibilities on the other hand increases the complexity of the system. This might be a reason, why current implemented role models are much easier, often differ only between case member and case owner, at least for the ACM system.

2.8 ACM Requirements

Adaptive case management as a business methodology is expected to fulfill various requirements. Different authors defined the ACM requirements and in the following the most significant ones for this thesis are described:

A short definition of requirements where given by Keith Swenson in comparison to BPM [59]:

- It is not based on the principles of scientific management

- It does not require that a process diagram be discovered and formalized beforehand

- It does not expect a large up-front cost to be recouped through a large number of repeated processes

Apart from the emphasis of run-time process definitions, Pucher lists more technical requirements of a real software solution [73]:

- Provide an ecosystem that enables structures (business data) and unstructured (content) information to members of structured (business) and unstructured (social) organizations to securely execute - with knowledge INTERACTIVELY gathered in previous processes - structured (process) and unstructured (case) work in a transparent and auditable manner (Pucher 2009).

- Provide a modelling repository that allows the explicit definition of the aforementioned business architecture ontology.

- Allow the instantiation of business entities from the ontology with (SOA or similar) data links to back-end silos.

- Empower business users to create and adapt processes from repository components as they perform the process.

- Organize processes and their resources and tasks around process goals and store those as templates

- Enable the definition of natural language rules by business users based on the ontology in the repository.

- Enable the creation of business resources (content and data) from the repository by the business user.

- Enable the capture, classification and data extraction of incoming business content from any channel.

- Allow execution-time delegation of tasks to authorized performers from a skill database.

- A real-time trained pattern matching capability for complex events and their business context based on the ontology.

- Offer a real-time view of all processes as either task lists or graphs that can be manipulated by authorized users.

- Provide the ability to store runtime created processes as templates for future use to fulfill defined process goals and customer outcomes.

Using a business user ontology, natural language and supporting supervisors with an overview should be part of an ACM solution. White collected a comprehensive set of more theoretical requirements for an ACM system [65]:

- Striking a balance between Practice and Procedure

- Capturing Implicit Rules and Tacit Knowledge

- Formalizing Experience - Supporting Learning

- Supporting Ad Hoc Change

- Involving Participants in the Design of Knowledge Processes

- Supporting Collaboration

- Supporting Decisions

- Effectively Coordinating Participants

- Managing Complexity

- Managing Artifacts

- Integrating Disparate Systems

As Pucher he sees a need in practice-orientation, ad hoc changes and learning. White also claim the need for highly collaboration and capturing of tacit knowledge. Especially those aspects will be addressed by the following chapter.

2.9   ACM Summary

This chapter provided an overview of the adaptive case management approach. The advantages like flexibility, guidance and focus on get things done are highlighted as well as known problems like required responsibility. Knowledge work is getting more and more important and ACM was developed to support knowledge workers. In the previous research the user interface and user interaction got no attention. Modern user interface concepts as well as support for mobile devices

is not considered. To come back to the research questions: the described concepts in this chapter are used for the design of the generic user interface concept. The needs of knowledge workers are part of the Personas. Concepts like goals, tasks, pattern recognition, artifacts or the role and process models, are covered by the user interface concept as far as required for the chosen use cases.

Literature review

Adaptive case management is a small academic research field with less than 100 papers. Two literature reviews were written about research challenges in ACM [36, 69]. Combined with a key word search for *adaptive case management* and equally key words, I had a comprehensive overview of ACM.

3

Computer-supported Cooperative Work

As described in the previous chapter 2 adaptive case management is based on concepts in many areas. Knowledge worker, collaboration, adaptive workflows or goal-orientation are examples rooted in computer-supported cooperative work(CSCW). In this area questions are asked like how computers can support cooperative work, a typical requirement in knowledge-intensive work environments. The term "Computer-Supported Cooperative Work" was introduced by Irene Greif and Paul Cashman back in 1984, describing an interdisciplinary workshop they were organizing on the topic: how to support people in their work arrangements with computers [41]. At first view this seems to cover a broad area of research, at closer inspection this is true. CSCW researchers ask questions like: ''What are the characteristics and hence the general support requirements of cooperative work as opposed to work performed solely by individuals? Why do people enter into cooperative work arrangements and how can computer-based technologies be applied to enhance their ability to do whatever it is they strive to do by cooperating? How can the coordination requirements of cooperative work arrangements be accomplished more easily, rapidly, flexibly, comprehensively, etc. with information technology? What are the implications of these requirements for the architectures of the underlying systems and services?" [56].

Based upon the research area's size it is not easy to give a clear definition of CSCW. Greif defines CSCW as "an identifiable research field focused on the role of the computer in group work" [41]. While Greif's definition focuses on the role of the computer, Bannon and Schmidt find "CSCW should be conceived as an endeavor to understand the nature and characteristics of cooperative work with the objective of designing adequate computer-based technologies" [62]. As the researchers didn't want to be a side car of Groupware, they wanted to really focus on the social aspects of the cooperative working and so Suchman came up with a weaker definition: CSCW is "the design of computerbased technologies with explicit concern for the socially organized practices of their intended users" [63]. Their efforts were rewarding, in 1999 Carstensen and Schmidt claimed Groupware as a part of CSCW, while Groupware describes the implementation of theoretical considerations of CSCW research [84]. At the time this thesis is written, also Wikipedia advance the view of Carstensen and Schmidt [97] and categorize Groupware as a part of CSCW.

With CSCW researcher focused on what the actual customer needs [56] and though introduced user-centered design. Decisions were not made on prejudices, law or labor market agreements [56]. This practical part of this thesis bases on established user-centered design principles and methods which will be described in detail in the Methods section.

Before we look at the workflow part of CSCW three things have to be discussed first: social work, wicked problems and knowledge sharing.

Social work

Schmidt [56] says that all work is complexly social and we are social animals. But he also states that we are not always mutually dependent in our work. Individual work is inherently distinct from cooperative work, both in theory and practice. Cooperative workers have to articulate their distributed individual activities and must do tasks, which are not directly impact the product they are working on, like writing a to-do list for his colleague. Schmidt thinks for CSCW this conception is quite appropriate for following reasons [56]:

- Cooperative ensembles are either large, or they are embedded within larger ensembles.

- Cooperative ensembles are often transient formations, emerging to handle a particular situation after which they dissolve again.

- Membership of cooperative ensembles is not stable and often even nondeterminable. Cooperative ensembles typically intersect.

- The pattern of interaction in cooperative work changes dynamically with the requirements and constraints of the situation

- Cooperative work is distributed physically, in time and space.

- Cooperative work is distributed logically, in terms of control, in the sense that agents are semi-autonomous in their partial work. Cooperative work involves incommensurate perspectives (professions, specialties, work functions, responsibilities) as well as incongruent strategies and discordant motives.

- There are no omniscient agents in cooperative work in natural settings.

All of those reasons apply also to adaptive case management. Nobody knows everything; Work is distributed physically as well as logically; In one case there are mostly different people involved and so on.

Wicked problems

In 2.1 it is already depicted that knowledge work can not be solved in advance. Rittel and Webber characterized two types of problems: wicked problems and tame problems [38]. While tame problems can be solved sequentially by a predefined process, wicked problems can not be handled that way. Tame problems are well covered by rigid workflow systems. Fitzpatrick writes they arise mostly in the social realm and lists a set of key properties of wicked problems [31]:

- There is no definitive formulation of a wicked problem. The problem is only understood progressively as solutions are developed.

- Because problem definition and solution co-evolve, and because there are no criteria for determining when the problem is adequately defined, wicked problems have no internal stopping rules.

- It is not possible to exhaustively enumerate the set of possible solutions.

- Solutions are never true or false but instead are qualitatively judged as better or worse. A 'satisfying' or 'good enough' solution is the realistic goal.

- There can be no immediate, ultimate, or definitive test of a solution because the consequences can possibly extend across time in any number of ways; also rigorous experimentation of possible solutions is not possible.

- The process of solving a wicked problem is inherently non-linear. Progress is defined qualitatively in terms of how much more is understood about the problem rather than distance from the solution.

- There are a number of stakeholders who are interested in how a wicked problem is solved. Each could make different qualitative judgements about the nature of the problem and the value of the solution.

- Every instance of a wicked problem is essentially unique.

- Every wicked problem can be considered to be a symptom of another problem. The problem should be settled on as high a level as possible.

Wicked problems and knowledge work are not the same. Still ACM is on a good path to handle wicked problems, while former approaches like business process management(BPM) would have much more difficulties with them.

Sharing Knowledge and Expertise

CSCW also addresses knowledge and expertise sharing, which is closely related to what described already in 2.1. In CSCW the social part of knowledge gets more attention. Ackerman states that "social is an essential part of using any knowledge" and that this happens e.g. by information systems and computer supported cooperative learning software [68].

3.1 Workflow Technology as a Part of CSCW

Bowers et al. understand by "'workflow technology' [...] any technology designed to (in some way) give order to or record the unfolding of work activity over time by, for example, providing tools and information to users at appropriate moments or enabling them to overview the work process they are part of or to design work processes for themselves or others or whatever" [47]. The research on workflow technology is the most relevant part of CSCW for ACM. Per definition ACM is a workflow technology as it supports the knowledge worker to reach a goal by providing a proper overview over the whole case and it can provide a process description, if sensible from the case owners point of view.

The Dual Use of Workflow Technology

The paper of Bowers et al. [47] reports a fieldwork from a printing company using a workflow technology called PrintFlow PF2. They noticed several shortcomings of the system e.g when one employee is doing a process. Without the formal system employees could take over a job on the quick, but with PF2 in use the flexibility got lost. Apart from the problems of the system, Dourish [81] exposed two roles of the workflow technology. First to manage the work of the printing

worker so that the sequence of work activities are right and their coordination is managed. The problems addressed by Bowers et al. are attributed to this role. Second to get an overview of the status of all work activities in the printing company, both for coordination as well as organizational accounting. A client was able to inspect the current status of its jobs and in that role, PF2 was much more successful.

Workarounds and Viscosity

One workaround of the printing shop employees was to write all working information on a sheet of paper instead of using the system during work time. In the evening a single person had to enter all the information into the system. On the one hand this method provided the workers the flexibility they needed to reach the goal efficiently, but on the other hand they had a lot of overhead as well as the status of the shop's work was not up-to-date during the day.

Poelmans defines a **workaround** as a "coping strategy that deviates from the strategies that have been defined the WFS [workflow system]. Endusers work around the system to save time and/or efforts to avoid the limitations of the WFS" [89]. This doesn't need to be necessary negative, depending on how much they impact the rest of the system and how much additional effort it takes.

Viscosity is defined by Poelmans as the "perception of extra efforts that do not contribute to the enduser's goal" [89]. Well this depends on what the worker is perceiving as the enduser's goal, but sitting an hour in the evening to put handwritten data into the workflow system, as done in the printing shop, could be mostly seen as high viscosity. The aim of a good workflow system should be minimizing viscosity and maximize perceived ease of use.

Criticism on Process-based Workflows

'Automate the office', under this premise early computer systems where developed [13, 14, 75, 76]. But such systems have been admitted as failures [30]. Schmidt says about those systems: "information is treated as something on which office actions operate producing information that is passed on for further actions or is stored in repositories for later retrieval" [56]. In the ACM context we defined such work as predictable cases 2.2. Schmidt sees it difficult to build computer

systems concerned only of the *information flow* instead of supporting the articulation work to make the *flow* possible.

Dourish raises 3 objections of process-based workflows [81]:

1. **Routine work of business processes doesn't exist:** process-based workflow systems lean on the concept that same tasks are handled in the same way again and again. Ethnographic studies of work has revealed that work activities are ad-hoc and improvised [34, 64]. Still for managing and describing work they may be useful, but not as a "generative function in organizing behaviour" [81].

2. **Flaws of the Speech Act Theory:** Theoretically workflow systems are based on the Speech Act Theory introduced by John Austin [52]. Button [33] arguments that the Speech Act Theory itself is flawed and is not an appropriate theoretical foundation. According to Dourish [81] those critics focus on the infringement of "speech act theory's explicit, stable and abstract categorization of utterances with the situated, indexical and circumstantially contingent nature of linguistic action".

3. **Who defines the essence of workflows:** The core of workflow systems is the categorization of actions, what can be done. The question is: Who defines which actions can be done? Dourish states that a "process representation presents a 'cleaned up' view of the world that strips away irrelevant detail to reveal the essence of the work" [81]. But who defines that and are those really invaluable actions?

As ACM is goal-based instead of process-based routine work as well as the essence of workflows are abolished. The objection regarding the Speech Act Theory addresses ACM as well, but in ACM the articulation is done by the knowledge worker. This bottom-up principle might neglect some proposed flaws.

3.2 Document-centered Collaboration

In the beginning of this millennium in CSCW a new approach has been explored: document-centered collaboration is in some sense similar to adaptive case management as the focus is completely on the data. Contrary to ACM the coordination functionality is onto the documents themselves, whilst in ACM it is on a case and provide thus a longtime context. The documents are accessed by external applications, but those applications don't have any control about them [2].

Maui is such a document-centered collaboration software. Developed by LaMarca et al. coordination functionality is provided through active properties on the documents, in response to user actions such as reading or editing. An advantage compared to other workflow systems is that users can use any tools to work on documents. The workflow system restrain no activities performed over documents, so that the system only provides coordinative functions, and nothing more.

Content Coordination

Computer applications focus on *content manipulation* [2]. They define which content is accessible by whom, organize the content, record activities on the content and present the content. As previously shown, Schmidt and Bannon [56] argue that articulation work is central in CSCW. This *content coordination* work, who works on what, when and why, are elementary in CSCW environments. Systems which focusing only on one of the two aspects are only useful in specific scenarios [2]. Document-centered collaboration as well as ACM embrace both aspects, the first in documents, the second in cases.

Another differentiation of content coordination is between *monolithic systems* and using a *collaboration harness* [2]. In a monolithic system the manipulation and presentation content can be fully integrated, whereas a collaboration harness shares single-user applications. The second approach proved to be useful only in specific scenarios such as remote presentations [2]. E.g. if someone updates a document and all other users have to be notified, this can't be done if not one system is covering everything. But by putting the coordination functionality into the documents,

this is possible.

Drawbacks of document-centered collaboration

LaMarca et al. constructed their system as a general purpose tool. The drawback of those tools are that they lose the tight semantic binding that specialized applications provide [2]. ACM is not affected by this drawback, as the workflow logic is in the case and the semantic binding can still be maintained.

3.3 Adaptive Workflow Systems

In 1999 Bernstein [3] addressed the need of adaptiveness in workflow systems: deviations in the ideal process can include process enactment errors, violations of the assumptions or changes in the business environment. Bernstein claims that if such exceptions are not detected and handled effectively, they severely impact the effectiveness of collaborative work.

At this time workflow systems provided little support for such challenges, when a process model started execution, modification was not allowed anymore. Exceptions are handled by adding conditional branches for all possible paths. But first, it is difficult to cover all possible states and second, adding such branches complicates the process model and obscures the "preferred" processes [3]. Systems which supported dynamic workflow modifications, did not help the user to handle the exception nor was it possible to modify the underlying process model template for reuse in the future. In the last years BPM addressed these concerns by introducing adaptive BPM and BPM 2.0 [79], but still it is much more rigid than ACM. Dr. Bussler of Boeing said that "workflow solutions aren't flexible enough to cope with exceptions in the process and organizational/policy changes. He concluded that workflow systems have to be more adaptive and able to cope with exceptional changes" [3]

Since then adaptiveness established as a requirement of process management systems and in 2014 Heß analyzed the intuitive notations and interaction design of such systems. He summarized that "the challenge of allowing end-users to understand, adapt and manipulate adaptive software systems has been addressed by developing simpler notations. These nevertheless still

are not to easy to use" [50]. While he states in the following that a certain level of complexity is necessary, ACM offers several ways to adapt the workflow. While there is a certain complexity for analysts in design-time, during run-time modelling knowledge is not required.

Why Managing Processes is not Possible

An interesting implication comes from Dourish: "if the process description is not deeply intertwined with the work activity itself, there is no reason for there to be simply one" [81]. A single action in a system might play a role in different processes. For instance, when ordering a PC for a project, the project goal is met, a step is taken in the budget management process for the group, and a process for the computer support is initiated. In traditional workflow technologies it is difficult to implement this except by defining a single enormous process, which includes all activities of all groups somehow connected to any action within the process, but it is not recommended by process modelling languages like BPM.

Visualization and Managing

Dourish proposed as the second role of workflow technologies to provide an overview of the system 3.1. In the PF2 context, the process is visible for their customers, which are mostly interested that their job is getting done promptly and efficiently, means their money is being well spent. Dourish focuses on the this role of a workflow system and believes it is the important one. The system is used to visualize the workflow rather than managing it. In this role the system doesn't have to enforce the workflow, it has to perceive it and visualize it [81].

The critical part is, that both roles are not in different systems. So that one would manage the tasks and another would clean it up and present it, Dourishes thinks that it would be no problem at all if those where two different systems [81]. The tension is created by having two different use cases, two roles in one system and the system has to serve the needs of both.

Workers Need Informal Work Support

Schmidt points to the importance of informal work support [56]. Office procedures require solving activities and negotiation with co-workers, not only in terms of acting as a human, providing

companionship and emotional support, but also that they are "crucial to the actual conduct of the work process itself" [56]. Schmidt sees evidence for this in environments where workers following exactly the rules and the office grinds to a halt very quickly. ACM by itself doesn't support informal activities. Most systems are enhanced by comments, chat or even social network functionality to back informal activities.

Support Practice-centered Awareness

To effectively work on a process it is essential to be aware of what happens and what others did and how and why. Anya and Tawfik [80] addressed this field. At first they noticed that currently computer-mediated collaborations focus on synchronous collaboration and they do not consider sufficiently the nature where the problem is solved. In their system for medical practices doctors in different locations had different approaches. 96.1% of the participants said that they do not have confidence in accepting information from across borders because of lack of trust [80]. Even if all clinicians have the same goal: providing the most effective care for their patience, people do not trust approaches outside their boundaries. For effective cross-boundary e-health decision support they evolved following characteristics:

- Perception of the subject domain or field of work:

- Bridging boundaries in order to maximize transparency

- Perception of the place and time of work

- Differences are reconciled by common goals and shared artifacts

- Sharing awareness information

- Perception of situated or circumstantial factors

- De-contextualization and morphing in clinical reasoning

On the whole it can be expected that most of these characteristics are also relevant in cross-boundary support in other domains. So far this is not inherently part of adaptive case management.

3.4 CSCW and ACM

Adaptive case management is often said to have its roots in the CSCW field [57, 60]. Having a closer look at related research topics in the CSCW area, this statement held true. Does provide CSCW additional insights for an adaptive case management user interface? Yes, adaptive case management considers recent results of CSCW, but obviously there is much more in-depth CSCW literature available. Additionally comparing previous approaches with adaptive case management helps to know what does work and what doesn't when creating a generic user interface.

First at all we differentiated individual work to complex social work 3, whereby in the latter one articulation work is needed. We also highlighted wicked problems 3 in contrast to tame problems. While tame problems are solveable by all rigid workflow systems, it is not obviously if ACM would be able to handle all wicked problems. Yes, comparing to existent workflows systems ACM has much more potential to solve wicked problems, but within ACM it is expected to improve case templates by using key performance indicators. In wicked problems there are not always quantitative indicators available how good a certain goal has been reached. All research of CSCW about knowledge and expertise sharing is also relevant for ACM 3.

Workflow Technologies

As ACM is a workflow technology, the related research in CSCW is of interest 3.1. The differentiation by Bowers et al. about the dual use of workflow systems 3.1 shed light on ACM. By default ACM provides a case overview which supports the second role of workflow technologies already well. Enhancing most ACM systems provide additional visualization for managers and customers to retrace the workflow. With this approach the different needs of each stakeholder can be covered: the knowledge worker can see all information he needs to reach the goal, while in the same system visualization for each stakeholder can be created as demanded in 3.3.

Workarounds 3.1 are inherently designated by allowing the knowledge worker to create custom ad-hoc tasks and writing notes to objects in the ACM system. This integration of workarounds in the system should stimulate positive impacts and prevent negative impacts.

Except for the analytical part viscosity is tried to be minimized in adaptive case management. ACM supports the articulation of information flow, but first put words in the knowledge worker's mouth. This allows the knowledge worker to go its own path, but recommend to use the existing ones. As long as the worker knows what he is doing, that seems to be a good trade-off.

Document-centered Collaboration

Document-centered collaboration 3.2 has a similar definition, but the fact that everything is about documents and not cases, the impacts are huge. Mostly noteworthy a case can have process descriptions and a context. Apart from that it is interesting that despite their similarities document-centered collaboration is not mentioned in the ACM literature.

Adaptive Workflow Systems

Adaptive workflows systems 3.3 are one source ACM is based on, at least with it's realization in BPM enhancements. ACM allows users to modify the process in two ways: by using a modelling notation as well as directly on the case by creating new tasks or update existing ones. While the first is designed for analysts, the second is frequently used by knowledge workers to adapt to external events. External to the system informal work has to be supported 3.3. There is no inherently support for this aspect within ACM, but is neither prevented. Some ACM systems implemented chat or social network functionality to address this. The last point in this thesis about CSCW was the awareness of others 3.3. While the aim of ACM is to provide all important information within one context, they might also provide insight of the subject domain. This is worth to have a closer look in future research.

Literature review

Searching in the computer-supported cooperative work research field is more complicate. It is huge with thousands of papers written over decades. Initially I've started with a few core papers provided by the expertise of Fitzpatrick. From that point I've extended the search by using key words and cross-references.

CHAPTER 4

Methods

This thesis is based on two methods: a literature research in ACM and CSCW for the theoretical part and user-centered design for the practical part.

4.1 Literature research

This thesis includes several topics and so the literature research required different approaches.

- **ACM:** Explained in the summary of the adaptive case management chapter 2.9.

- **CSCW:** Explained in the summary of the computer-supported cooperative work chapter 3.4.

- **Methods:** Based on classic books like *The Inmates Are Running The Asylum* [4], *Sketching User Experiences: Getting the Design Right and the Right Design* [98] or *The Elements of User Experience: User-Centered Design for the Web and Beyond* [51] I've chosen the methods most fitting the user-centered design to define a user interface concept for adaptive case management. Additional required details were found by a key word search and references.

4.2 User-centered Design

The user-centered design community established multiple techniques, methods and approaches to understand the work context and provide a proper solution considering the actual customer needs. At the beginning of user-centered design process the question 'what is needed?' needs to be answered. As adaptive case management is a workflow approach used by multiple domains this question is not an easy answer. The assumption is that focusing on an area of work used in most domains provide a good insight if the user interface concept does work. I hypothesized that creating an account and updating the information of an account is used in most adaptive case management systems. The discussion with various users supported that hypothesis throughout the design process.
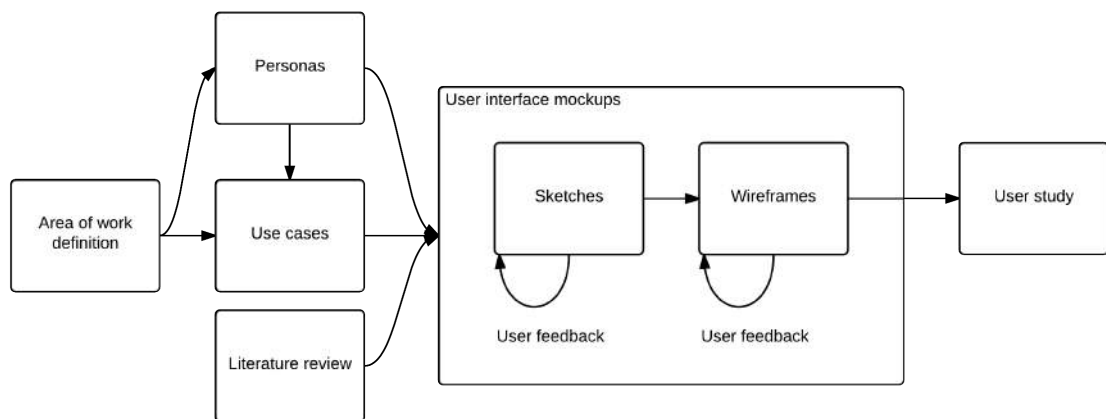
Figure 4.1: Design process followed in this master thesis

Phase	Task	Material used	# of participants
Personas	Describing, Informal interview	Paper, Persona template	5
Use cases	Describing, Creating scenario	Paper, Use case template	2
Sketches	Reviewing, Brainstorming	Beamer, Laptop, Whiteboard, Paper	3
Wireframes	Reviewing	Beamer, Laptop, Whiteboard, Paper	3
User study	Interview, Usability Study	Laptop, Questionnaire, Paper	6

Table 4.1: Summary of stages in the user-centered design process

A critical part of a user-centered design is the selection of users. In this thesis considered is: diversity of age, gender, job position and business domain. People were recruited from my business and personal contacts complying the requirement to do at least sometimes the workflow of creating and managing accounts. Due to anonymization the names were changed.

Name	Age	Gender	Position	Domain	Phase
Konrad	48	m	Clerk	Health, Sales, IT	Use cases, Wireframes
Erwin	52	m	Manager	IT	Persona, Wireframes
Anna	34	w	Clerk	Marketing	Persona, Wireframes
Sarah	24	w	Owner	Insurance broker	Persona, Use cases
Sabine	42	w	Manager	Bank	Persona, Pre-study
Thomas	23	m	Clerk	Bank	Persona, Pre-study
Maria	53	w	Owner	Insurance broker	Usability evaluation
Simon	64	m	Manager	Insurance	Usability evaluation
Claudia	28	w	Clerk	Telecommunication	Usability evaluation
Susanne	24	w	Doctor	Health	Usability evaluation
Sonya	22	w	Clerk	Sales	Usability evaluation
Daniel	37	m	Clerk	Sales	Usability evaluation

Table 4.2: Table of participants in the user-centered design process

Erwin and Konrad are also experts in adaptive case management. Their knowledge and feedback were used in the initial design stages to assure that the user interface is covering the requirements and following the principles of adaptive case management.

For this thesis qualitative user research methods are used and described in detail in the following sections.

4.3 Personas

The persona method where introduced 1999 by Cooper in "The Inmates are Running the Asylum" [4]. A persona is a stereotypical representation of users and it is fictive. The first advantage is, unlike real users a persona is always present. If precise specified, designers and developers can put themselves in the position of the users and are closer to them, if necessary for problem solving. The second advantage of a persona is, real users have funny quirks and behavioral anomalies, positive as negative. Single users can widely vary in cognitive performance - a persona smooths this peculiarities.

The creation process of personas following the advices of Cooper by starting with a reasonable approximation and quickly converge on a believable population of personas. 5 participants were invited for a session to define common employees in their working area. With each participant I had an informal interview to gather their experience and knowledge about common qualities, values, goals and other properties of personas. I've shown the participant a hardcopy of the persona template by FakeCrow [26] and asked the participant to describe common workers and fill-out the categories based on their experience in the industries and companies they have been worked in. After those interviews I've collected the hardcopys filled with notes and created distinct personas matching as good as possible the descriptions from the participants. In a second short meeting I've shown them two personas to 3 participants to collect feedback. They rose a few amendments and the personas has been updated accordingly.

4.4 Use Cases

Use cases where formulated the first time 1986 by Jacobson and popularized in 1992 by his book "Object-Oriented Software Engineering - A Use Case Driven Approach" [44] for capturing functional requirements. Jacobson defines: "a use case is all the ways of using a system to achieve a particular goal for a particular user. Taken together the set of all the use cases gives you all of the useful ways to use the system, and illustrates the value that it will provide" [45].

The scope of the use cases should cover the requirements of a generic process of creating and managing accounts. The use cases were developed with two participants: Konrad worked in various domains like Health, Sales and IT and is a process analyst as well as an expert of adaptive case management. As the details of the process can be very different in each domain, we decided to use an abstract scenario which covers the similarities of each domain. He stated that the software needs to be customized to cover domain-specific requirements. The second discussion held with Sarah, a young owner of an insurance broker company. She confirmed the validity of the abstract scenario in her domain and noted as well, that some customization needs to be done.

The written notes of the discussions were summarized and put in a use case template [16]. Both participants gave feedback on the use cases and minor amendments were done.

4.5 User Interface Mockups

Merriam-Webster dictionary describes mockups as "a full-sized structural model built to scale chiefly for study, testing, or display" [74]. In contrast to prototypes they have no functionality. They only serve as a quick access to get an idea how the system actually works. This improves the feedback frequency and lead to faster design cycles, which should lead to a better design [98].

The creation of mockups took the most time. Various ideas were created in this stage. Review cycles were held with 3 participants at the beginning on a daily base, in the later phases on a weekly base. The mockups were presented to the participants and they explained what works for them and what not. As Konrad and Erwin are also experts of adaptive case management they had two different perspectives on the mockups which provided additional insights and ensured

that the functionality and principles of adaptive case management are covered as well. Anna served as a neutral person with no experience in adaptive case management to discover major usability problems for people with adaptive case management experience in advance. Verbal feedback, written notes and sketches of new ideas were used to create the next set of mockups. The results of the phase can be divided in two different kind of mockup types: sketches and wireframes.

Sketches: Buxton captures the most relevant attributes of sketches as: quick, timely, inexpensive, disposable, plentiful, clear vocuabulary, distinct gesture, minimal detail, appropriate degree of refinement, suggest and explore rather than confirm and ambiguity.

As a mockup type sketches were used to explore design ideas, to open the mind of the designers. It is not about what design is the right, it is about which design paths are possible. Julie Zhuo, product design director of facebook visualized the ways of using or not using this design approach:
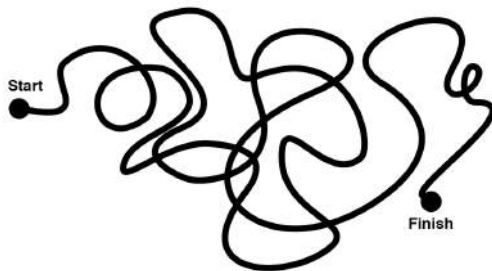
Figure 4.2: Junior designer's process [55]   **Figure 4.3:** Senior designer's process [55]
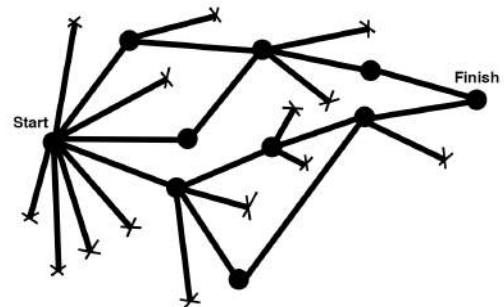
Wireframes: If sketches are the callow type of mockups, wireframes are the mature ones. They show the user interface with all its elements and interaction while leaving out the design. The visual design is the last part of the development process and not part of this thesis. According to Garrett [51] wireframes contains information design, navigation design and interface design.

As wireframes are close to the actual product in terms of design, they were used for the

element specification as well as the usability study. The information and interface design is well represented, the navigation is provided by allowing interaction with the mockups with hyperlinks.

4.6 Usability Evaluation

To test the user interface concept the think aloud method, a qualitative user research method, has been used. "People are used to do the job, not to explain it" [67]. It is possible, that the explanation is incomplete or even incorrect. A good method to get the information you want is to instruct the user to work and they should think aloud. It is recorded and used for analyzing the design process. Van Someren states that think aloud protocols are a very direct method to gain insight in the knowledge.

The think aloud method is coming from psychological research and dates back to 1930s and 1940s [67]. In the usability field it got introduced by Lewis in 1982 [15]. Two types of think aloud methods exists:

- **Concurrent think aloud:** The user is thinking aloud during he is working on the task.

- **Retrospective think aloud:** The user has to complete the task first silently. Afterwards he has to verbalize the process.

Despite the popularity of the concurrent think aloud method it changes the way the user works. The performance might be better or worse and both is not wanted. Van den Haak and de Jong did a study to compare both methods. Overall both methods resulted in similar numbers and types of problems, but in the retrospective think aloud method the added value of the verbalization was more substantial [66]. In a study by Guan et al. the validity of retrospective think-aloud method was measured by eye tracking. They found retrospective think aloud to be valid and reliable and it's not affected by task complexity [100]. In this thesis both methods are used. The concurrent think aloud method for the pre-study to find logical and design errors of the wireframes. The retrospective think aloud method for the actual study to identify usability problems.

The details of the evaluation are described in the Usability Evaluation chapter 6.

Design of the User Interface

The goal is to provide a user interface concept for adaptive case management by user-centered design. Adaptive case management is a workflow system designed for various industries and user groups and to consider all user requirements would be out of the scope of this thesis. To reduce the complexity the requirements of one industry will be gathered and the area of work 'create and managing accounts' will be analyzed in the design process. 'Create and manage accounts' are common in various industries like bank, telecommunication, health and more. As assumed and confirmed during the personas interviews they are usually start at the very beginning of a process and have no system preconditions. This makes it proportionally easy to analyze and covers the scope of an adaptive case management generic user interface. The design process followed the described methodology in chapter 4. First in discussions with the user group data has been gathered. Based on the data personas and use case were defined. Feedback were obtained to refine them. Use cases and personas served as a base for the next phase of exploration. First by sketches, then by wireframes. Based on the wireframes an element specification was extracted and the user study was defined.

ALEXANDER

AGE	25
OCCUPATION	Bank Clerk
STATUS	Single
LOCATION	Vienna
TIER	Prosumer
ARCHETYPE	The Seeker

Ambitious	Friendly	Neat

"Do what you want and learn, but learn for what you are interested in."

facebook.

Microsoft

twitter

runtastic

MOTIVATIONS

Incentive
Fear
Achievement
Growth
Power
Social
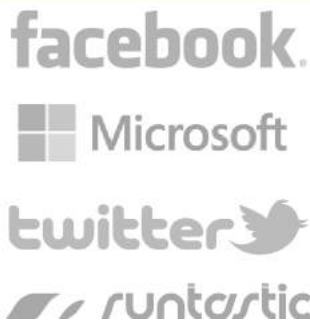
GOALS

- Make dreams come true
- Promotion to something great
- Gain reputation through work

FRUSTRATIONS

- Unexpected negative consequences
- Mistakes by colleagues
- Long working hours

BIO

Patrick is working in the company for 2 years. He holds a bachelor degree in business finance and focuses on his career. He appreciates the opportunities of advancement which are offered by the bank industry. As a digital native he is working in the online and homebanking section. He always buys the latest technology products and talks about their advantages and features. At home he is watching various series in the TV like House of Cards or Breaking Bad. Three times a week he is running to keep his body fit. On the weekend he visits bars in the town with friends.

PERSONALITY

Extrovert	Introvert
Sensing	Intuition
Thinking	Feeling
Judging	Perceiving

TECHNOLOGY

IT and Internet

Software

Mobile Apps

Social Networks
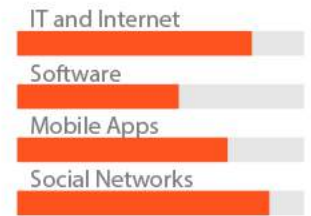
Figure 5.1: Persona: Alexander

PETRA

AGE	50
OCCUPATION	Bank Divisional Manager
STATUS	Married, 2 Children
LOCATION	Vienna
TIER	Enthusiast
ARCHETYPE	The Ruler

Ambitious   Loyal   Sociable

"Without me,
everything would get
out of control."

Microsoft

NESPRESSO

IBM

MOTIVATIONS

Incentive
Fear
Achievement
Growth
Power
Social

GOALS

- Raise and promotion
- Secure the job
- Create a prosperous community

FRUSTRATIONS

- Software crashes
- Loss of autonomous thinking
- Chaotic work by colleagues

BIO

Petra started her work life in the company for 35 years as an apprentice. She takes care of all business customers and colleagues in her store. She knows the company's software products by heart and she often acts as an administrative support for her colleagues. She is usually working on a dozen projects at a time as she wants to raise customer satisfaction and she assures that everybody is doing a great job. At home she usually uses the computer for staying in contact with friends and family or read news. At the weekend she likes to have fine dinner with her husband or visit her son in his appartment.

PERSONALITY

Extrovert	Introvert
Sensing	Intuition
Thinking	Feeling
Judging	Perceiving

TECHNOLOGY

IT and Internet

Software

Mobile Apps

Social Networks

47
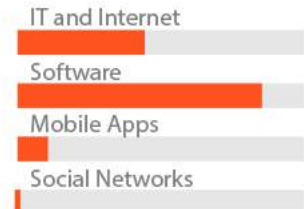
Figure 5.2: Persona: Petra

5.1 Personas

As described in 4.3 a stereotypical representation of the target user group has been created. The personas are based on discussions with users as described in the design process section4.2 and persona section4.3. The finalized personas were reviewed and updated with the users in collaboration. The persona design is based on the template used in the informal interviews [26]. To enhance the persona's personality, psychological categorizations were included:

Pearson's Heroic Archetypes: Carol Pearson describes twelve archetypes in his book *Awakening The Heroes Within* [9]. They are based on Jung's description of archetypes [8]. The two archetypes used in this thesis are *The Seeker* which is looking for improvements in his life until they usually find their true self and *The Ruler* which quest is to create order and structure and being fully responsible to prevent their system from chaos.

Myers-Briggs Types: Extrapolated from Jung's theories, Isabel Briggs Myers and Katharine Briggs developed an identification of basic preferences [77]. Four dialectic properties are defined: *Extroverted* people focus on the outer world, while *introverted* people focus on the inner world of themselves. *Sensing* people prefer to focus on the available information, whereas *intuitive* people also interpret and add meaning. *Thinking* people prefer logic and consistency, while *feeling* people have first a look at the people and special circumstances. *Judging* people get things decided, instead of keeping them open for new information, like *perceivers* do.

Core motivations: Motivation theories exists in various complexity and their amount of different theories are countless. Some core motivators were used: *Incentives* involves a form of reward like bonuses, money or promotions. *Fear* involves consequences in lack of doing the work right. It is often referred to as the "carrot and stick" management style. *Achievement* is referred to as the drive to competency, driven to achieve goals and go on for new challenges. *Growth* represents the need for self-improvement and increasing knowledge. *Power* can both: desire for autonomy or desire to control everything around. *Social* factors are desires to be connected to the field around and to make a difference in the lives of others.

Also the personas contain required parts like an image, name, motto, most important goals and a short but detailed biography. The personas in this thesis also describe the familiarity to technologies and common frustration factors, which are interesting for the software design.

5.2   Use Case

User-centered design's goal is to meet the user's needs verified by test sessions with the user. The use cases need to be a requirement in all industries. For the study they also need to be simple enough so that the study can be executed fast and better comparable results. Based on the generic area of work 'create and manage accounts', together with two users the uses cases *Open account* and *Update account information* were created. The use cases are defined as described in chapter 4.4. The use case diagram shows the relation of use cases and actors.
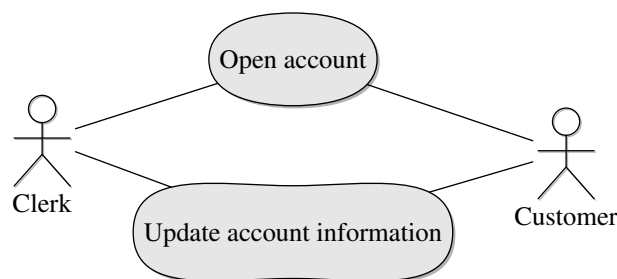
Figure 5.3: Use case diagram

The use case description is based on the use case template presented in *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development* [16]. Elements describing implementation details are left out because in this thesis they are only used for UI design.

Use Case 1	Open account
Scope:	Enterprise software
Level:	User-goal
Primary Actor:	Bank clerk
Stakeholders and Interests:	• Customer: Handle financial affairs • Bank manager: Verified customer with collaterals
Preconditions:	Bank clerk is logged into the system and authorized to create new accounts
Postconditions:	• A new account has been created and available for all authorized bank clerks • Information provided during the creation process is stored in customer's case
Trigger:	Clerk find a potential customer

Basic flow:

1. Transmit application forms to potential customers by mail, fax, email, SMS, hardcopy, ...

2. Customer provides filled-out form and identification card

3. Bank clerk checks provided information and accept it

4. Bank clerk sends account information and a welcome message to the customer

---

Extensions:

1.a Customer contacts the bank:

    1. Customer contacts the bank and discuss various scenarios

    2. Continue with step 1

2.a Invalid form or identification card:

    1. System shows invalid fields or documents

    2. Clerk ask customer to complete form or provide additional documents

    3. Return to step 2

2.b Missing identification card:

    1. System alerts a missing identification card

    2. Clerk ask customer to provide an identification card

    3. Return to step 2

Extensions:

2.c Form and identification card provided as hard-copy:

    1. Clerk scans documents into the system

    2. Continue with step 3

3.a Account for this customer can't be created as he doesn't meet the requirements:

    1. Clerk informs the customer that the creation of the account couldn't be accepted

3.b Ask supervisor or colleague for advice:

    1. Clerk asks for an advice from the supervisor

    2. Continue with step 3

3.c Hand-over task to a colleague

    1. Clerk hands-over the task to a colleague

3.d Customer has already an account at the bank:

    1. Clerk links the new account to the existing one

    2. Continue with step 4

Use Case 2	**Update account information**
Scope:	Enterprise software
Level:	User-goal
Primary Actor:	Bank clerk
Stakeholders and Interests:	• Customer: Handle financial affairs • Bank manager: Verified customer information in case of complaints
Preconditions:	Bank clerk is logged into the system and authorized to update customer's account
Postconditions:	• Account has been updated and available for all authorized bank clerks • Information provided or changed during the update process is stored in customer's case
Trigger:	Customer contacts the bank because of changed personal data

Basic flow:

1. Clerk verifies the changes

2. Clerk updates data in the database

3. Clerk informs customer that changes were successfully done

---

Extensions:

1.a Invalid changes:

    1. Clerk informs customer that additional documents are necessary or that update is not possible

1.b Ask supervisor or colleague for advice:

    1. Clerk asks for an advice from the supervisor

    2. Continue with step 1

1.c Hand-over task to a colleague:

    1. Clerk hands-over the task to a colleague

5.3 Sketches

After defining the requirements the next step was to explore possible user interfaces by creating sketches. During the design process various sketches were created and from the important ones photos have been taken. The sketches were constantly reviewed with a small user group. Additional to the described use cases and personas also generic ACM requirements as described in 2 were considered. As usability has something to do with what users are used to, following popular *project management* and *customer-relationship management* software products were used as

inspirational sources:

- Atlassian JIRA

- Basecamp

- BPMonline

- Comindware

- ConvergeHub

- ISIS Papyrus CRM

- Salesforce

- Trello

- Wave

- Zoho Reports

To create a unified user interface for all industries one software has been chosen for a thorough inspection. ISIS Papyrus offers all software solutions in one massive environment and they got rated as a strong performer for ACM by Forrester in 2014 [18]. They offer a dedicated ACM solution as well as solutions for XRM, Capture, Correspondence and Campaign Management enhanced by ACM functionality [42]. The product inspired the design process mostly by functionality and data structuring.
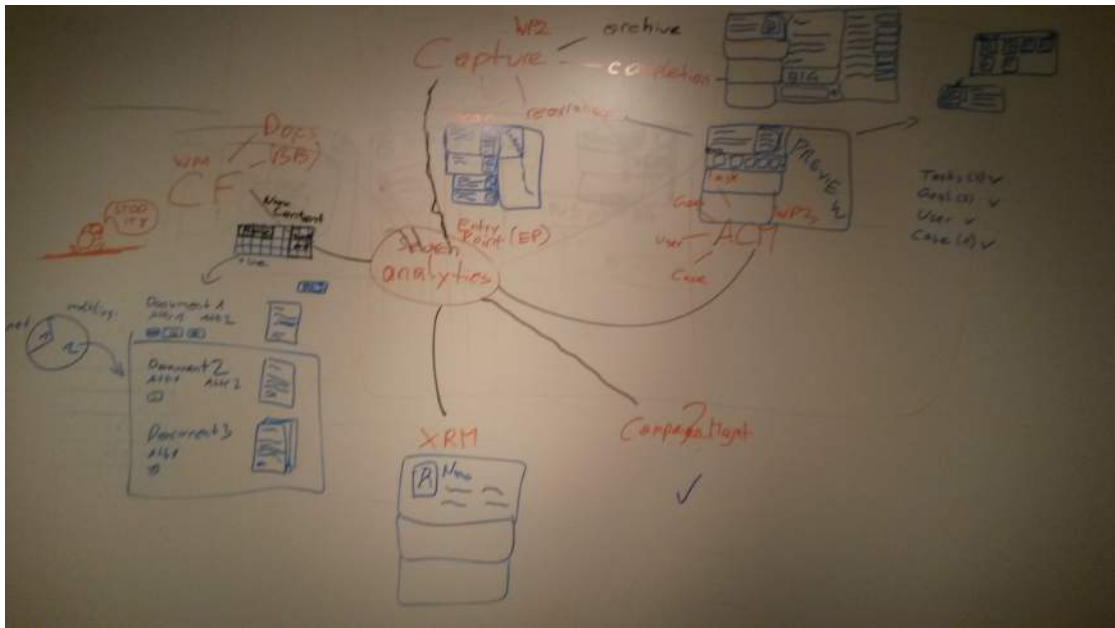
Figure 5.4: Combining different solutions into one ACM user interface

Content

ACM is providing an overview of a case, customer, employee, document and other artifacts. The user should be able to immediately see all important information of one ACM object. In the reviewed ISIS Papyrus solutions the details are mostly shown on the right side, but in ACM there are much more details to show on one screen. A new interface design was required. One proposal was to use a tab structure to split content, but the user would have to click every time he wants to see another part of information. This would destroy the overview and require the user to do a lot of clicks. The user's working memory would be also sorely tested. Another proposal was using collapsible sections. In 2014 Google released the first draft of its Material Design [32], which is keen based on the card pattern.

Cards are based on the metaphor of physical cards. Chris Tse, Founder of the card movement writes: "When done right, a card looks like responsive web content, works like a focused mobile app, and feels like a saved file that you can share and reuse" [10]. The power of cards are respon-

siveness to all devices and providing a strong frame for one chunk of information. Ambassadors of the card pattern grant cards clearness and great usability. The card pattern looked promising for the ACM user interface: business data could be presented in comprehensible containers, actions are directly and intuitive available at the data and they can be ordered and structured by the user. Cards in one system usually have the same width, but can vary in length.

Using cards with collapsible sections didn't look viable. Another approach was using a vertical scrollbar as it is a standard in web applications. To present blunt all data of a case in cards looked messy. There was no structure, no guidance where to find which information. The solution for this was to order cards in rows, whereas each row represents one chunk of information e.g.: tasks related to the case, team members worked on that case, related customers, related documents, etc. The information was presented in a clear way, but it was expected that the height of cards will be different: if importance of cards should be reflected in card's size, a team member card would need much less space than a task card. The final step was to swap rows and columns. Additionally a search was added. Entering text would keep only matching cards visible.
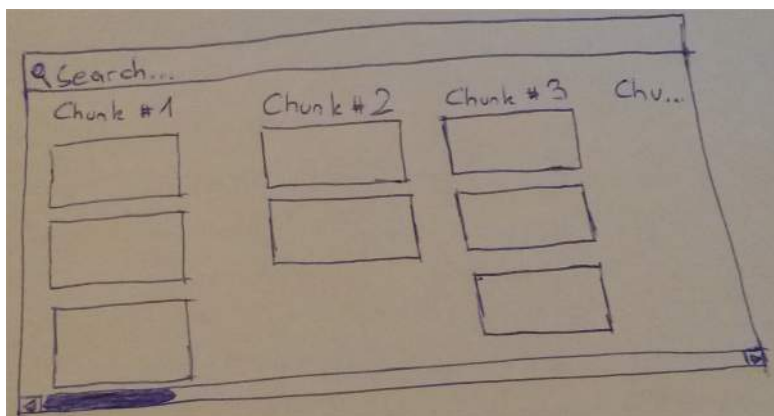
Figure 5.5: Cards ordered in columns

The order of cards and columns should be defined by the company and reflects the importance. For some settings it might be sensible to allow the user changing the order. As an example an easy way to change the priority of tasks would be by repositioning a card. This concept of cards, columns and horizontal scrolling follows the same principles as Trello, a popular project management software. Also since Windows 8 horizontal scrollbars are exhaustively used and as Windows is the common operating system for the targeted user group, it can be expected that they are used to horizontal scrolling. Users can get a quick overview and they only need to scroll to see additional information. In case of various columns a quick overview might be helpful to see all columns. As this feature is not always necessary and it also makes the user interface more complicate, it should be optional and non-intrusive. A fold-out side menu was used to display the overview. Non-visible columns also show most important information e.g. title of top 3 cards.
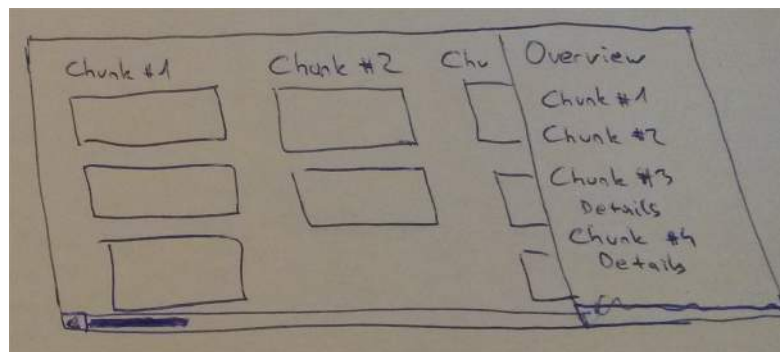
Figure 5.6: Side menu provides an overview of the whole case

To open a customer a list has been added on the left side to show all available customers in the system. Search and filter options are required if the list contains a vast number of items. The list should be fixed and not affected by the horizontal scrollbar to quickly allow selecting another customer. This list can be used to search for all kind of objects in the ACM system.
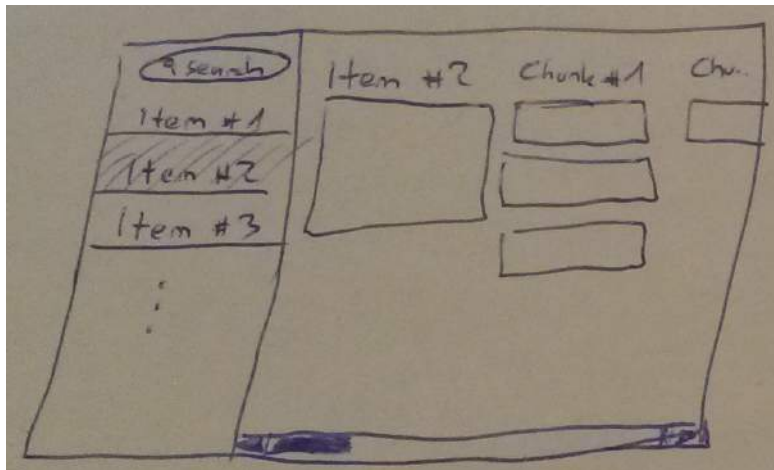
Figure 5.7: List shows all customers

The last challenge was to get focus on the task. E.g. writing a mail within this system needs more space than one card offered at this time. Following two approaches seemed to be useful:

1. Increase size of the card to emphasize its power and importance

2. Use a modal dialog to put the user in a mode

To first idea fits better in the existing concept. It follows the card pattern [10], as well it does not force the user to do something, which is against the principles of ACM.

59
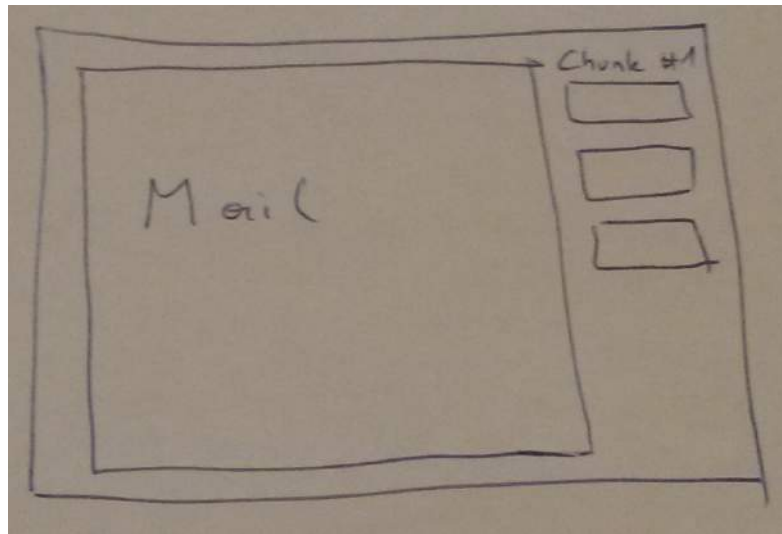
Figure 5.8: Card as major view

Workplaces

A generic navigation has to be found to switch between several views, like *task inbox* and *customer details*. One goal is to combine similar use cases in one view as far as possible. To switch fast between these so-called workplaces, the navigation should be always visible. Finally a small sidebar was most promising, as the user can see all possible workplaces and immediately change the workplace if wanted.
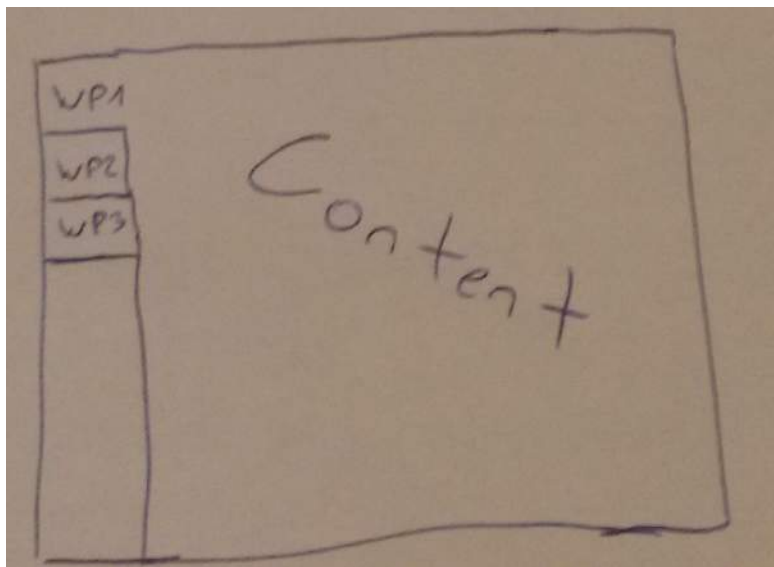
Figure 5.9: Workplaces embraces similar use cases

Header

During the sketching process the last question was about where to put general stuff like settings for changing font size, changing role, changing language or showing the company's logo. A header is common to be used for those requirements. This design accords with most web sites and web applications. The header includes the logo in the left area and user specific settings below a drop-down in the right upper side.
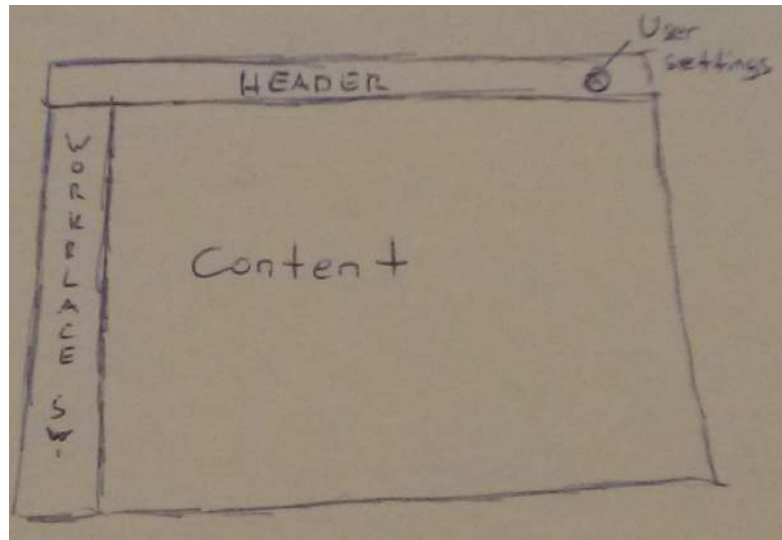
Figure 5.10: Basic composition of the application

5.4 Wireframes

The rough user interface was defined at this point. Through creating high fidelity wireframes the discussions with users got focused on the details. Again constant feedback helped to improve clearness and consistency. The task view contains a task inbox and most work is done within that screen. The details of artifacts and objects can be viewed in the details view.

Detail view
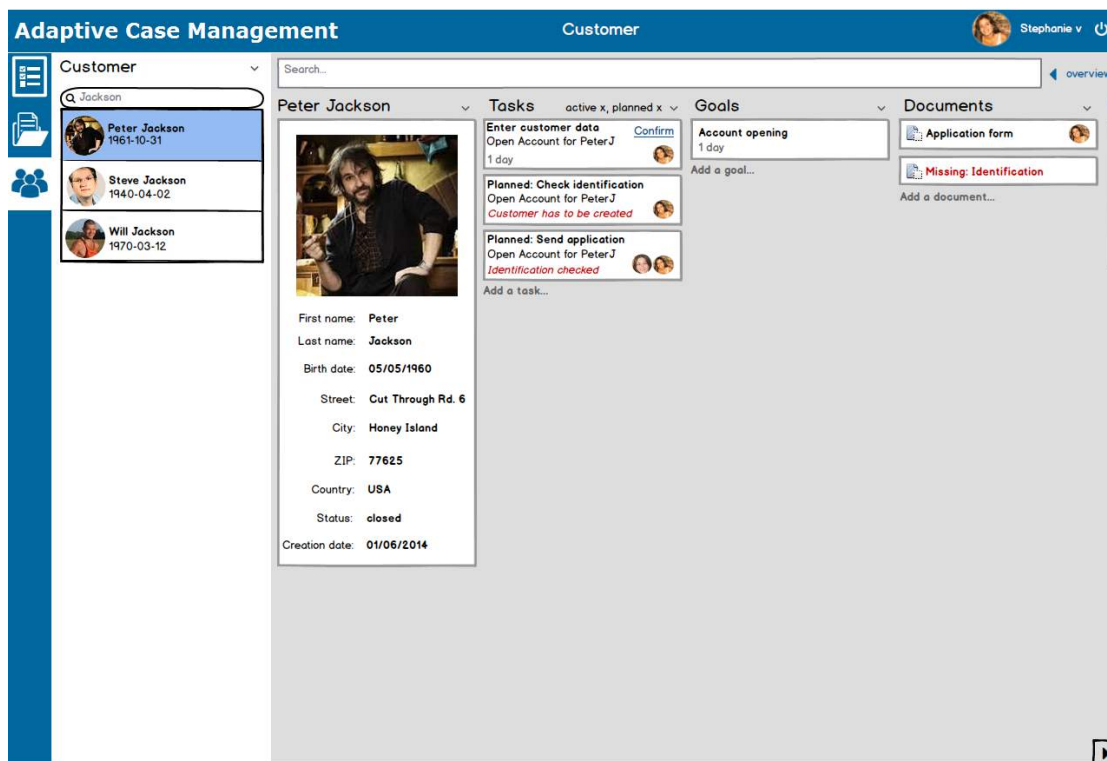
Figure 5.11: Wireframe: Customer details

The header kept very similar as exposed in the sketching phase. Workplaces are represented by an icon to minimize required screen space. Links which leads to an unknown destination as long as you don't point with the cursor on them are called *Mystery meat navigation* [93]. It's a common bad practice for user interface design. Nevertheless it is expected that the gains of

space screen are more important to the users than the higher learning curve. Especially it has to be considered that the software is used by the same person.

It is expected that most workplaces will have a list on the left side to select items like a customer in the customer workplace. Despite the different look and feel the list share similarities with a column. Beside the title of a column a drop-down is visible containing all actions for that column. The list would contain actions like *New customer*, *Filter >*, *Sort >*. Selecting an item refreshes the customer view on the right side. Set filters are shown in between the title and the drop-down. Clicking on an active filter removes it. If the list or a column is filtered or sorted by an attribute which is not visible, the missing attribute is added below the entry. It is expected that filtered attributes are important to solve the current task and the actual value should be visible to the user. On the top above all columns a search bar is available to filter. In future advanced commands for power users are provided to change ACM states and relations.

Customers have a name and a photo for more individuality. Only a photo is shown for a team member, the name and department is visible on mouse over. Missing information are marked in red color. If a new card can be created in a column the action is available at the bottom of all cards and additionally in the drop-down of the column. Cards follow the keep it simple and short design principle, but also contain all relevant information. In this case title, associated case, deadline and associated employees are shown. In some cases it makes sense also providing the primary action. E.g. changing the customer data has to be done within the customer view, it is expected that users will mostly complete the task in the customer view. In some other cases like writing a mail the task is expected to be completed in the task view; providing the primary button in this case would more likely leading to misconduct.

The scrollbar in a column is only visible, when more cards are existing than can be shown on the available space. The horizontal scrollbar is hidden until the user moves the cursor to the bottom of the application. The arrow icon indicates the functionality of scrolling, this behavior was requested by some users during design sessions. It has to be proven in the study if that functionality is clear to users.

64
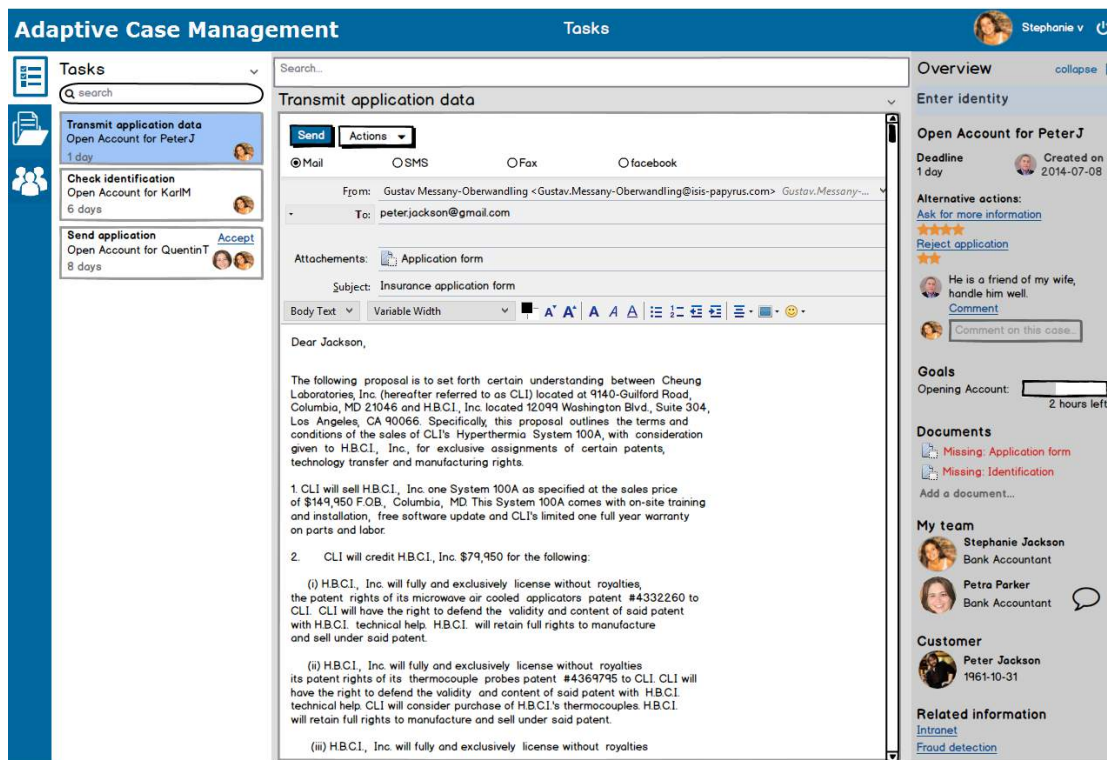
Task view

Figure 5.12: Wireframe: Mail task

The task view is following the same principles as the details view. Different user requirements apply for this view. The major use case in this view is to complete the task and to achieve that the card size is increased. The task card can also contain more complex UI elements like a mail editor or form. This leads to less space for all other columns. As the details of each column might be less important than an overview, the sidemenu is opened by default. The overview shows the top 3 cards of each column.

The mail view looks like common mail software products like Outlook or Thunderbird. The output channel can be changed by the user. Send as the major action is visible at the top left corner. According to Google's material design action buttons of a card should be placed on the top, right or bottom side.

Sample wireframes of other workplaces and views are appended in the appendix A. The wireframes show different views of the workplaces: task inbox, case, customer and management.
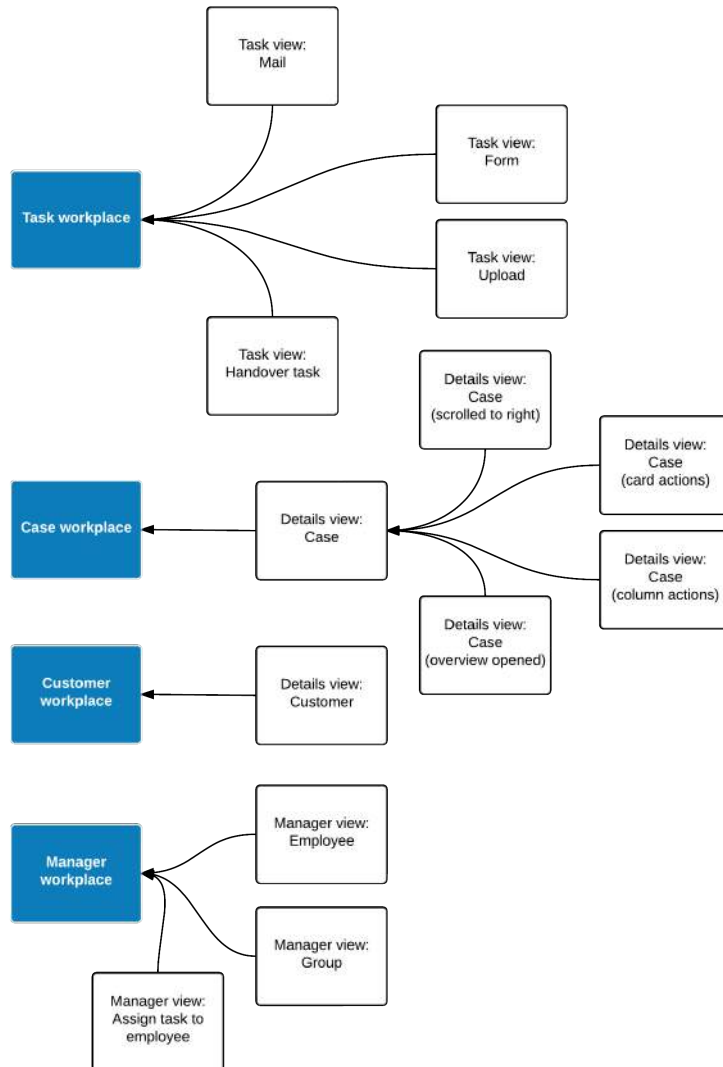
Figure 5.13: Overview of wireframes

5.5 Element Specification

Based on the results of the wireframe an element specification has been created which shows all defined components used for the ACM user interface. In addition to the wireframes functional requirements are considered known from the discussions. Also in this section the incorporated related work is described.
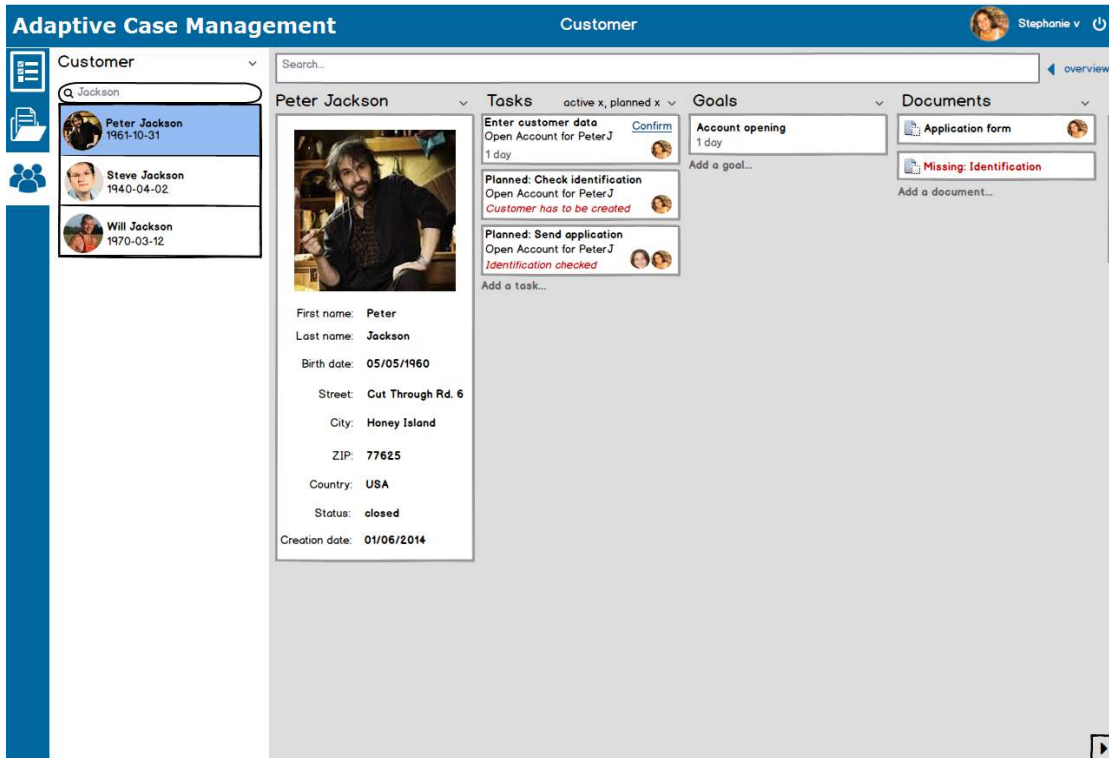
Figure 5.14: ACM user's overview

Header

Figure 5.15: ACM column search

The header is a delimited area contains system-specific functionality and serves as a frame for cases, goals and tasks.

- Logout

- Reload (not needed in browser)

- User settings in a drop-down

Header and workplace switcher have the same color.

Workplace Switcher

Contains all available workplaces depending on the role, responsibilities and expertise. Each workplace represents a clear distinct area for the user usually fractionated by ACM cases and use cases. Workplace icons provide a fast and easy access to workplaces by clicking on the icon. The current selected workplace is highlighted.

Will be not visible when only one workplace is used.

Selecting another workplace saves the status of the workplace (search, open tabs, selected items), so that users can continue their work when coming back to the previous workplace.

Workplace switcher is neither closable nor collapsible. On mouseover a tooltip appears with the workplace's name.

Workplaces can be rearranged. Workplace switcher can be docked to other edges on the screen. To prevent rearranging on accident: provide a 'lock workplace switcher' option is provided on right click.

Figure 5.16: ACM column search

Main Area

The main area contains all information of the workplace ordered in columns. It serves as a cockpit for knowledge workers to achieve their goals.
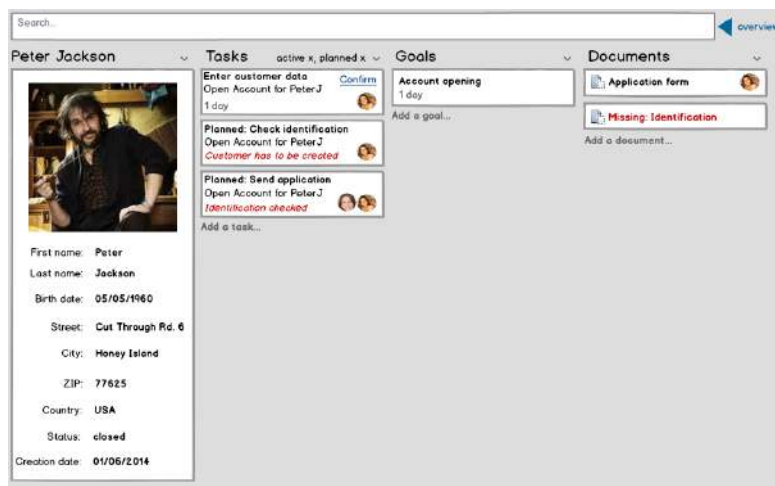
Figure 5.17: ACM column search

It consists of:

- **Column search:** a search field which filters over all columns by visible properties.

- **Column:** a container for related data sets of the selected object. E.g. all documents related to the selected customer.

- **Horizontal slider:** if more columns are available than can be displayed.

Visual cue for more columns   Giving the user a hint that more columns are available on either the left side or the right side, these columns have to be partly visible.

Column Search

One of the major use cases in ACM systems is to find data in a case. Sometimes the case can get huge and a reduction of the data is necessary. A generic search over all data and all relevant attributes in case serves as a single entry point. As a result only matching cards are visible; if within a column no single card matches the string, the whole column is invisible.

Depending on the performance of the system, cards can be dynamically updated while typing or when confirmed by pressing enter. This setting has to be the same for all workplaces within a system.

Autocomplete   Five most expected values are suggested as a list while entering text. For simplicity word frequencies can be used. The list is alphabetically sorted.

Column

A column is one chunk of data, can be tasks, goals, a type of artifacts or related data. The column consists of a title, column actions, cards and a scrollbar.
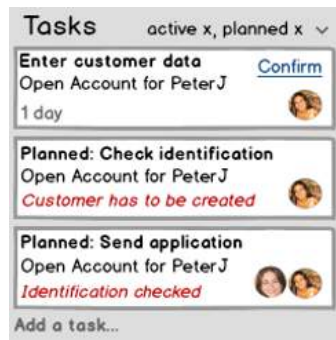
Figure 5.18: ACM column

Title A mandatory title is positioned in the upper left corner.
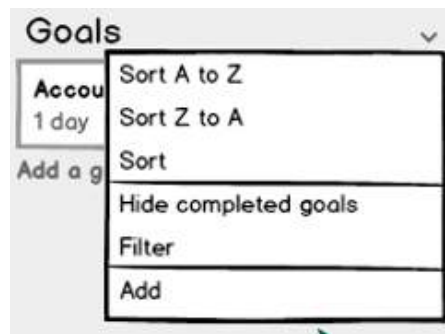
Figure 5.19: ACM column search

Column actions Column actions are actions or simple tasks a user wants to do to achieve a certain goal. This can include sorting, filtering and column specific actions.

Filtered attributes are visible beside the drop-down button. If there are too much filters set, they are combined beneath a <number of filters set> filters set drop-down.

For better usability the action 'add a card' is available below the last card in the column, additionally to the drop-down in the header.

Cards Cards are the heart of the user interface and represents an atomic data and interaction unit. They present the data in well-formed and comprehensive chunks. A detailed description

can be found in chapter Cards 5.5.

Scrollbar If there is too less vertical space to show all cards a scrollbar is visible as an overlay. The behavior is similar to MacOS and has been chosen to reduce visual clutter. It is visible:

- **On focus:** If an element or subelement is selected and currently in focus

- **While scrolling:** Fades out after two seconds.

- **First second:** After loading the scrollbar is visible for a second.

Card

Cards contain a unique set of related, heterogeneous information. The used card pattern is related to Google's Material Design [32]. Cards represent usually the most important information and provides more details on opening. The width is constant for all cards in one context, the height is variable and content-dependent. Cards are not resizable and drag-drop may be enabled e.g. for allowing prioritization within a column. Each card has at least a header or content.

Example: Within the task view a click on the header of a related customer will open the customer detail view. The first column provides all direct information about the customer, other columns will show related data like documents, cases and so on.

72
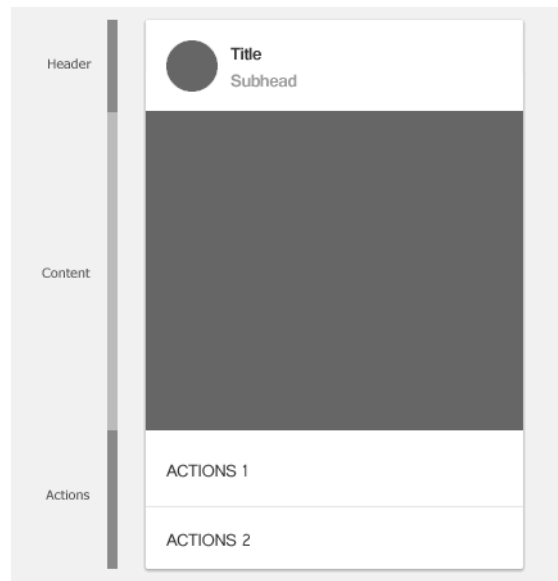
Figure 5.20: Card example from Material Design [32]
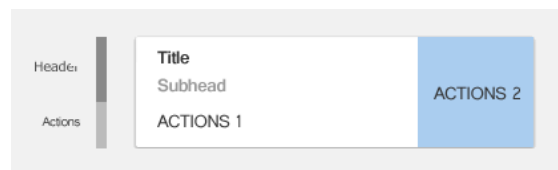
Figure 5.21: Card example from Material Design [32]

Header   If a card has a header a title in the upper-left corner has to be used, which serves as an entry point to detailed information. Card actions are provided at the upper-right corner. Additionally an image or subtitle can be used.

Content   The content of a card can vary greatly in terms of type, quality and quantity.

Actions   There are three areas of a card where actions can be done:

Supplemental action area   This optional area is used for actions related to the content of a card and are presented either at the top, bottom or right side of the card If an overflow menu is

used the amount of content actions in the supplemental area should be limited to two.

Overflow menu   This optional menu contains content actions as well as card actions like:

- **Delete:** Removes the relation of the card to the selected item.

- **Move to ...:** Moves the card to another place, column or even case.

- **Maximize (only big cards):** Opens the card in full-screen.

Usually the overflow menu is visible in the upper right corner on hover, but it can be placed in the lower right if it improves usability or legibility. It should be taken care to not overload the overflow menu.

View actions   View actions are directly embedded in the content and changes the view of the presented card. E.g. a slider which changes the date and updates data.

Keep in mind even a card allows various places to present actions, that common cards are an entry point to a detailed view and most actions should be presented there.

Additions   These are elements added to the card from outside. E.g. a filter is set for the column but the selected attribute is normally not visible on the card.
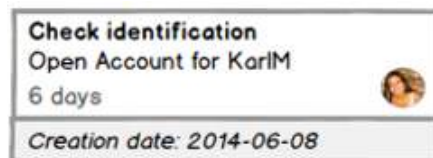
Figure 5.22: ACM card additions

Different size   For big cards there are no detailed information. They should be at least three times as big as normal cards, it is always the first column and only one big column should be used per view. They can embed a plugin like mail or hold a huge form. The complexity can be increased but user-centered design principles should still be applied.

74

List column

The list column is an entry point for the workplace and several elements are similar to columns like the header or overflow menu. E.g. in a task workplace the primary column serves to select a task to get details.

Figure 5.23: List column

Differences compared to standard columns:

- Increased importance for the work flow

- White background as not part of the case/task/...

- Distinct search field: filters over most relevant properties

Overview Overlay

If there is not enough horizontal space for all columns an overview overlay is available which provides and overview of the ACM case or task-related data. Current visible columns for the user are highlighted and no additional information is shown. The overview overlay should be visually distinctive from other UI areas like using a frosted glass effect.
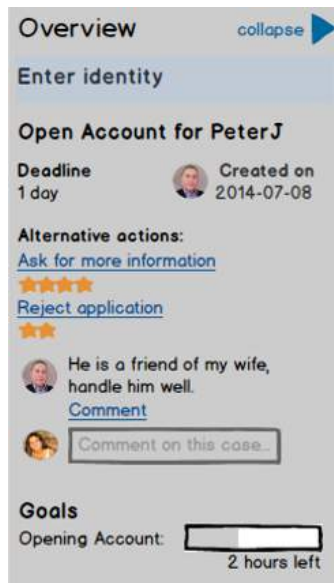
Figure 5.24: ACM overview overlay

Usability Evaluation

A user study has been conducted to test the ACM user interface as described in 4.6. The study should reveal usability findings related to the generic ACM user interface concept. Usability findings which are not directly related to the generic ACM UI concept are presented at the end of this chapter.

Study Preparation

The study consists of 4 parts (interview guideline can be found in the appendix B:

- **Introduction:** The user filled-out a consent form and got introduced to the study.

- **Interview:** Discover the participant's needs for their work and experience with software products. Check if the participant really fits the targeted user group.

- **Tasks:** The participant has to complete 3 tasks in a series of interactive mockups . At the end of each task the participant explains his thoughts and experiences.

- **Questionnaire:** Test user acceptance by quantifying perceived usefulness and ease of use as well as most positive and negative aspects of the user interface. The questionnaire and definition of user acceptance, perceived usefulness and ease of use has been taken from Perlman and Davis [25].

In the mockups only a few UI elements are interactive which are relevant to complete the given task. The limitation has been explained during the introduction. The mockups of the study can be found in the appendix C. The time to complete all 3 tasks aimed for a maximum of 45 minutes. The short time frame assures a proper concentration of the participants. All tasks were created based on the use cases and should verify the most important assumptions made during the design process of the ACM user interface concept:

1. Distinction between work view (e.g. mail) and detail view (e.g. customer) is required.

2. Primary actions on a card are highly recognized and leads the user through the process.

3. The meaning of tasks and goals are intuitive and can be used without explanation

4. The overview of ACM provides the user an advantage.

5. The cooperative approach of ACM provides the user an advantage.

6. Icon as workplaces does not impact the usability of the system in the long term.

7. Horizontal scrolling causes no problems because of the familiarity of used software.

8. Drop-down for minor actions on a card or columns to find more actions is easy to use.
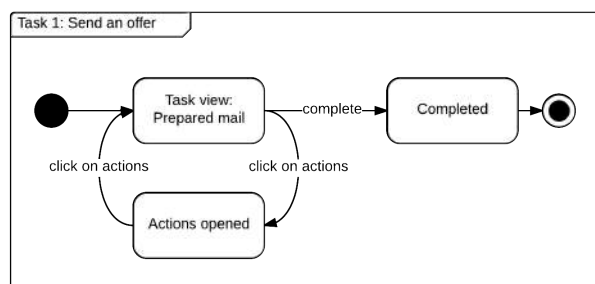
Figure 6.1: Wireframe of task 1: Send an offer
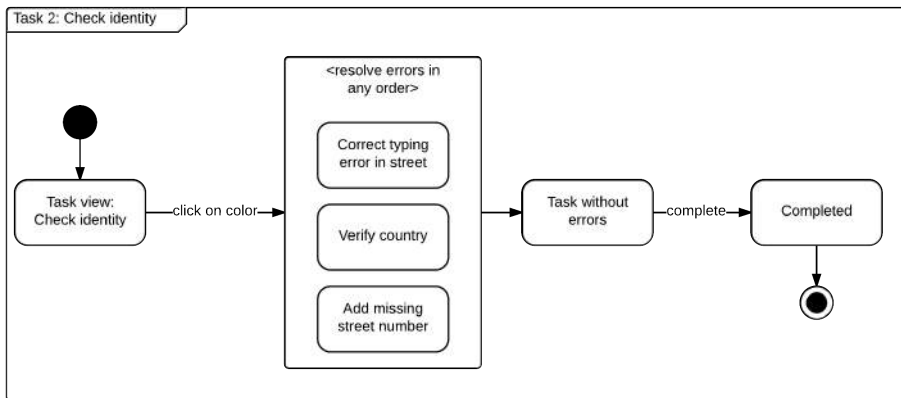
Figure 6.2: Wireframe of task 2: Check identity
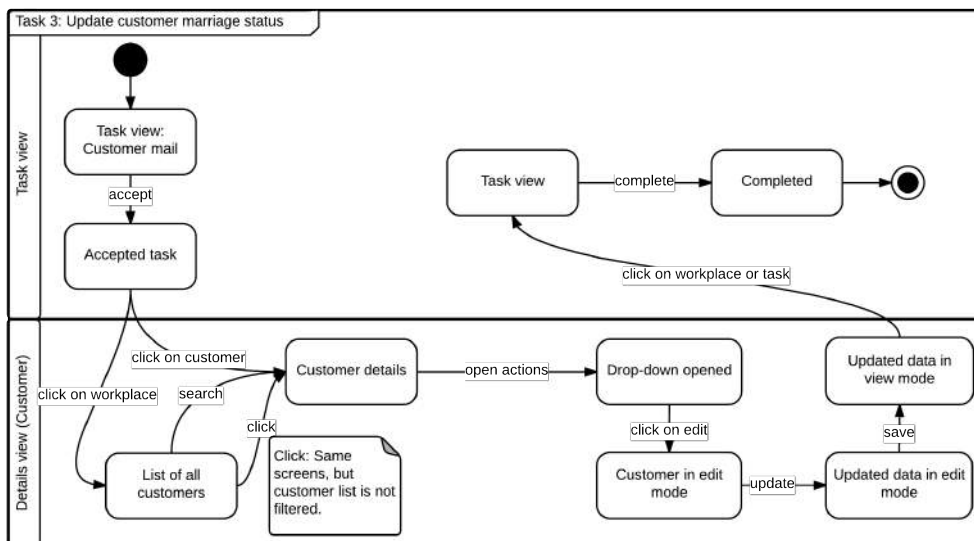
Figure 6.3: Wireframe of task 3: Updated customer marriage status

Pre-study A pre-study has been carried out to smooth out major logical and visual errors of the mockups. 2 people took part and exposed a few errors which where cleared for the actual study.

Participants Virzi discovered 1992 that 4 to 5 test users are enough to find 80% of the usability problems. Additional subjects participating in the study are less and less likely to reveal more information [87]. For this thesis 2 participants participated in the pre-study and 6 participants in the actual study4.2. The participants were selected by finding people responsible for creating and managing accounts. Another criteria was to get more diversity within the participants by distributing age, gender, job position and business domain

Study Execution

The study has been taken place in a silent room with the participant and an observer in the participant's home. While doing the tasks: screen and voice has been recorded. All participants passed the study on the same laptop. During the tasks the participants got no help as far as possible.

One problem evolved as the users wanted to try out several functions of the user interface to get a feeling for the software, but the limited scope of the mockups didn't allow that. Even the framing at the introduction and before the tasks, led to dissatisfaction. In such situations the participants were explained again that the mockups only support a fraction of the functionality and encouraged to continue.

Problems not related to the user interface were solved by the observer. E.g. the laptop had an invisible scroll function on the touchpad which changed the displayed mockup. The observer reverted such mistakes.

6.1   Study Results

Overall the user interface got good response from the participants. All participants could complete all tasks. A different behavior could be identified between both personas: Participants of

Alexanders's type had nearly no problem with the system. They easily understood most functions directly or got the right interpretation as soon as the data has been changed. E.g. what does the Missing: <Document> means. They would like to test a real interactive system as in motion the software would be even easier to understand.

Participants of *Petra's* type suffered more from usability shortcomings and needed more information beforehand. They always needed to understand what is behind something and they had the fear that a wrong click would crash the system. All of them expected a training if they would use the system in reality.

The time to complete all tasks were between **20 and 35 minutes**. Only one participant took 50 minutes with elaborated explanations of his thoughts.

Questionnaire

A short questionnaire about the perceived usefulness and ease of use of the system has been conducted. Overall the participants perceived the system as most likely useful and easy to use.

Perceived Usefulness

1. Using the system in my job would enable me to accomplish tasks more quickly.

2. Using the system would improve my job performance.

3. Using the system in my job would increase my productivity.

4. Using the system would enhance my effectiveness on the job.

5. Using the system would make it easier to do my job.

6. I would find the system useful in my job.

Overall the perceived usefulness is rated with 84%. Participants rated less lower rates in improving their job performance. The lowest acceptance rate with 70"%" got the question if the system would enhance the effectiveness on their job. Still in mind that the participants got no introduction into adaptive case management and the longterm impacts are hardly noticed.
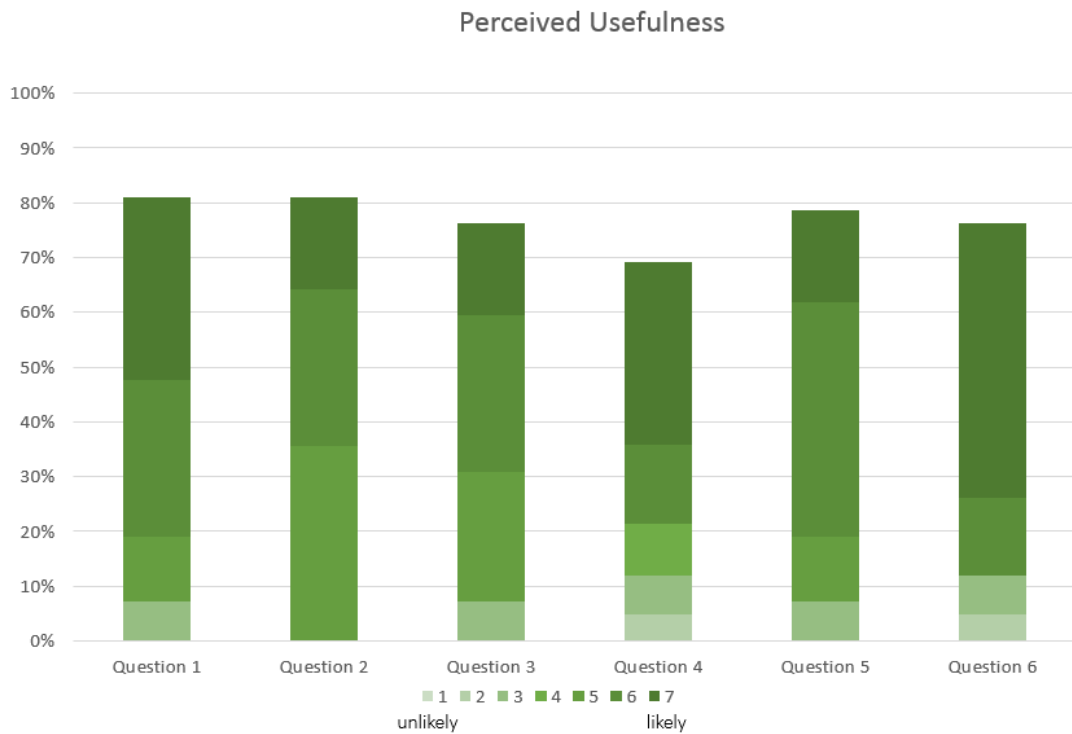
Figure 6.4: Study results: perceived usefulness

Perceived Ease of Use

1. Learning to operate the system would be easy for me.

2. I would find it easy to get the system to do what I want it to do.

3. My interaction with the system would be clear and understandable.

4. I would find the system to be flexible to interact with.

5. It would be easy for me to become skillful at using the system.

6. I would find the system easy to use.

The perceived ease of use is even higher rated with 87%. The lowest rating got the last question if the system is easy to use. The highest rating got the question if the system is flexible
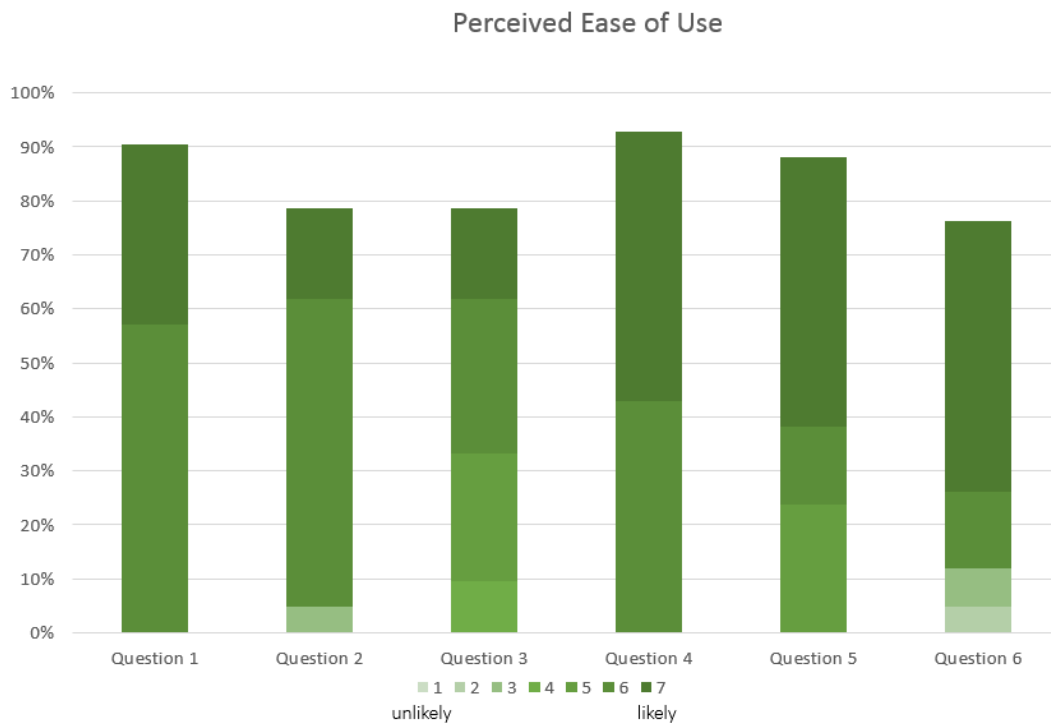
Figure 6.5: Study results: perceived ease of use

to interact with. This might be caused, because most participants using rigid software products in their company.

Usability Findings for ACM UI Concept

They expectation to get usability findings of the generic ACM user interface through a specific scenario worked well. Following usability validations (✓), insights (•) and issues (✗) could be identified:

✓ **Structured self-explanatory UI:** 5 participants liked the structured view. The big working area is clear and the customer view provides in a good manner all details. Only one felt the user interface is too much overloaded, but this comes mostly from the sidebar which is discussed below in more detail.

✓ **Inspired design from social networks:** Participants from Alexander's type liked the familiarty of the user interface. It reminds them of social networks like Facebook, Google+ or Linkedin. Participants of Petra's type noticed that connection too, but they dislike it, mostly again because of the crowded sidebar and heavy usage of photos..

✓ **Clear buttons:** All participants could easily identify the major button. They felt some sort of guidance by the importance of the button.

✓ **Teamwork:** 2 participants explicitly adored the collaboration features. Especially the possibility to view team members, contact team members and hand over tasks to team members were appreciated. They would really like to see similar features in their current system. Other participants liked the features as well, but with less enthusiasm.

✓ **One big software product:** 5 participants liked, that everything is handled by one integrated software product. Some of them couldn't believe that this might be possible. Only one participant disliked this point, because of the overhead by mixing up data.

✓ **Integrated documentation:** The participant from the health industry positively highlighted the fact that all data is automatically documented without any extra effort. Documentation is quite important in their industry and the automation saves time.

✓ **Overview:** Participants liked to get a complete overview of the customer including all relevant information like personal data, documents, correspondence, tasks and more.

✓ **Transparent information supports the workflow:** 4 participants could use the information of "Missing: Identification" to get confidence what is expected from them to do. One participant: 'It's like showing relevant company guidelines in the right context - this will prevent a lot of errors'.

✓ **Goals and deadlines:** 2 participants appreciated the possibility to set goals and deadlines to do project management.

• **Horizontal scrolling:** Horizontal scrolling was not part of the tasks. Still most participants noticed that more information is on the right side. On the question how they would

view the hidden data, all participants answered they would use horizontal scrolling or drag and drop on the empty space. No participant had experience with Windows or Trello.

- **Icon for workplaces should get a tooltip:** One participant would have liked to see the workplace name as a tooltip. Other participants had no problems with the icons, but in a few cases expected something different behind a workplace.

- **Column and card drop-down recognized as collapse:** 3 participants misunderstood the meaning of the drop-down icon. They only could solve the task because it was the only reasonable available option.

- **Chat system could be abused:** 1 particpant argued that in their less knowledge-intensive company most employees would abuse the chat system for social talk instead of working.

- **Training necessary:** Participants of Petra's type demand a training to use the system in practice.

✗ **Sidebar is confusing:** It provides too much information and photos. After explaining the sidebar, all participants liked the concept, but given information is not comprehensive enough.

✗ **Two searches are confusing:** Participants didn't understand why two searches are available and what can be searched for.

✗ **Difference between task and goal:** 2 participants didn't understand the difference of goal and task in given context.

✗ **Difference between Accept and Confirm:** A major usability problem is the similarity of the Accept and Confirm button. As both buttons are on the same location with the same design it happens too easy that both actions are executed consecutively. Also the different meaning was unclear to 2 participants, because they didn't understand they have to accept a team task, before they can work on it.

✗ **Rating of best next actions:** Best next actions were correctly recognized, but no participant understood the meaning of the star rating.

Other Usability Findings

Several usability problems of the study are not related to the ACM UI concept and the results are not relevant for the research question. Still for completeness they are listed below:

- **Photos get too much attention:** Depending on the domain participants are not used to have a personal connection to the customers. 2 participants felt distracted by the photos while doing the tasks. On the other hand 2 participants appreciated the personality of the system.

- **Risk of duplicates:** The system allowed the user to create duplicates. The protection by show information of similar accounts were not enough. This is a domain specific requirement.

- **Colored markers to identify problems with OCR:** Checking the incoming application is supported by automatically capturing the form and show possible mistakes to the user. Without any help 3 participants didn't understand the marking. One of them didn't even notice the colors. OCR is not part of the generic ACM UI concept.

- **Inactive choices:** Despite the multiple framing all participants disliked the fact that most interface elements are not active.

- **Tooltips:** 2 participants would like to have tooltips. This was not possible with the used mockup software.

- **Font size and font type:** 4 participants disliked either the font size or font type which are too small or too comic-like. Font type is part of the mockup software and not changeable. Font size can be changed in the user settings which was not possible in the study mockups.

- **No introduction:** All participants would like to get more introduced into the tasks, getting into the context or describing the software product. This was done by intention to get unspoiled results by let the participant exploring the functionality.

✗ **Sample data doesn't make sense:** Some participants found the data too generic and not relevant for their industry, which was intended by the study as participants from various industries conducted in the study.

✗ **Surveillance:** The participant from the health industry criticized the surveillance of the user's work. The same applies to their newly implemented case management software and all software integrated documentation systems.

✗ **Dependency on the system:** The participant from the health system claimed the dependence of the users on the system. If the system doesn't allow something or doesn't work, it is hard to work properly. Also the workflow is changing: In their current case management software they have to enter all patient information during anamnesis which affects rapport negatively. Alternatively they can try to remember all information and enter data after anamnesis which takes more time and leads to incomplete data. This applies to all documentation systems.

Summarized the user interface got several validations, but the study provided also new insights and shortcomings. Participants liked the structured self-explanatory user interface as well as the design inspired by modern social networks. Clear buttons as well as the possibility of working in a team are appreciated. They liked that the whole process is covered by one software product and the integrated documentation. Participants also liked the provided overview and transparent information like goals and deadlines which supports them in their workflow. Horizontal scrolling was recognized by the users without experience in software products using horizontal scrolling as a major technique. Interesting is also the objection that the chat system could be abused in certain companies. Other identified ACM related insights and problems are prioritized be and solutions for the next iteration are proposed:

High **Sidebar is confusing** very complex

Rethink when and how the sidebar is opened.

Medium **Two searches are confusing** very complex

Change design and label. If this doesn't work well enough, a redesign of the left part needs to be considered.

Medium **Difference between task and goal** less complex

Users do not need to understand the difference of the ACM terminology. Rename goal to task.

Medium **Difference between Accept and Confirm** complex

In most cases tasks can be directly assigned to people. Only in certain domains this requirement exists. Team tasks need to be better represented as team tasks.

Low **Rating of best next actions not understood** very complex

Test to open a dialog to enter additional information and within the dialog the action could be rated.

Low **Icon for workplaces should get a tooltip** less complex

Mouse-over tooltip will be available.

Low **Column and card drop-down recognized as collapse** less complex

Another icon will be used: 3 dots vertically ordered.

Other found usability problems are not related to the generic adaptive case management user interface and will not be considered in the next iteration. It would be helpful to amend the tasks so that the usability problems doesn't occur. Most of those problems are related to the used mockup tool, they are fixed when using an HTML prototype. It is expected that different studies for each domain would provide additional insights. Due to the complexity of horizontal scrolling and the sidebar further detailed studies are recommended. Also interesting would be testing the generic user interface concept with different use cases like reporting for manager.

Critical Reflection

As we have seen in the literature review, a closer look on the user interaction and user interface of adaptive case management was missing. This thesis examined a possible solution for a generic user interface and extends the related work in a reasonable way. Overall the user interface got a good response. Depending on the participant and their ratio of knowledge intensive work the results are varying from 'very useful' to 'nice, but wouldn't help the participant in their actual work'. The reflections are parted in more generic reflections on adaptive case management and reflections on the user interface concept and study.

Is it possible to design a generic user interface concept of adaptive case management focusing on usability and get a good user acceptance?

Using a user-centered design approach focusing on usability a generic user interface concept could be created. The study results suggests that a good user acceptance has been achieved.

Too powerful for some users   In section 2.8 various requirements of adaptive case management are described. In the study only a subset was visible to the user and still some knowledge workers struggled with the power of the system. Even if in theory the power of adaptive case management seems to be great the user interface needs to provide the functionality in a way the user can use it. With the developed user interface concept of this thesis some features over-

strained the user. As an example a generic chat system has been disapproved by some users, they like to chat but they expect it would decrease their job performance. One option would be to disable certain features, another to provide training, which might not solve the issue.

Domain independence Adaptive case management as a generic framework is covering all business domains. The participants from the health and telecommunication domains are using already a case management system which covers mostly the same functionality as adaptive case management from a user point of view. Some functions are missing like progress visualization, deadlines, best next actions, integration of collaboration and saving mails into the case. Apart from the additional functionality an adaptive case management system would not change user's work behavior. This means that everything a business is getting out of adaptive case management like reporting or process improvement doesn't effect the user acceptance.

Data in the middle Adaptive case management puts the data in the middle [58] and focus on the actual work. This approach gets good acceptance from the participants. It follows the natural way of knowledge workers to think about the goal and get the work done. All participants focused on the work and not on the process. They even expected from the system to check that the process is correct. E.g. one participant from the insurance domain explained that the system is deficient because it allows duplicates. In the participant's domain this is not possible and therefor the system is responsible to check for duplicates and offer solutions to the user.

Negative pattern recognition In 2.4 negative pattern recognition is described to increase the reliability of supposed best next actions. During the study participants didn't expect that the system offers unreliable options to the user. Either the system knows what to do or it doesn't. Provided best next actions are considered if the user does not know how to succeed. This would be fine, but this also means the user would never refuse an offered action. To bring the concept of best next actions another user interaction is required. This could be solved by explaining the functionality to the users in a training. Another option would be to use a drop-down to hide the uncertainty of the system. This might lead to confusing situations or incorrect work and should be tested in further research.

90

Theory meets practice   Just as the map is not the territory, the recipe is not the dish, the methodology is not the software product. A generic user interface concept for adaptive case management can not be built purely on the theories about adaptive case management. Instead as much as real context needs to be considered: the company's culture, the work context, the building, the knowledge, the amount of workers, the amount of hours workers are using the system and much more. A generic user interface can not be built for all of these situations, but it can be designed with possibilities for customization.

User-centered design process for customization recommended   Usability depends among other things on user's behavior and patterns [22]. The results of the study has shown that some participants are not used to act autonomously as a knowledge worker. Adaptive case management is a new way of thinking to achieve certain goals and this forces the user to interact in a new way with the system. Users need to learn and get used to the new system, this requires user acceptance. Usually the user-centered design process helps to increase user acceptance by improving the user interface to the needs of the users as well as by articulation work. The articulation work helps the user do understand what they really want, what the system is able to do. Even if the generic user interface concept helps to create a system faster, when a company decides to use adaptive case management I recommend to follow the user-centered design process for customizing the generic user interface concept.

Does previous CSCW research provide insights for creating an adaptive case management user interface?

Also this research question can be answered with yes. Yes in multiple ways:

Implicit usage of CSCW research by using the state of the art user-centered design approach   Methods like personas and use cases or wireframes are coming from the CSCW area to capture the needs of the users, understand them and developing a solution they really want to use and are able to use.

Social collaboration Second by getting deeper knowledge in a root of adaptive case management. The differentiation between individual work and complex social work which and the need of articulation work 3. Which has to be tackled from multiple sites: using business language by the application developers, capturing the needed tasks by the requirement analysts and providing the users their own possibility for expression by comments, descriptions and chats.

Wicked problems In the CSCS chapter 3 the relationship between adaptive case management and wicked problems are described. Adaptive case management is probably not able to solve wicked problems by itself. In the study participants felt responsibility for their problems. The system should guide them and support them, but for thinking outside of the box the user is responsible and adaptive case management is supporting them solving wicked problems. Yes, wicked problems exist, but not the system has to solve it, the user has to and should be able to solve it.

Rigid workflows Adaptive case management allows to predefine workflows 2.2 3.3. During discussions with users in the user-centered design process, they disliked enforced rigid workflows. Even if they understand the necessity to follow the exact process steps they felt depreciated from the system and from the company's management like treated as they are not smart enough to follow the workflow on their own. Users wanted to be guided by the system as much as the system is able to do their work, but not a bit more.

Forced to use the software Bowers [47] highlighted that using a workflow technology can influence the working flexibility. To gather every piece of information in the case everything needs to be done in the system. It must be used for every task to ensure completeness. This forces the users to work in a specific way and might hinder the best workflow. The participant from the medical domain dislikes to sitting in front of the computer and document the anamnesis instead of fully staying in contact with the patient. This is a tough problem which needs further research. The aim should be a seamless integration of data analyzing and data capturing. This means reducing the viscosity to 0 as discussed in section 3.1.

CHAPTER 8

Summary and Future Work

In this thesis first the principles and models of adaptive case management where explained. Then the relevant adaptive case management related research of CSCW where discussed and compared with the adaptive case management principles. Based on the theoretical analysis a user interface for two use cases were defined following the user-centered design principles. Finally a study has been conducted to get feedback from users about the generic adaptive case management user interface design. The results were presented and reflected.

The research question if *it is possible to design a generic user interface concept of adaptive case management based on user-centered design principles getting a good user acceptance* can be confirmed. The ease of use of the user interface were rated with 84% to be liked. The perceived usefulness of the user interface were rated with 87% to be liked. The qualitative research results come to a similar outcome.

For further research it would be interesting to conduct different studies for different domains and create user interfaces based on the needs of one group instead of all possible adaptive case management users. Those studies could left out functionality which is provided by adaptive case management, but not needed in the specific context. This would reduce the complexity of the user interface and the participants would be familiar with company user interface guidelines.

It would be also interesting to test more intensely functionality like horizontal scrolling or the use of the sidebar. An interactive prototype is recommended to use.

Another future research could focus on the managing abilities as well as the analyzing part of the adaptive case management system. Develop use cases for managers and how they can get an overview of their scope of responsibility and manage it. Develop use cases for the analysts and how a user interface would looks like to support them to analyze various cases of the same type.

Bibliography

[1] A. Bögl, M. Kobler, M. Schrefl. Knowledge Acquisition from EPC Models for Extraction of Process PPattern in Engineering Domains. In *Proceedings der Multikonferenz Wirtschaftsinformatik*. Gito-Verlag, 2008.

[2] A. LaMarca, W. Edwards, P. Dourish, et al. Taking the Work out of Workflow: Mechanisms for Document-Centered Collaboration. In *Proceedings of the 6th European Conference on Computer Supported Cooperative Work*, pages 1–20, 1999.

[3] Abraham Bernstein, Chrysanthos Dellarocas, Mark Klein. Towards adaptive workflw systems: CSCW-98 workshop report. *ACM SIGGROUP Bulletin*, 20(2):54–56, 1999.

[4] Alan Cooper. *The Inmates Are Running the Asylum*. Macmillan Publishing Co,, 1999.

[5] Alistar Cockburn. *Writing EEffective Use Cases*. Addison-Wesley, 2001.

[6] Anselm Strauss. Work and the division of labor. *The Sociological Quarterly*, 26(1):1–19, 1985.

[7] Brad Myers et al. How designers design and program interactive behaviors. *Visual Languages and Human-Centric Computing*, pages 177–184, 2008.

[8] Carl Gustav Jung. *Man and His Symbols*. Dell, 1968.

[9] Carol S. Pearson. *Awakening the Heroes Within: Twelve Archetypes to Help Us Find Ourselves and Transform Our World*. HarperOne, 1991.

[10] Chris Tse. Stacking the Card Deck: Reclaiming Our Mobile Future with HTML5-based Cards. `http://www.cardstack.io/`, June 2014. [Online; accessed 22-02-2015].

[11] Christian Rohrer.   When to use which uuser-experience research methods. `http://www.nngroup.com/articles/which-ux-research-methods/`, 2014. [Online; accessed 15-02-2015].

[12] Christiane Gernert. *Agiles Projektmanagement: Risikogesteuerte Softwareentwicklung*. Hanser Fachbuch, 2003.

[13] Clarence A. Ellis, Garry J. Nutt. Office Information Systems and Computer Science. *ACM Computing Surveys*, 12(1):27–60, 1980.

[14] Clarence A. Ellis, Marc Bernal. Officetalk-D: An experimental office information system. In *Proceedings of the ACM Conference on Office Information Systems*, pages 131–140, 1982.

[15] Clayton H. Lewis. Using the TThinking AloudMMethod in Cognitive Interface Design. Technical report, IBM, 1982.

[16] Craig Larman. *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development*. Prentice Hall, 1995.

[17] Craig LeClair, Connie Moore. Dynamic Case Management - An Old Idea Catches New Fire. Technical report, Forrester, 2009.

[18] Craig LeClair, Derek Miers. The Forrester Wave: Dynamic Case Management, Q1 2014 - Design Time And Runtime Features Differentiate The Leaders. Technical report, Forrester, 2014.

[19] Dana Khoyi, Keith Swneson. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter Templates, Not Programs, pages 145–162. Meghan-Kiffer Press, 2010.

[20] Dermot McCauley. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter Achieving Agility, pages 257–277. Meghan-Kiffer Press, 2010.

[21] Dermot McCauley. *Taming the Unpredictable Real World Adaptive Case Management: Case Studies and Practical Guidance*, chapter Considerations for Implementing Adaptive Case Management, pages 65–76. Future Strategies Inc., 2011.

[22] Donal Norman. *Psychology of Everyday Things*. Basic Books, 1988.

[23] Erin Friess. *The User-Centered Design Process: Novice Designers' Use of Evidence in Designing from Data*. PhD thesis, Rhetoric, Carnegie Mellon University, 2011.

[24] eurostat. Employment in high- and medium-high technology manufacturing sectors and knowledge-intensive service sectors. `http://ec.europa.eu/eurostat/product?code=tsc00012`, 2015. [Online; accessed 31-01-2015].

[25] F. D. Davis. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. `http://hcibib.org/perlman/question.cgi?form=PUEU`. [Online; accessed 28-01-2015].

[26] Fake Crow. Download our free persona template. `http://fakecrow.com/free-persona-template/`, April 2014. [Online; accessed 09-09-2014].

[27] Frank M. Kraft. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter Improving Knowledge Work, pages 181–210. Meghan-Kiffer Press, 2010.

[28] Frank M. Kraft. *Taming the Unpredictable Real World Adaptive Case Management: Case Studies and Practical Guidance*, chapter Using the AdaPro Workstream Platform for improving Knowledge Work, pages 97–115. Future Strategies Inc., 2011.

[29] George Doran. There's a S.M.A.R.T. way to write management's goals and objectives. *Management Review*, 70(11):35–36, 1981.

[30] Gerald Barber. Supporting organizational problem solving with a work station. *ACM Transaction on Information Systems*, 1(1):45–67, 1983.

[31] Geraldine Fitzpatrick. *The Locales Framework: Understanding and DesDesign for Wicked Problems*. Springer, 2003.

[32] Google. Material design. `http://www.google.com/design/spec/material-design/introduction.html`, 2014. [Online; accessed 09-09-2014].

[33] Graham Button. What's wrong with speech-act theory. *Computer Supported Cooperative Work*, 3(1):39–42, 1994.

[34] Graham Button, Richard Harper. Taking the Organisation into Accounts. *Technology in Working Order: Studies of Work, Interaction, and Technology*, pages 98–107, 1993.

[35] H. A. Reijers, J. H. M. Rigter, W. M. P. van der Aalst. The case handling case. *International Journal of Cooperative Information Systems*, 12(3):365–391, 2003.

[36] H. R. Motahari-Nezhad, Keith Swenson. Adaptive Case Management: Overview and Research Challenges. *IEEE 15th Conference on Business Informatics*, pages 264–269, 2013.

[37] Larry Hawes. Adaptive Case Management Could Be The Foundation For Networked Business. `http://www.forbes.com/sites/larryhawes/2014/06/26/adaptive-case-management-could-be-the-foundation-for-networked-busines`, 2014. [Online; accessed 07-03-2015].

[38] Horst W. J. Rittel, Melvin M. Webber. Dilemmas in a general theory of planning. *Policy Sciences*, 4(2):155–169, 1973.

[39] Ian Alexander, Ljerka Beus-Dukic. *Discovering Requirements: How to Specify Products and Services*. John Wiley & Sons, 2009.

[40] Ian Brinkley, Sotiria Theodoropoulou, Michelle Mahdon. Knowledge Workers and Knowledge Work. Technical report, the work foundation, 2009.

[41] Irene Greif. *Computer-supported cooperative work: a book of readings.* Morgan Kaufmann Publishers Inc., 1988.

[42] ISIS Papyrus. ISIS Papyrus CCommunication and Process Platform. `http://isis-papyrus.com/`. [Online; accessed 25-02-2015].

[43] ISO 9241-210:2011-01. Ergonomics of human-system interaction – Part 210: Human-centred design for interactive systems, 2010.

[44] Ivar Jacobson. *Object oriented Software Engineering. A Use Case Driven Approach.* Addison-Wesley, 1992.

[45] Ivar Jacobson. Use Case 2.0. `http://www.ivarjacobson.com/download.ashx?id=1282`, December 2011. [Online; accessed 14-02-2015].

[46] Ivar Jacobson. Use Case 2.0 - Slices and Relationships: Extension. `http://blog.ivarjacobson.com/use-case-2-0-%E2%80%93-slices-and-relationships-extension/`, May 2013. [Online; accessed 14-02-2015].

[47] J. Bowers, G. Button, W. Sharrock. Workflow From Within and Without: Technology and Cooperative Work on the Print Industry Shopfloor. In *Proceedings of the 4h European Conference on Computer-Supported Cooperative Work*, 1995.

[48] Jacob P. Ukelson. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter What to Do When Modeling Doesn't Work, pages 29–39. Meghan-Kiffer Press, 2010.

[49] James A. Landay, Brad A. Myers. Interactive sketching for the early stages of user interface design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pages 43–50, 1995.

[50] Jan Heß. *Evolving Practices of End User Articulation in Software Co-Design*. PhD thesis, Universität Siegen, 2014.

[51] Jesse James Garett. *The Elements of User Experience: User-Centered Design for the Web and Beyond*. New Riders, 2010.

[52] John L. Austin. *How to Do Things With Words*. Harvard University Press, 1962.

[53] John Pruitt, Jonathan Grudin. Personas: practice and theory. In *Proceedings of the 2003 conference on Designing for user experiences*, pages 1–15, 2003.

[54] John T. Matthias. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter Technology for Case Management, pages 63–88. Meghan-Kiffer Press, 2010.

[55] Julie Zhuo. Junior Designers vs Senior Designers. `https://medium.com/the-year-of-the-looking-glass/junior-designers-vs-senior-designers-fbe483d3b51e`, September 2014. [Online; accessed 15-02-2015].

[56] K. Schmidt, L. Bannon. Taking CSCW seriously: SupSupport Articulation Work. *Computer Supported Cooperative Work*, 1(1-2):7–40, 1992.

[57] Keith Swenson. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*. Meghan-Kiffer Press, 2010.

[58] Keith Swenson. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter Historical Perspective, pages 293–302. Meghan-Kiffer Press, 2010.

[59] Keith Swenson. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter The Nature of Knowledge Work, pages 5–28. Meghan-Kiffer Press, 2010.

[60] Keith Swenson. *Taming the Unpredictable Real World Adaptive Case Management: Case Studies and Practical Guidance*. Meghan-Kiffer Press, 2011.

100

[61] Klaus Schmidt. *Gestaltungsfeld Arbeit und Innovation: Perspektiven und Best Practices aus dem Bereich Personal und Innovation*. Haufe-Lexware, 2009.

[62] Liam Bannon, Kjeld Schmidt. CSCW: Four characters in search of a context. In *'89. Proceedings of the First European Conference on Computer Supported Cooperative Work*, 1989.

[63] Luchy A. Suchman. Notes on Computer Support for Cooperative Work. Dept. of Computer Science, University of Jyväskylä, SF-40100 Jyväskylä, Finland, May, 1989.

[64] Lucy A. Suchman. Office procedure as practical action: models of work and system design. *ACM Transcations on Information Systems*, 1(4):320–328, 1983.

[65] M. White. Case Management: Combining Knowledge with Process. `http://www.bptrends.com/publicationfiles/07-09-WP-CaseMgt-CombiningKnowledgeProcess-White.doc-final.pdf`, July 2009.

[66] Maaike J. van den Haak, Menno D.T. de Jong. Exploring two methods of usability testing: concurrent versus retrospective think-aloud protocols. In *IEEE International Professionel Communication Conference*, 2003.

[67] Maarten W. van Someren et al. *The Think Aloud Method: A Practical Guide to Modelling Cognitive Processes*. Academic Press Inc, 1994.

[68] Mark S. Ackerman et al. Sharing Knowledge and Expertise: The CSCW View of Knowledge Management. *Computer Supported Cooperative Work*, 22(4-6):531–573, 2013.

[69] Matheus Hauder , Simon Pigat , Florian Matthes. Research Challenges in Adaptive Case Management - A Literature Review. *3rd International Workshop on Adaptive Case Management and other non-workflow approaches to BPM*, 2014.

[70] Matheus Hauder, et al. Examining adaptive case management to support processes for enterprise architecture management. *18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations*, pages 23–32, 2014.

[71] Matthias Kurz, Christian Herrmann. Adaptive Case Management - Anwendung des Business Process Management 2.0-Konzepts auf schwach strukturierte Geschäftsprozess. In *Dienstorientierte IT-System für hochflexible Geschäftsprozesse*. University of Bamberg Press, 2011.

[72] Max J. Pucher. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter The Elements of Adaptive Case Management, pages 89–135. Meghan-Kiffer Press, 2010.

[73] Max J. Pucher. *Taming the Unpredictable Real World Adaptive Case Management: Case Studies and Practical Guidance*, chapter Considerations for Implementing Adaptive Case Management, pages 27–45. Future Strategies Inc., 2011.

[74] Merriam-Webster. mock-up. `http://www.merriam-webster.com/dictionary/mock-up`, 2015. [Online; accessed 15-02-2015].

[75] Michael Hammer, Jay S. Kunin. Design principles of an office specification language. In *AFIPS '80 Proceedings*, pages 541–547, 1980.

[76] Michael Zisman. *Representation, Specification and Automation of Office Procedures*. PhD thesis, Dept. of Decision Sciences, The Wharton School, Univ. of Pennsylvania, 1977.

[77] Myers and Briggs Foundation. MBTI Basics. `http://www.myersbriggs.org/my-mbti-personality-type/mbti-basics/`. [Online; accessed 20-02-2015].

[78] Nathaniel Palmer. *Mastering the Unpredictable. How Adaptive Case Management Will Revolutionize The Way That Knowledge Workers Get Things Done*, chapter Introduction, pages 1–5. Meghan-Kiffer Press, 2010.

[79] Nathaniel Palmer. *Taming the Unpredictable Real World Adaptive Case Management: Case Studies and Practical Guidance*, chapter BPM and ACM, pages 77–86. Future Strategies Inc., 2011.

[80] O. Anya, H. Tawfik. Supporting Practice-centered Awareness in Computer-Mediated Collaboration across Communities of Practice. *Collaboration Technologies and Systems (CTS)*, pages 64–71, 2014.

[81] P. Dourish. Process descriptions as organisational accounting devices: the dual use of workflow technologies. In *GROUP '01 Proceedings of the 2001 International ACM SIG-GROUP Conference on Supporting Group Work*, pages 52–60, 2001.

[82] Peter Drucker. *Landmarks of Tomorrow*. Transaction Publishers, 1996.

[83] Peter Drucker nach Wilson. The nonsense of 'knowledge management'. *Information Research*, 8(1), 2002.

[84] Peter H. Carstensen, Kjeld Schmidt. Computer SuSupport Cooperative Work: New Challenges to Systems Design. In K. Itoh, editor, *Handbook of Human Factors*, pages 619–636, 1999.

[85] Åsa Blomquist, Mattias Arvola. Personas in action: ethnography in an interaction design team. In *Proceedings of the second Nordic conference on Humand-computer interaction*, pages 197–200, 2002.

[86] Richardson, Hope. The role of information systems and technology in case management: A case study in health and welfare insurance. *Australian journal of information systems*, 10(2):143–155, 2003.

[87] Robert A. Virzi. Refining the test phase of usability evaluation: how many subjects is enough? *HHuman Factors- Special issue: measurement in human factors*, 34(4):457–468, 1992.

[88] Robert Bogue. Use S.M.A.R.T. goals to launch management by objectives plan. `http://www.techrepublic.com/article/use-smart-goals-to-launch-management-by-objectives-plan/`, 2005. [Online; accessed 31-01-2015].

[89] Stephan Poelmans. Workarounds and Distributed Viscosity in a Workflow System: A Case Study. *SIGGROUP Bull.*, 20(3):11–12, 1999.

[90] T. T. K. Tran et al. Towards a pattern recognition approach for transferring knowledge in ACM. *IEEE 18th International Enterprise Distributed Object Computing Conference Workshops and Demonstrations*, 2014.

[91] Thomas Davenport, Laurence Prusak. *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Press, 1998.

[92] Van der Aalst, Berens. Beyond workflow management: product-driven case handling. *Prodceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work*, pages 42–51, 2001.

[93] Vincent Flanders. *Web Pages That Suck: Learn Good Design by Looking at Bad Design*. Sybex Inc., 1998.

[94] W. M. P. van der Aalst, A. H. M. ter Hofstede, M. Weske. Business Process Management: A Survey. *Lecture Notes in Computer Science*, 2678:1–12, 2003.

[95] W. M. P. van der Aalst et al. Case handling: a new paradigm for business process support. *Data & Knowledge Engineering*, 53:129–162, 2005.

[96] Whittlr. Whittlr Tumblr Blog. `http://whittlr.tumblr.com/`, 2015. [Online; accessed 14-02-2015].

[97] Wikipedia. Collaborative software. `http://en.wikipedia.org/wiki/Collaborative_software`. [Online; accessed 07-02-2015].

[98] William Buxton. *Sketching User Experiences: Getting the Design Right and the Right Design*. Morgan Kaufmann, 2007.

[99] Wolfgang Dorst. Adaptive Case Management - Leitfaden und Nachschlagewerk. Technical report, BITKOM, 2013.

104

[100] Zhiwei Guan et al. The validity of the stimulated retrospective think-aloud method as measured by eye tracking. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pages 1253–1262, 2006.
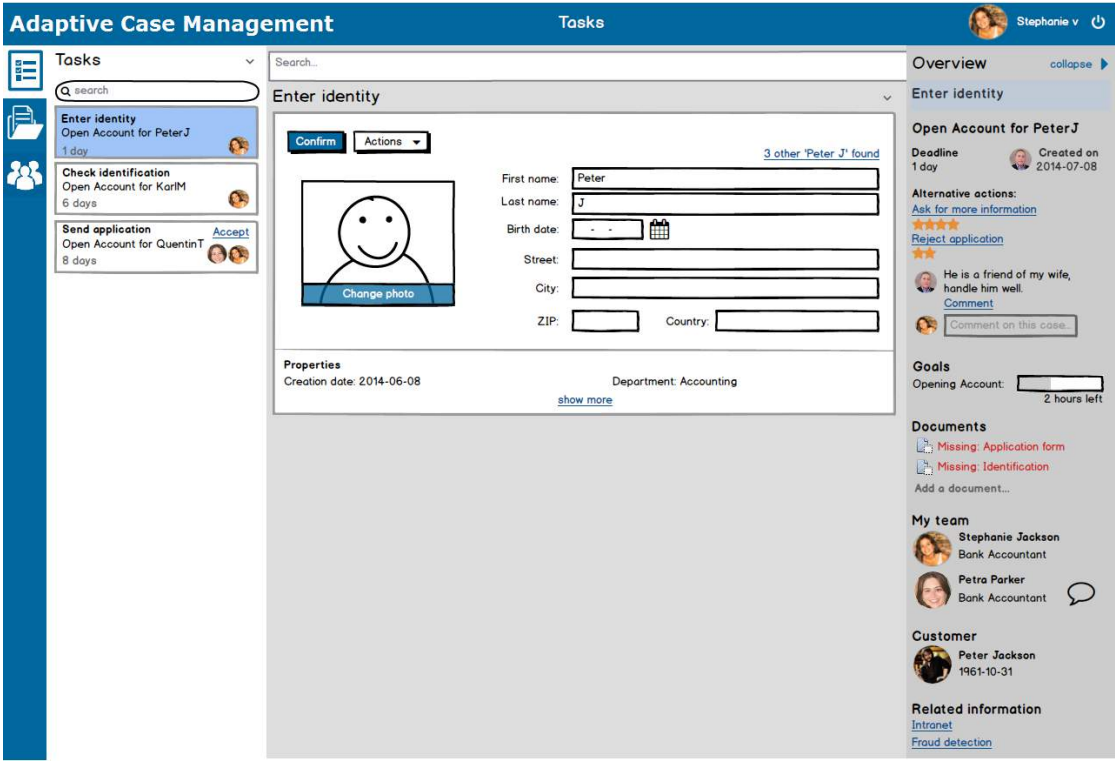
List of Figures

Wireframes
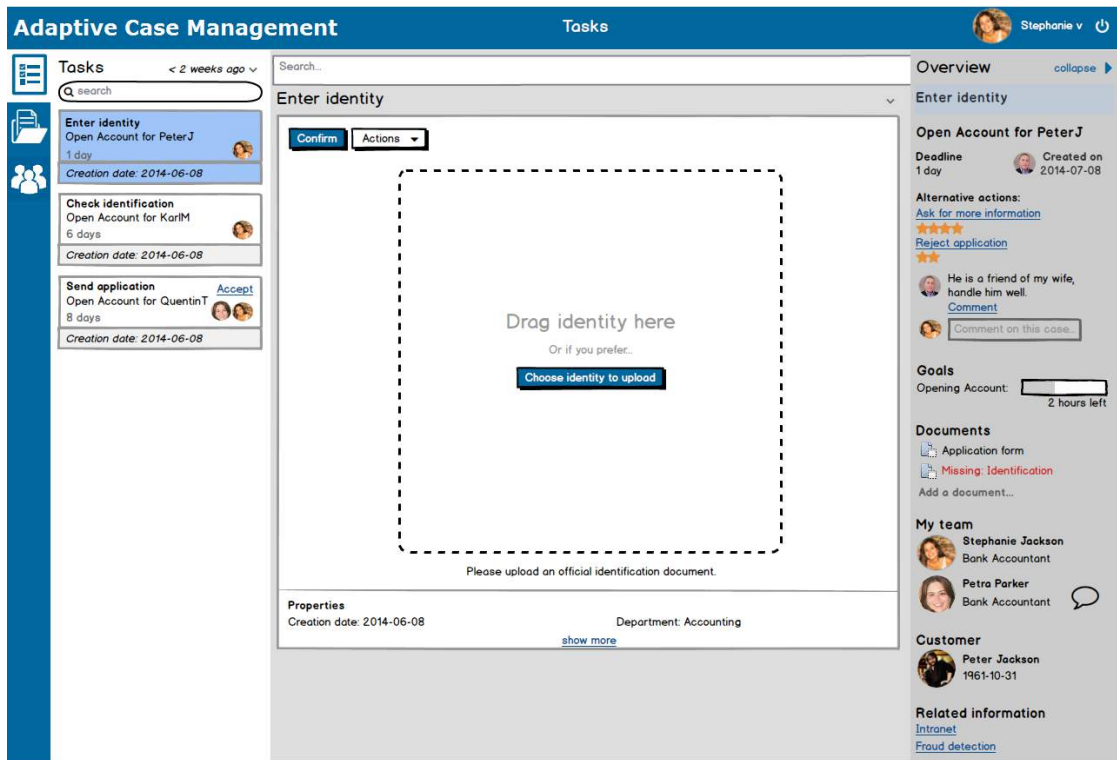

Figure A.1: Wireframe: Form task
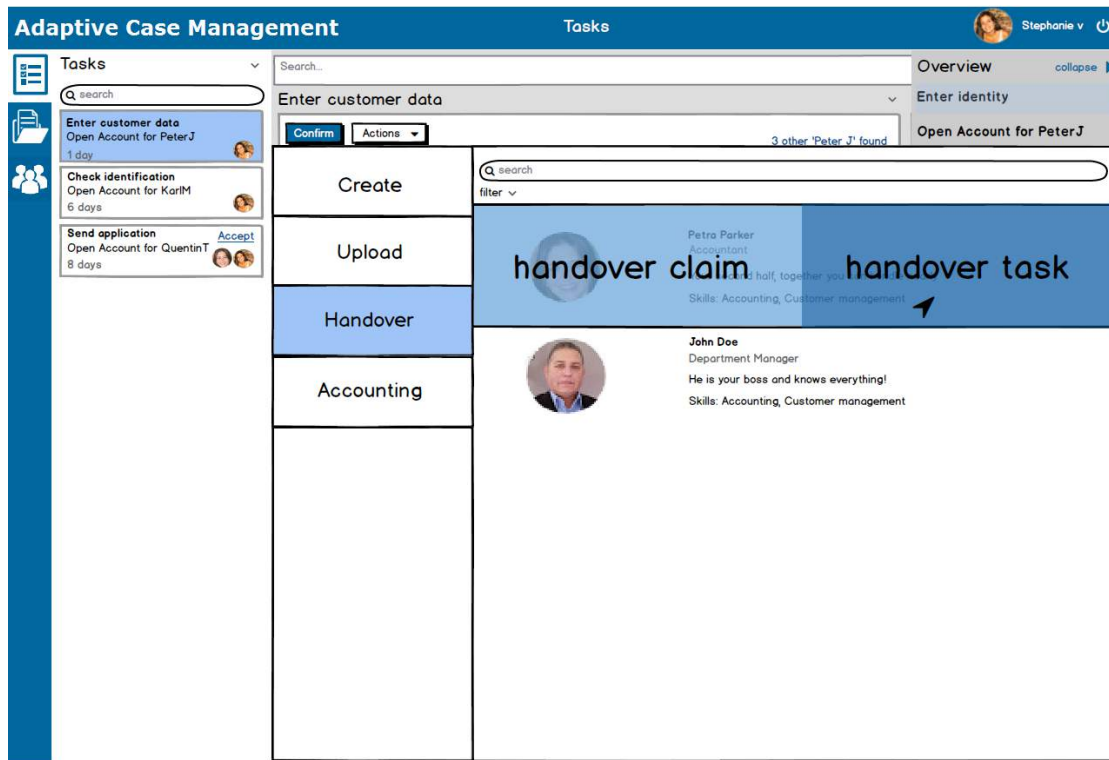
Figure A.2: Wireframe: Upload task

Figure A.3: Wireframe: Handover a task
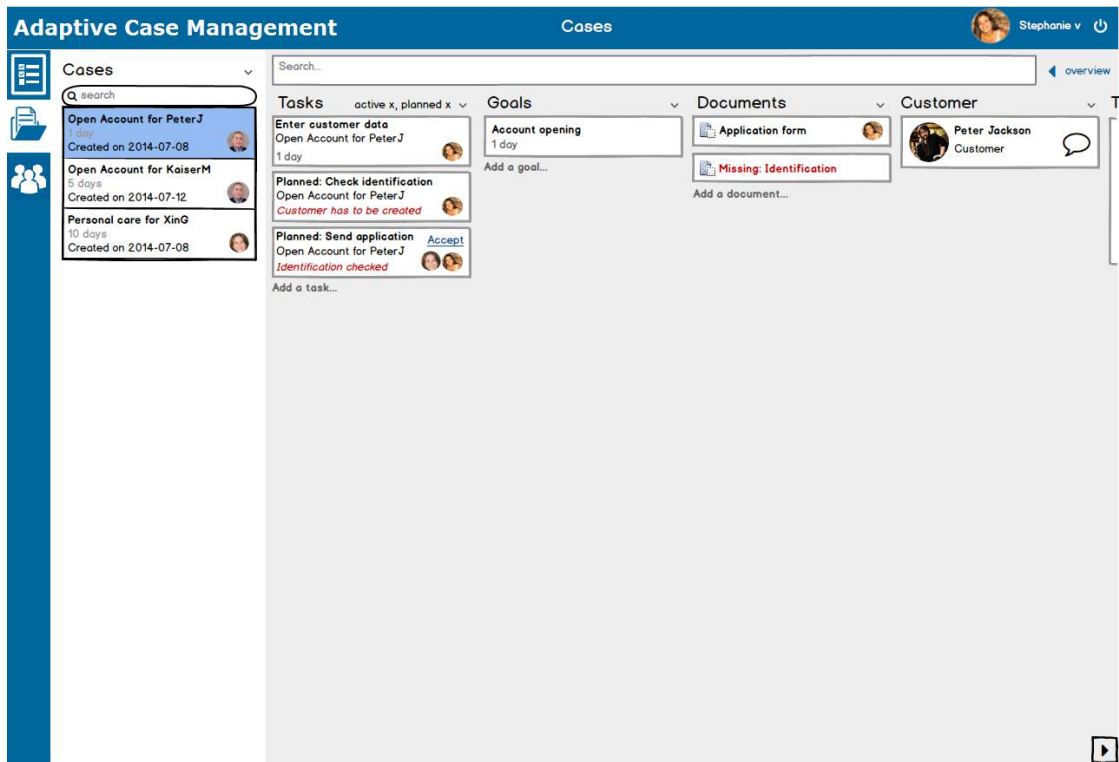
Figure A.4: Wireframe: Case workplace
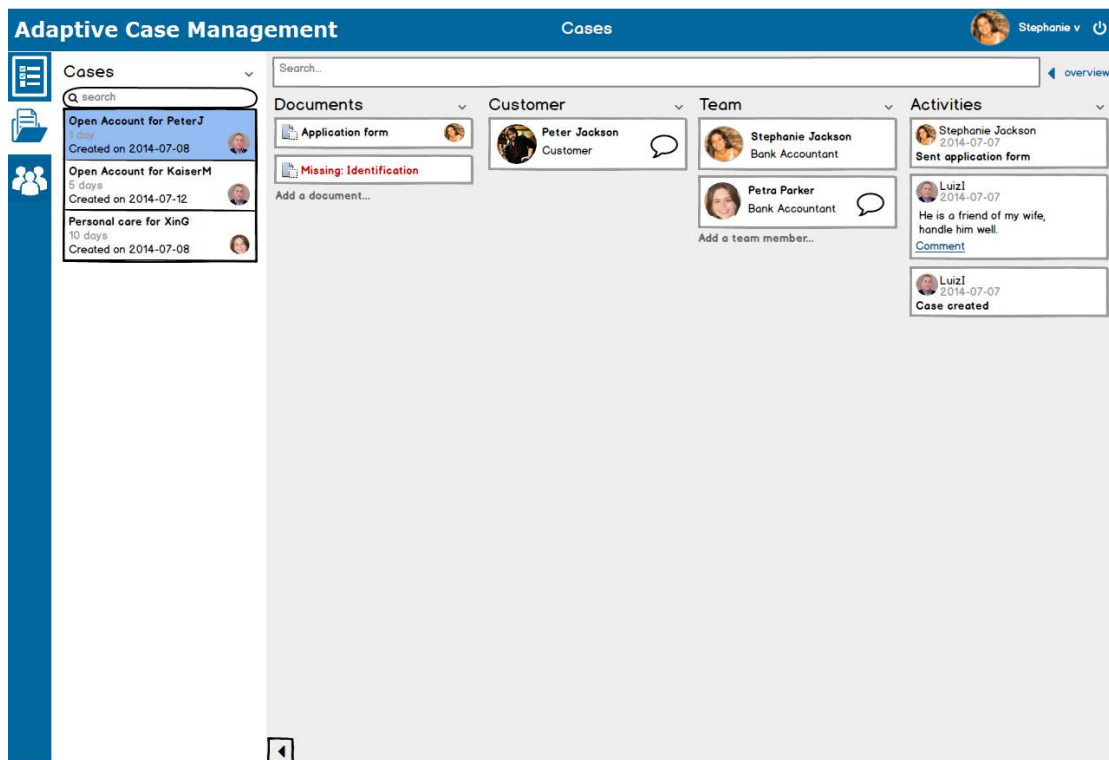
Figure A.5: Wireframe: Case workplace scrolled to the right
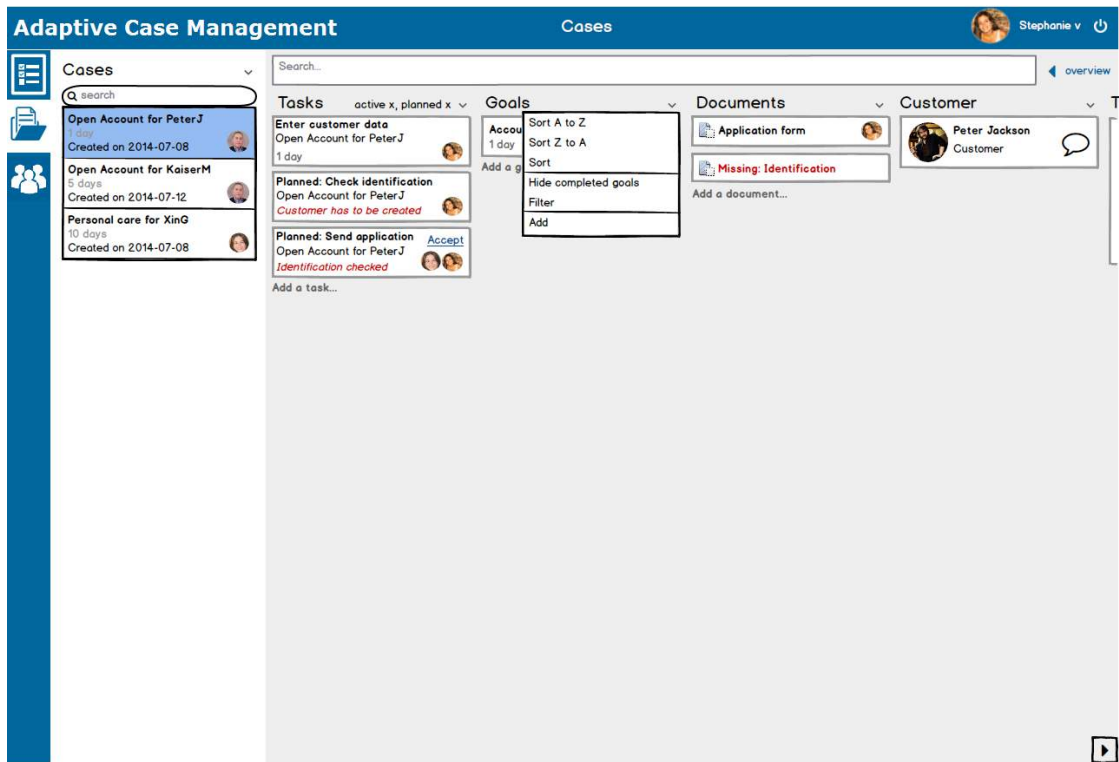
Figure A.6: Wireframe: Case column actions example
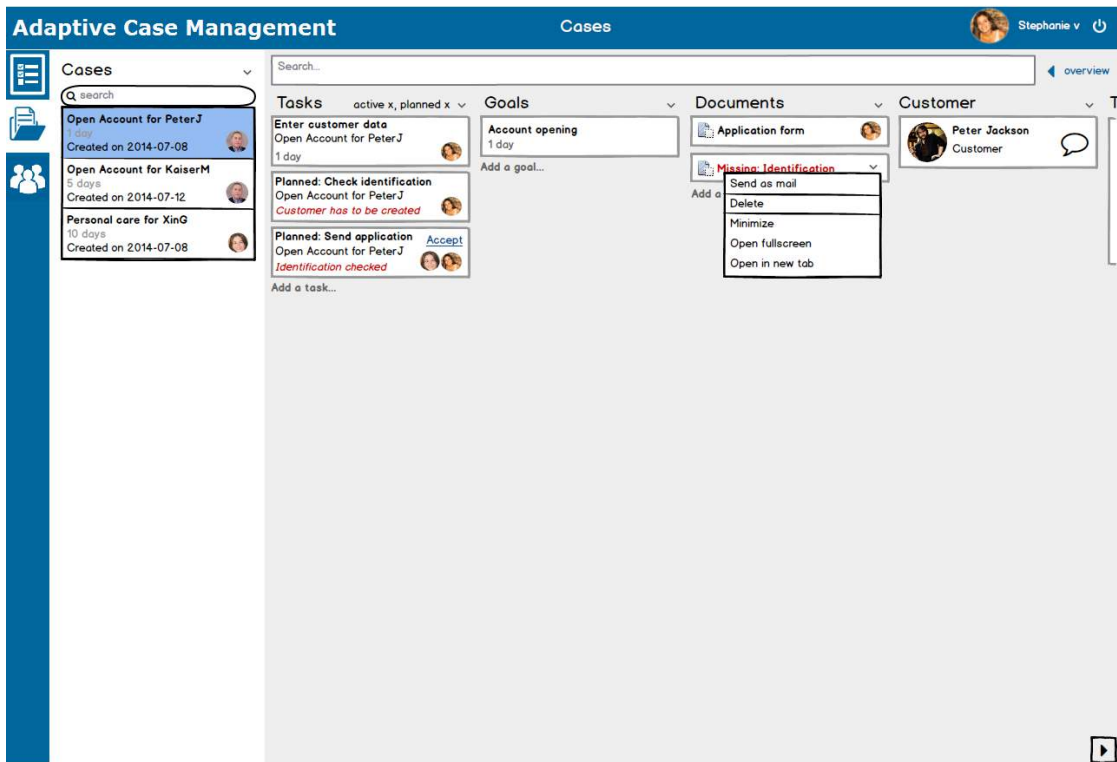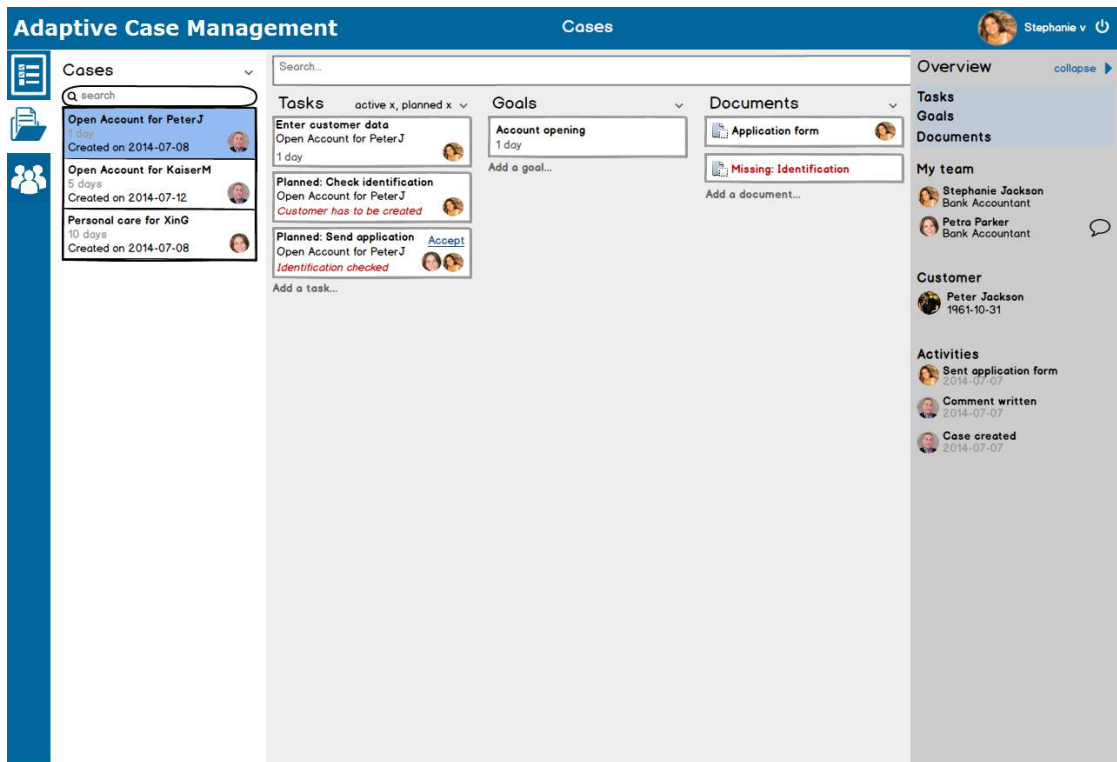
Figure A.7: Wireframe: Case card actions example
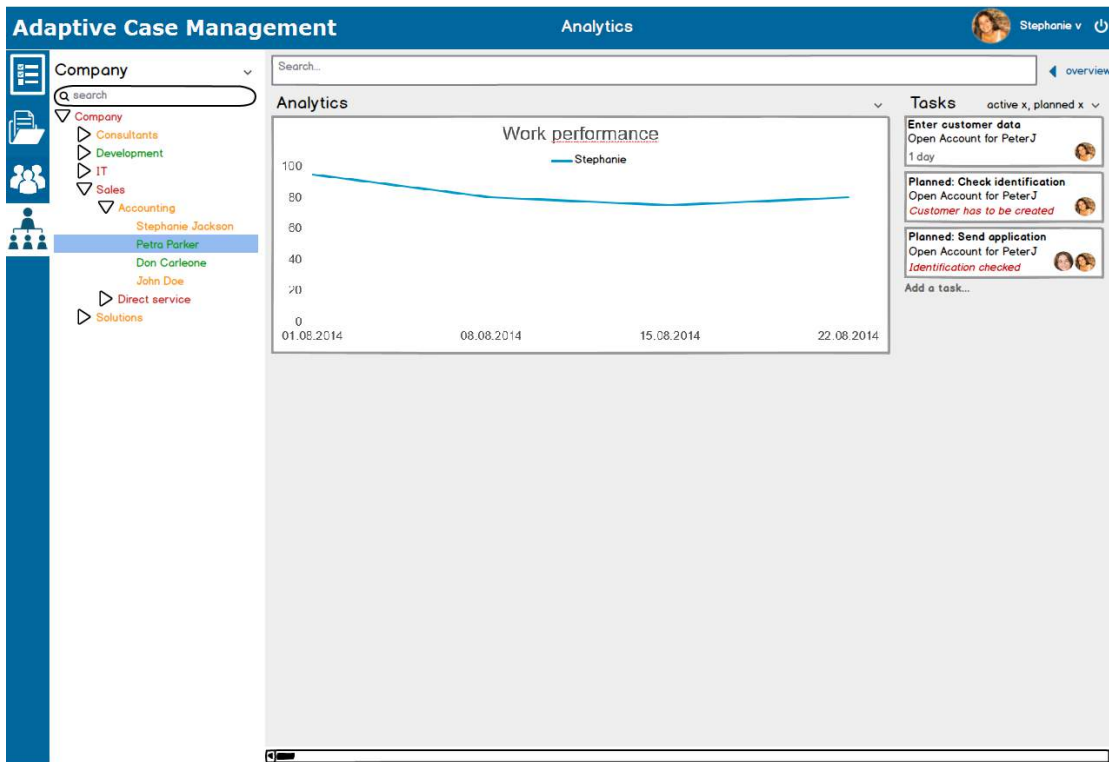
Figure A.8: Wireframe: Case overview opened

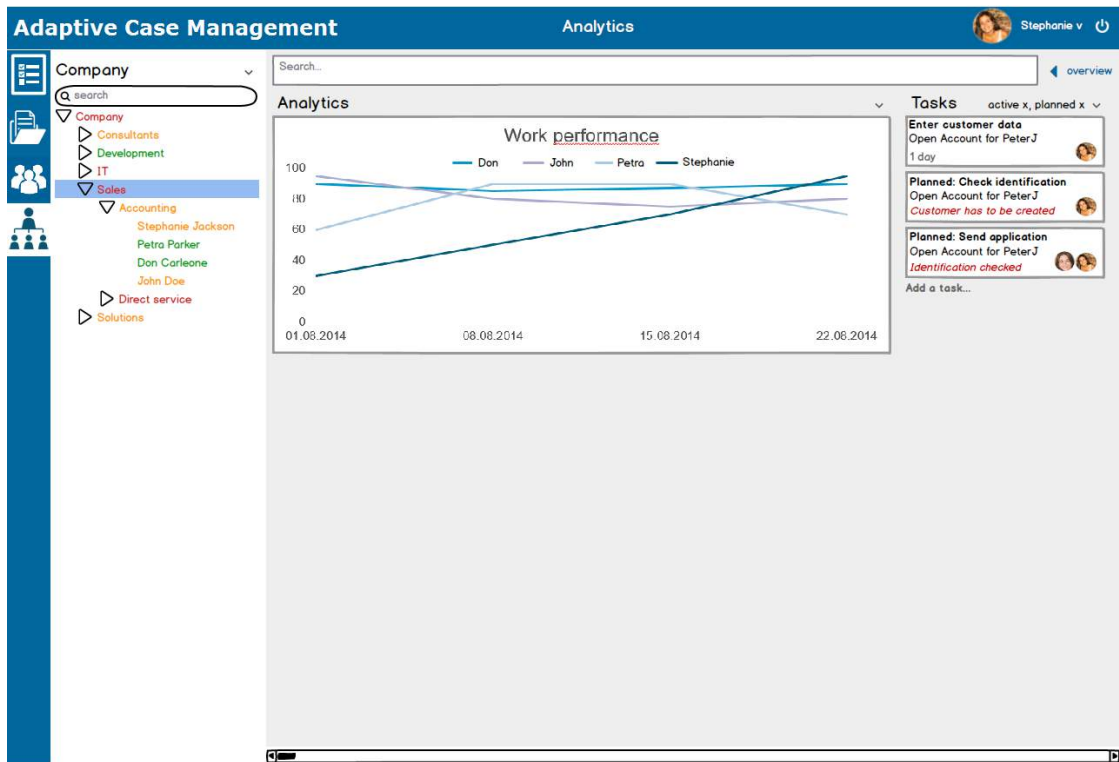**Figure A.9:** Wireframe: Manager view

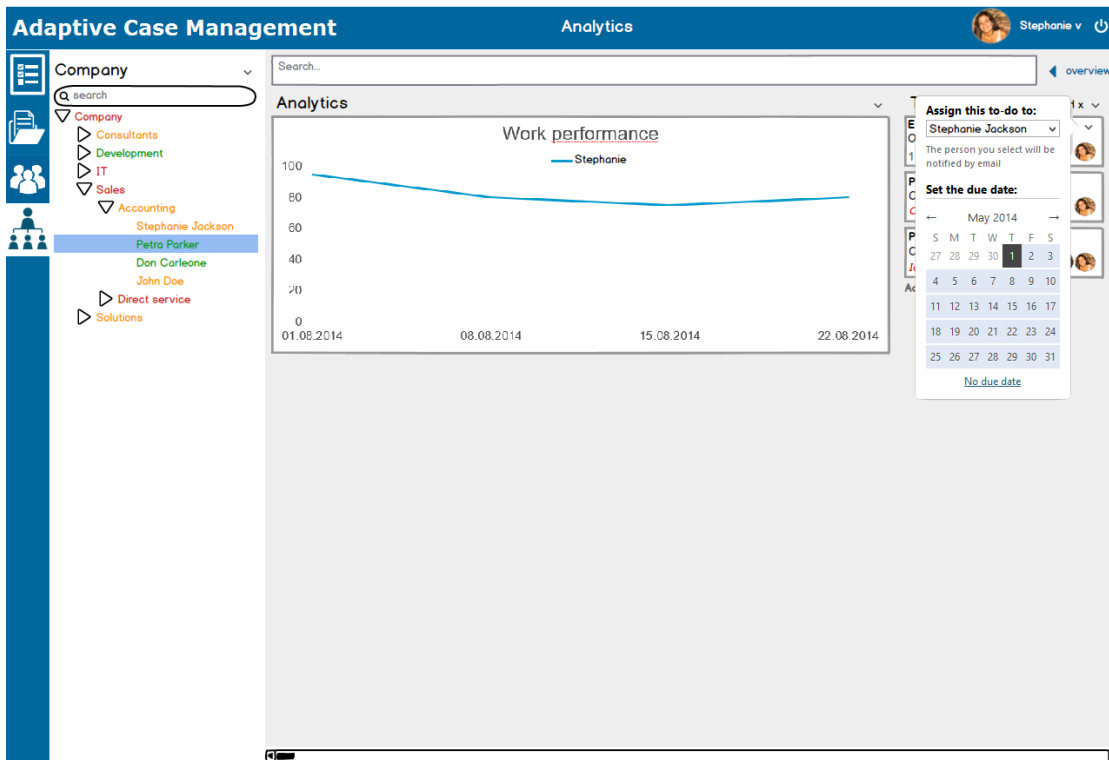**Figure A.10:** Wireframe: Manager group view

Figure A.11: Wireframe: Manager assign task

APPENDIX B

Interview Guideline

Introduction

Hi, _____. My name is Gustav, and I'm going to be walking you through this session today.

Before we begin, I have some information for you, and I'm going to read it to make sure that I cover everything.

You probably already have a good idea of why we asked you here, but let me go over it again briefly. We're asking people to try using a Web site that we're working on so we can see whether it works as intended. The session should take about an hour.

The first thing I want to make clear right away is that we're testing the software, not you. You can't do anything wrong here. In fact, this is probably the one place today where you don't have to worry about making mistakes.

As you use the site, I'm going to ask you as much as possible to try to think out loud: to say what you're looking at, what you're trying to do, and what you're thinking. This will be a big help to us.

Also, please don't worry that you're going to hurt our feelings. We're doing this to improve the site, so we need to hear your honest reactions.

If you have any questions as we go along, just ask them. I may not be able to answer them right away, since we're interested in how people do when they don't have someone sitting next to them to help. But if you still have any questions when we're done I'll try to answer them then. And if you need to take a break at any point, just let me know.

You may have noticed the microphone. With your permission, we're going to record what happens on the screen and our conversation. The recording will only be used to help us figure out how to improve the software, and it won't be seen by anyone except me. And it helps me, because I don't have to take as many notes.

Do you have any questions so far?

General questions

OK. Before we look at the software, I'd like to ask you just a few quick questions.

First, what's your occupation? Can you walk me through a typical day of you?

How many hours last week would you say you spent using the computer, including enterprise software and Web browsing, at work and at home?

And what's the split between using enterprise software and everything else – a rough percentage?

What kinds of software products in general do you use commonly?

OK, great. We're done with the questions, and we can start looking at things.

First, I'm going to ask you to look at this screen and tell me what you make of it: what strikes you about it, what you can do here, and what it's for. Just look around and do a little narrative, but don't click on anything yet.

Tasks

Thanks. Now I'm going to ask you to try doing some specific tasks. I'm going to read each one out loud and give you a printed copy.

And again, as much as possible, it will help us if you can try to think out loud as you go along.

- ❑ **Write down start time, end time and completion state of each task.**

- ❑ **Task 1:**
  You have met your boss on the floor and he asked you to send an application today to a new potential customer Quentin. He assigned to you the task already.

- ❑ **Task 2:**
  You've completed all your tasks for today and go home. You come back on the next morning and look into your inbox and process with your tasks. You got an answer from Quentin and complete the creation.

- ❑ **Task 3:**
  Peter sent you a mail that he is married. Please change his marital status.

PERCEIVED USEFULNESS		1	2	3	4	5	6	7		NA
1. Using the system in my job would enable me to accomplish tasks more quickly	unlikely	○	○	○	○	○	○	○	likely	○
2. Using the system would improve my job performance	unlikely	○	○	○	○	○	○	○	likely	○
3. Using the system in my job would increase my productity	unlikely	○	○	○	○	○	○	○	likely	○
4. Using the system would enhance my effectiveness on the job	unlikely	○	○	○	○	○	○	○	likely	○
5. Using the system would make it easier to do my job	unlikely	○	○	○	○	○	○	○	likely	○
6. I would find the system useful in my job	unlikely	○	○	○	○	○	○	○	likely	○
PERCEIVED EASE OF USE		**1**	**2**	**3**	**4**	**5**	**6**	**7**		**NA**
7. Learning to operate the system would be easy for me	unlikely	○	○	○	○	○	○	○	likely	○
8. I would find it easy to get the system to do what I want it to do	unlikely	○	○	○	○	○	○	○	likely	○
9. My interaction with the system would be clear and understandable	unlikely	○	○	○	○	○	○	○	likely	○
10. I would find the system to be flexible to interact with	unlikely	○	○	○	○	○	○	○	likely	○
11. It would be easy for me to become skillful at using the system	unlikely	○	○	○	○	○	○	○	likely	○
12. I would find the system easy to use	unlikely	○	○	○	○	○	○	○	likely	○

		1	2	3	4	5	6	7		NA
List the most **negative** aspects		List the most **positive** aspects								
1.		1.								
2.		2.								
3.		3.								

APPENDIX **C**

Study Mockups

Adaptive Case Management

Tasks

Stephanie v ⏻

Tasks

🔍 search

Send an offer
Open Account for QuentinT
1 day

Search...

Send an offer ⌄

Send | Actions ⌄

◉ Mail   ○ SMS   ○ Fax   ○ facebook

From: stepahnie.jackson@bank.com

To: quentin@tino.com

Attachements: 📄 Application form

Subject: Insurance application form

Body Text ⌄ | Variable Width ⌄ | ■ A˅ A˄ | A A A | ☰ ☰ ☰ ☰ | ☰ ▾ ■ ▾ ☺ ▾

Dear Mr. Tino,

We want to sent you this offer for a new account in our company. The offer is great with special benefits!

1. CLI will sell H.B.C.I., Inc. one System 100A as specified at the sales price of $149,950 F.O.B., Columbia, MD. This System 100A comes with on-site training and installation, free software update and CLI's limited one full year warranty on parts and labor.

2.   CLI will credit H.B.C.I., Inc. $79,950 for the following:

   (i) H.B.C.I., Inc. will fully and exclusively license without royalties, the patent rights of its microwave air cooled applicators patent #4332260 to CLI. CLI will have the right to defend the validity and content of said patent with H.B.C.I. technical help. H.B.C.I. will retain full rights to manufacture and sell under said patent.

   (ii) H.B.C.I., Inc. will fully and exclusively license without royalties its patent rights of its thermocouple probes patent #4369795 to CLI. CLI will have the right to defend the validity and content of said patent with H.B.C.I. technical help. CLI will consider purchase of H.B.C.I.'s thermocouples. H.B.C.I. will retain full rights to manufacture and sell under said patent.

   (iii) H.B.C.I., Inc. will fully and exclusively license without royalties its patent rights of its thermocouple probes patent #4369795 to CLI. CLI will have the right to defend the validity and content of said patent with H.B.C.I. technical help. CLI will consider purchase of H.B.C.I.'s thermocouples. H.B.C.I. will retain full rights to manufacture and sell under said patent.

Open Account for QuentinT

Deadline   Created on
1 day   2014-07-08

Alternative actions:
Ask for more information
★★★★
Reject application
★★

He is a friend of my wife, handle him well.
Comment

Comment on this case...

Goals
Opening Account: ▮▮▮▮▯▯
                    2 hours left

Documents
📄 Missing: Application form
📄 Missing: Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker   💬
Bank Accountant

Related information
Intranet
Fraud detection

Adaptive Case Management

Tasks   Stephanie ⌄ ⏻

Tasks

🔍 search

Send an offer
Open Account for QuentinT
1 day

Search...

Send an offer   ⌄

| Send | Actions ▾ |

Ask for more information
Reject application

⦿ Mail   ○ Fax   ○ facebook

@bank.com

To: quentin@tino.com

Attachements: 📄 Application form

Subject: Insurance application form

Body Text ⌄   Variable Width   ⌄   ■ ▾ A⁺ A⁺ A A A ☰ ☷ ⯮ ⯬ ☰ ▾ ■ ▾ ☺ ▾

Dear Mr. Tino,

We want to sent you this offer for a new account in our company. The offer is great with special benefits!

1. CLI will sell H.B.C.I., Inc. one System 100A as specified at the sales price
of $149,950 F.O.B., Columbia, MD. This System 100A comes with on-site training
and installation, free software update and CLI's limited one full year warranty
on parts and labor.

2.   CLI will credit H.B.C.I., Inc. $79,950 for the following:

    (i) H.B.C.I., Inc. will fully and exclusively license without royalties,
the patent rights of its microwave air cooled applicators patent #4332260 to
CLI. CLI will have the right to defend the validity and content of said patent
with H.B.C.I. technical help. H.B.C.I. will retain full rights to manufacture
and sell under said patent.

    (ii) H.B.C.I., Inc. will fully and exclusively license without royalties
its patent rights of its thermocouple probes patent #4369795 to CLI. CLI will
have the right to defend the validity and content of said patent with H.B.C.I.
technical help. CLI will consider purchase of H.B.C.I.'s thermocouples. H.B.C.I.
will retain full rights to manufacture and sell under said patent.

    (iii) H.B.C.I., Inc. will fully and exclusively license without royalties
its patent rights of its thermocouple probes patent #4369795 to CLI. CLI will
have the right to defend the validity and content of said patent with H.B.C.I.
technical help. CLI will consider purchase of H.B.C.I.'s thermocouples. H.B.C.I.
will retain full rights to manufacture and sell under said patent.

Overview   collapse ▶

Send an offer

Open Account for QuentinT

Deadline   **Created on**
1 day   2014-07-08

Alternative actions:
Ask for more information
★★★★
Reject application
★★

He is a friend of my wife,
handle him well.
Comment

Comment on this case...

Goals
Opening Account: [▭▭▭▭]
                        2 hours left

Documents
📄 Missing: Application form
📄 Missing: Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker
Bank Accountant   💬

Related information
Intranet
Fraud detection

Tasks ⌄

search

No tasks available

✓ Mail sent successfully!

Adaptive Case Management

Tasks

Stephanie ⌄ ⏻

Tasks ⌄

🔍 search

Check identity
Open Account for QuentinT
1 day

Search...

Check identity ⌄

Confirm **Actions** ▾

3 other 'Peter J' found

First name:	Quentin
Last name:	Tino
Birth date:	1963-03-27 📅
Street:	Pulp fiation street
City:	San Francisco
ZIP: 245	Country: United States
Marial status	Single

Change photo

Properties
Creation date: 2014-06-08   Department: Accounting

show more

Dear Mr. Tino,

thanks for your great offer. I'm really interessted in that! I've attached the form and my identification.

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiction street 12
City: San Francisco
ZIP: 245
Country: United States
Marial status: Single

Overview   collapse ▶

Check identity

Open Account for QuentinT

Deadline   **Created on**
1 day   2015-01-22

Alternative actions:
Ask for more information
★★★★
Reject application
★★

He is a friend of my wife, handle him well.
Comment

Comment on this case...

Goals
Opening Account:
8 hours left

Documents
📄 Application form
📄 Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker
Bank Accountant 💬

Related information
Intranet
Fraud detection

Adaptive Case Management

Tasks

Stephanie ∨ ⏻

Tasks ∨

🔍 search

Check identity
Open Account for QuentinT
1 day

Search...

Check identity ∨

[Confirm] [Actions ▾]

3 other 'Peter J' found

First name: Quentin
Last name: Tino
Birth date: 1963-03-27 📅
Street: Pulp fiation street 12
City: San Francisco
ZIP: 245   Country: United States
Marial status: Single

[Change photo]

Properties
Creation date: 2014-06-08   Department: Accounting

show more

Dear Mr. Tino,

thanks for your great offer. I'm really interessted in that! I've attached the form and my identification.

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiction street 12
City: San Francisco
ZIP: 245
Country: United States
Marial status: Single

Overview   collapse ▶

Check identity

Open Account for QuentinT

Deadline   Created on
1 day   2015-01-22

Alternative actions:
Ask for more information
⭐⭐⭐⭐
Reject application
⭐⭐

He is a friend of my wife, handle him well.
Comment

Comment on this case...

Goals
Opening Account:
8 hours left

Documents
📄 Application form
📄 Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant
Petra Parker
Bank Accountant 💬

Related information
Intranet
Fraud detection

Adaptive Case Management

Tasks

Stephanie v

Tasks

search

Check identity
Open Account for QuentinT
1 day

Search...

Check identity

Confirm   Actions ▾

3 other 'Peter J' found

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiation street
City: San Francisco
ZIP: 245   Country: United States
Marial status   Single

Change photo

Properties
Creation date: 2014-06-08   Department: Accounting

show more

Dear Mr. Tino,

thanks for your great offer. I'm really interessted in that! I've attached the form and my identification.

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiction street 12
City: San Francisco
ZIP: 245
Country: United States
Marial status: Single

Overview   collapse ▶

Check identity

Open Account for QuentinT

Deadline   Created on
1 day   2015-01-22

Alternative actions:
Ask for more information
★★★★
Reject application
★★

He is a friend of my wife, handle him well.
Comment

Comment on this case...

Goals
Opening Account:
8 hours left

Documents
📄 Application form
📄 Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker
Bank Accountant

Related information
Intranet
Fraud detection

Tasks

🔍 search

Check identity
Open Account for QuentinT
1 day

Search...

Check identity ⌄

[Confirm] [Actions ⌄]

3 other 'Peter J' found

[Change photo]

First name: Quentin
Last name: Tino
Birth date: 1963-03-27 📅
Street: Pulp fiction street
City: San Francisco
ZIP: 245   Country: United States
Marial status: Single

Properties
Creation date: 2014-06-08   Department: Accounting

show more

Dear Mr. Tino,

thanks for your great offer. I'm really interessted in that! I've attached the form and my identification.

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiction street 12
City: San Francisco
ZIP: 245
Country: United States
Marial status: Single

Overview   collapse ▶

Check identity

Open Account for QuentinT

Deadline   Created on
1 day   2015-01-22

Alternative actions:
Ask for more information
⭐⭐⭐⭐
Reject application
⭐⭐

He is a friend of my wife, handle him well.
Comment

Comment on this case...

Goals
Opening Account:
8 hours left

Documents
📄 Application form
📄 Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker
Bank Accountant   💬

Related information
Intranet
Fraud detection

Adaptive Case Management

Tasks

Stephanie v

Tasks

search

Check identity
Open Account for QuentinT
1 day

Check identity

Search...

Confirm   Actions ▾

3 other 'Peter J' found

First name:	Quentin
Last name:	Tino
Birth date:	1963-03-27 📅
Street:	Pulp fiation street 12
City:	San Francisco
ZIP:	245 Country: United States
Marial status	Single

Change photo

Properties
Creation date: 2014-06-08   Department: Accounting

show more

Dear Mr. Tino,

thanks for your great offer. I'm really interessted in that! I've attached the form and my identification.

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiction street 12
City: San Francisco
ZIP: 245
Country: United States
Marial status: Single

Overview   collapse ▶

Check identity

Open Account for QuentinT

Deadline	Created on
1 day	2015-01-22

Alternative actions:
Ask for more information
★★★★
Reject application
★★

He is a friend of my wife, handle him well.
Comment

Comment on this case...

Goals
Opening Account:
8 hours left

Documents
📄 Application form
📄 Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker
Bank Accountant 💬

Related information
Intranet
Fraud detection

Adaptive Case Management

Stephanie v ⏻

Tasks ⌄

🔍 search

Check identity
Open Account for QuentinT
1 day

Search...

Check identity ⌄

Confirm   **Actions** ▾

3 other 'Peter J' found

First name: | Quentin
Last name: | Tino
Birth date: | 1963-03-27 📅
Street: | Pulp fiction street 12
City: | San Francisco
ZIP: | 245   Country: | United States
Marial status | Single

Change photo

Properties

Creation date: 2014-06-08   Department: Accounting

show more

Dear Mr. Tino,

thanks for your great offer. I'm really interessted in that! I've attached the form and my identification.

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiction street 12
City: San Francisco
ZIP: 245
Country: United States
Marial status: Single

Overview   collapse ▶

Check identity

Open Account for QuentinT

Deadline   **Created on**
1 day   2015-01-22

Alternative actions:
Ask for more information
★★★★
Reject application
★★

He is a friend of my wife,
handle him well.
Comment

Comment on this case...

Goals
Opening Account:
8 hours left

Documents
📄 Application form
📄 Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker   💬
Bank Accountant

Related information
Intranet
Fraud detection

Adaptive Case Management

Tasks

Stephanie v ⏻

Tasks ⌄

🔍 search

Check identity
Open Account for QuentinT
1 day

Mail: I'm married!   Accept
Bank account of PeterJ
1 day

Send an offer
Open Account for PeterP
1 day

Search...

Check identity ⌄

[Confirm]   [Actions ▾]

3 other 'Peter J' found

First name:	Quentin
Last name:	Tino
Birth date:	1963-03-27 📅
Street:	Pulp fiction street 12
City:	San Francisco
ZIP: 245	Country: United States
Marial status	Single

Change photo

Properties
Creation date: 2014-06-08   Department: Accounting

show more

Dear Mr. Tino,

thanks for your great offer. I'm really interessted in that! I've attached the form and my identification.

First name: Quentin
Last name: Tino
Birth date: 1963-03-27
Street: Pulp fiction street 12
City: San Francisco
ZIP: 245
Country: United States
Marial status: Single

Overview   collapse ▶

Check identity

Open Account for QuentinT

Deadline   **Created on**
1 day   2015-01-22

Alternative actions:
Ask for more information
⭐⭐⭐⭐
Reject application
⭐⭐

He is a friend of my wife,
handle him well.
Comment

Comment on this case...

Goals
Opening Account: ▭▭▭
8 hours left

Documents
📄 Application form
📄 Identification
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker   💬
Bank Accountant

Related information
Intranet
Fraud detection

Stephanie v ⏻

Tasks ⌄

🔍 search

Enter identity
Open Account for QuentinT
1 day

Mail: I'm married!   Accept
Bank account of PeterJ
1 day

Send an offer
Open Account for PeterP
1 day

✔ QuentinT added as customer.

Adaptive Case Management

Tasks

Stephanie v ⏻

Tasks ⌄

🔍 search

Mail: I'm married!
Bank account of PeterJ
1 day   Accept

Send an offer
Open Account for PeterP
1 day

Search...

Mail: I'm married! ⌄

Accept | Actions ⌄ |

Dear Bank employee,

I'm proudly able to announce that I'm married!

My name has not change.

Best Regards,
Peter Jackson

Overview   collapse ▶

Mail: I'm married!

Bank account of PeterJ

Deadline   Created on
1 day   2015-01-20

Alternative actions:
Handover to Petra
★★★★

Comment on this case...

Goals
Opening Account:
                      2 hours left

Documents
📄 Application form
📄 Identification
📄 Mail: Financial problems
Add a document...

My team
Stephanie Jackson
Bank Accountant
Petra Parker
Bank Accountant   💬

Customer
Peter Jackson
1961-10-31

Related information
Intranet
Fraud detection

Adaptive Case Management

Tasks

Stephanie ∨ ⏻

Tasks

search

Mail: I'm married! — Complete
Bank account of PeterJ
1 day

Send an offer
Open Account for PeterP
1 day

Search...

Mail: I'm married!

Complete | Actions ▼

Dear Bank employee,

I'm proudly able to announce that I'm married!

My name has not change.

Best Regards,
Peter Jackson

Overview — collapse ▶

Mail: I'm married!

Bank account of PeterJ

Deadline
1 day

Created on
2015-01-20

Alternative actions:
Ask for more information
★★★★

Comment on this case...

Goals
Opening Account:
2 hours left

Documents
📄 Application form
📄 Identification
📄 Mail: Financial problems
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker
Bank Accountant 💬

Customer
Peter Jackson
1961-10-31

Related information
Intranet
Fraud detection

Adaptive Case Management

Customer

Stephanie v ⏻

Customer ⌄

🔍 Search

Andrew Dunkins
1940-04-02

Ben Kittler
1961-10-31

Charlie Down
1940-04-02

Dagobert Hook
1970-03-12

Francis Bacon
1961-10-31

Geroge Town
1940-04-02

Glinda Bloom
1970-03-12

Hans
1961-10-31

Hannes Peters
1940-04-02

Markus Johnson
1970-03-12

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...

◀ overview

Andrew Dunkins ⌄

First name: **Andrew**

Last name: **Dunkins**

Birth date: **05/05/1970**

Street: **Road 8**

City: **San Francisco**

ZIP: **245**

Country: **USA**

Marital status: **Single**

Creation date: **01/06/2014**

Tasks   active x, planned x ⌄

Enter customer data   Confirm
Open Account for AndrewD
1 day

Planned: Check identification
Open Account for AndrewD
Customer has to be created

Planned: Send application
Open Account for AndrewD
Identification checked

Add a task...

Goals ⌄

Open Account for AndrewD
1 day

Add a goal...

Documents ⌄

📄 Application form

📄 **Missing: Identification**

Add a document...

▶

Adaptive Case Management

Customer

Stephanie v

Customer

Jackson

Andrew Dunkins
1940-04-02

Ben Kittler
1961-10-31

Charlie Down
1940-04-02

Dagobert Hook
1970-03-12

Francis Bacon
1961-10-31

Geroge Town
1940-04-02

Glinda Bloom
1970-03-12

Hans
1961-10-31

Hannes Peters
1940-04-02

Markus Johnson
1970-03-12

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...

◀ overview

Peter Jackson ⌄

First name: **Peter**

Last name: **Jackson**

Birth date: **05/05/1960**

Street: **Cut Through Rd. 6**

City: **Honey Island**

ZIP: **77625**

Country: **USA**

Marital status: **Single**

Creation date: **01/06/2014**

Tasks   active x, planned x ⌄

Mail: I'm married!   Complete
Open Account for PeterJ
1 day

Add a task...

Goals ⌄

Handle mail
1 day

Add a goal...

Documents ⌄

📄 Application form

📄 Identification

✉ Mail: Financial Problems

Add a document...

▶

Adaptive Case Management

Customer

Stephanie v

Customer

Jackson

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...

◀ overview

Peter Jackson

First name:	**Peter**
Last name:	**Jackson**
Birth date:	**05/05/1960**
Street:	**Cut Through Rd. 6**
City:	**Honey Island**
ZIP:	**77625**
Country:	**USA**
Marital status:	**Single**
Creation date:	**01/06/2014**

Tasks   active x, planned x ∨

Mail: I'm married!
Open Account for PeterJ
1 day   **Complete**

Add a task...

Goals

Handle mail
1 day

Add a goal...

Documents

📄 Application form

📄 Identification

✉ Mail: Financial Problems

Add a document...

▶

Adaptive Case Management

Customer   Stephanie v ⏻

Customer ⌄

🔍 Jackson

Andrew Dunkins
1940-04-02

Ben Kittler
1961-10-31

Charlie Down
1940-04-02

Dagobert Hook
1970-03-12

Francis Bacon
1961-10-31

Geroge Town
1940-04-02

Glinda Bloom
1970-03-12

Hans
1961-10-31

Hannes Peters
1940-04-02

Markus Johnson
1970-03-12

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...   ◀ overview

Peter Jackson ⌄
| Edit |
| Close account |

First name: Peter
Last name: Jackson
Birth date: 05/05/1960
Street: Cut Through Rd. 6
City: Honey Island
ZIP: 77625
Country: USA
Marital status: Single
Creation date: 01/06/2014

Tasks   active x, planned x ⌄
Mail: I'm married!   Complete
Open Account for PeterJ
1 day

Add a task...

Goals ⌄
Handle mail
1 day

Add a goal...

Documents ⌄
📄 Application form
📄 Identification
✉ Mail: Financial Problems

Add a document...

Adaptive Case Management

Customer

Stephanie v ⏻

Customer ⌄

🔍 Jackson

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...

◄ overview

Peter Jackson ⌄

Edit
Close account

First name: **Peter**

Last name: **Jackson**

Birth date: **05/05/1960**

Street: **Cut Through Rd. 6**

City: **Honey Island**

ZIP: **77625**

Country: **USA**

Marital status: **Single**

Creation date: **01/06/2014**

Tasks   active x, planned x ⌄

Mail: I'm married!   Complete
Open Account for PeterJ
1 day

Add a task...

Goals ⌄

Handle mail
1 day

Add a goal...

Documents ⌄

📄 Application form

📄 Identification

✉ Mail: Financial Problems

Add a document...

▶

Adaptive Case Management

Customer

Stephanie v

Customer

Jackson

Andrew Dunkins
1940-04-02

Ben Kittler
1961-10-31

Charlie Down
1940-04-02

Dagobert Hook
1970-03-12

Francis Bacon
1961-10-31

Geroge Town
1940-04-02

Glinda Bloom
1970-03-12

Hans
1961-10-31

Hannes Peters
1940-04-02

Markus Johnson
1970-03-12

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...

◀ overview

Peter Jackson

First name: Peter

Last name: Jackson

Birth date: 05/05/1960

Street: Cut Through Rd. 6

City: Honey Island

ZIP: 77625

Country: USA

Marital status: Single

Creation date: **01/06/2014**

Save

Tasks   active x, planned x

Mail: I'm married!
Open Account for PeterJ
1 day   Complete

Add a task...

Goals

Handle mail
1 day

Add a goal...

Documents

Application form

Identification

Mail: Financial Problems

Add a document...

Adaptive Case Management

Customer

Stephanie v ⏻

Customer ⌄

🔍 Jackson

Andrew Dunkins
1940-04-02

Ben Kittler
1961-10-31

Charlie Down
1940-04-02

Dagobert Hook
1970-03-12

Francis Bacon
1961-10-31

Geroge Town
1940-04-02

Glinda Bloom
1970-03-12

Hans
1961-10-31

Hannes Peters
1940-04-02

Markus Johnson
1970-03-12

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...

◀ overview

Peter Jackson ⌄

First name:	Peter
Last name:	Jackson
Birth date:	05/05/1960
Street:	Cut Through Rd. 6
City:	Honey Island
ZIP:	77625
Country:	USA
Marital status:	Married
Creation date:	**01/06/2014**

Save

Tasks   active x, planned x ⌄

Mail: I'm married!
Open Account for PeterJ
1 day   Complete

Add a task...

Goals ⌄

Handle mail
1 day

Add a goal...

Documents ⌄

📄 Application form

📄 Identification

✉ Mail: Financial Problems

Add a document...

Adaptive Case Management

Customer

Stephanie ⌄ ⏻

Customer ⌄

🔍 Jackson

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...

◀ overview

Peter Jackson ⌄

First name: Peter
Last name: Jackson
Birth date: 05/05/1960
Street: Cut Through Rd. 6
City: Honey Island
ZIP: 77625
Country: USA
Marital status: Married
Creation date: **01/06/2014**

Save

Tasks   active x, planned x ⌄

Mail: I'm married!
Open Account for PeterJ   Complete
1 day

Add a task...

Goals ⌄

Handle mail
1 day

Add a goal...

Documents ⌄

📄 Application form

📄 Identification

✉ Mail: Financial Problems

Add a document...

Adaptive Case Management

Customer   Stephanie v ⏻

Customer ⌄

🔍 Search

Andrew Dunkins
1940-04-02

Ben Kittler
1961-10-31

Charlie Down
1940-04-02

Dagobert Hook
1970-03-12

Francis Bacon
1961-10-31

Geroge Town
1940-04-02

Glinda Bloom
1970-03-12

Hans
1961-10-31

Hannes Peters
1940-04-02

Markus Johnson
1970-03-12

Peter Jackson
1961-10-31

Steve Jackson
1940-04-02

Will Jackson
1970-03-12

Search...   ◀ overview

Peter Jackson ⌄

First name:	**Peter**
Last name:	**Jackson**
Birth date:	**05/05/1960**
Street:	**Cut Through Rd. 6**
City:	**Honey Island**
ZIP:	**77625**
Country:	**USA**
Marital status:	**Married**
Creation date:	**01/06/2014**

Tasks   active x, planned x ⌄

Mail: I'm married!   Complete
Open Account for PeterJ
1 day

Add a task...

Goals ⌄

Handle mail
1 day

Add a goal...

Documents ⌄

📄 Application form

📄 Identification

✉ Mail: Financial Problems

Add a document...

Adaptive Case Management

Customer

Stephanie v ⏻

Customer ⌄

🔍 Jackson

Peter Jackson	
1961-10-31	
Steve Jackson	
1940-04-02	
Will Jackson	
1970-03-12	

Search...

◀ overview

Peter Jackson ⌄

First name: **Peter**

Last name: **Jackson**

Birth date: **05/05/1960**

Street: **Cut Through Rd. 6**

City: **Honey Island**

ZIP: **77625**

Country: **USA**

Marital status: **Married**

Creation date: **01/06/2014**

Tasks active x, planned x ⌄

Mail: I'm married! **Complete**
Open Account for PeterJ
1 day

Add a task...

Goals ⌄

Handle mail
1 day

Add a goal...

Documents ⌄

📄 Application form

📄 Identification

✉️ Mail: Financial Problems

Add a document...

Adaptive Case Management

Tasks

Stephanie v ⏻

Tasks

🔍 search

Mail: I'm married!
Bank account of PeterJ
1 day   Accept

Send an offer
Open Account for PeterP
1 day

Search...

Mail: I'm married!

Complete | Actions ▾ |

Dear Bank employee,

I'm proudly able to announce that I'm married!

My name has not change.

Best Regards,
Peter Jackson

Overview   collapse ▶

Mail: I'm married!

Bank account of PeterJ

Deadline   **Created on**
1 day   2015-01-20

Alternative actions:
Ask for more information
★★★★

💬 Comment on this case...

Goals
Opening Account:
2 hours left

Documents
📄 Application form
📄 Identification
📄 Mail: Financial problems
Add a document...

My team
Stephanie Jackson
Bank Accountant

Petra Parker
Bank Accountant   💬

Customer
Peter Jackson
1961-10-31

Related information
Intranet
Fraud detection

Tasks ⌄

🔍 search

Mail: I'm married!   Accept
Bank account of Peter J
1 day

Send an offer
Open Account for PeterP
1 day

✅ Task completed!