# The Road to Useful Online Identity Managers

Design Science Research on the user experience side of Online Identity Managers

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**Abstract:** Each person that has used an online service, has an online identity, even if he or she does not realize it. Recently, online identity, and more specifically identity and privacy as rights on the internet, have come under global debate. The debate has been sparked by several global scandals related to online privacy infringement where several million online identities have been used for political purposes without consent of the online identity user.

Independent online identity protection and management could prevent similar future scandals as online identities would not be stored centrally on the servers of each online service individually, but at dedicated-, and independent online identity services. However, several problems have been identified that prevent such services to manifest online, among which the problem of not useful user experience design. The aim of this study was to provide a user experience design framework to entrepreneurs on utility and usability for designing more useful user experiences for Online Identity Managers.

The user experience utility results of this study were the user needs for creating, managing, and connecting an online identity with other online services to use it in the interaction with others. Usability results were the user needs for user experience design focused on simplicity where flat and intuitive information structuring is applied, containing only the most relevant information at each screen, and where the user is only notified in the case of online identity influencing events with easy-to-use decision-making features. Additionally, human rights on identity and privacy, along with related regulations and principles need to be fundamentally implemented to the user experience design of the Online Identity Manager.

The design framework was evaluated useful by a user experience expert and by user tests with a resulted 90% overall simplicity score, compared to an established average field benchmark of 50%. This study however focused only on simplicity in usability. It is advised for future research to expand and evaluate the design framework with other usability principles as well.

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**Keywords**
Design Framework, Online Identity, Online Identity Management, Online Identity Protection, Self-Sovereign Identity, Seniors, User Experience, User Experience Design

# Acknowledgements

2018 has not been a good year to me. Several issues in my private life, my business and my psychological health have occurred throughout the year. But one of the few things that made 2018 worthwhile to me was this research.

I denounce the current situation in online privacy and identity. I believe that if we do not take a sharp course alteration in the business models and systems that influence our online presence, we might head into several catastrophes that will be difficult to solve as a collective since the people that caused said problems have different motivations. A new dawn on the internet era starts with Self Sovereign Identity and other forms of online identity protection where both academics and entrepreneurs must join together to give it the change it deserves.

Having taken on one of the two main problems for Online Identity Management, the User Experience Design problem, I believe that I have given a solid start in solving this problem. However, I was not alone in this quest. Several people from different fields have given me the tools and knowledge to move ahead in this research. I would therefore like to thank Sandra Kemp, Jan Jukema, Mathan Geurtsen and Thijs de Mooij for the insightful contributions. In special notice, I would like to thank Robin Effing and Ton Spil for their academic guidance towards the final product. Their insights and advice have inspired me more than I could hope for. Thank you all.

# Acronyms

| | |
|---|---|
| **CL1** | **Level 1 Computer Literacy**<br>CL1 stands for the computer literacy level designated by the OECD Computer Literacy Study to be lowest computer literate group of people functional with a computer. |
| **CLR** | **Comprehensive Literature Review**<br>A literature review method. |
| **EIM** | **Expert Interview Method**<br>An interview method aimed at interviewing field experts |
| **OIM** | **Online Identity Manager**<br>A type of online service that allows people to centrally manage their online identity. |
| **OIM.UXD Framework** | **Online Identity Manager User Experience Design Framework**<br>The objective of this research and final product, and provides fundamental information in developing the UX side of an Identity Manager. |
| **ISRF** | **Information System Research Framework**<br>A Design Science Research method |
| **OECD** | **Organization for Economic Collaboration and Development** |
| **SSI** | **Self-Sovereign Identity**<br>Online data model principles aimed at protecting online identity |
| **UX** | **User Experience**<br>The experience as user has from a product or service when using the product or service |

# Table of Content

# 1. Introduction

Everybody that has access to the internet and interacts with others online, has on online identity, even if someone does not realize it (Ryan et al., 2017). The concept of identity is a right to people (Dinah, 2016) that is protected, together with the concept of privacy, through several regulations such as the General Data Protection Regulations for European citizens (EUGDPR, 2018). However, the Cambridge Analytica incident of 2018 showed that online identity and online privacy are not protected fully yet for online identity users. The incident involved the abuse of personal information from more than 90 million online identity users to manipulate the US presidential elections of 2016 (Cadwalladr, 2018; Hanna and Isaak, 2018). The underlaying problem is that current applied online identity data models do not give people full authority over their online identities but rather the organizations that apply them (Schanzenbrach, Bramm, and Schutte, 2018).

Newly proposed online identity data model principles could however turn the tides in favor of online identity users, but require online services that allow people to independently create, -host, and -manage their online identities (Kemp, 2019), called "Online Identity Managers". And while some exist in different form although similar such as federated identity (e.g. OpenID), they have not been universally adopted yet .

Online Identity Managers face several problems at present that prohibit their changes for universal adoption. First, Online Identity Managers do best to follow Self-Sovereign Identity principles as stated by Mühle et al. (2018) but often do not comply to the principle of online identity portability, which states that online identities must be able to be transferred from one Online Identity Manager to another. Second, the user experience is often experienced as too technical to be useful for most online identity users, especially for senior users (Jukema, 2019). Third, Online Identity Managers need to be integrated into the online identity systems of bigger online social services such as Facebook or Google as these can reach numerous people at once (Bao et al., 2013). While the problem of adoption by current popular social sites will be difficult to solve, solving one of these problems will mean one step into the right direction.

However, while the topics of online identity (management), online identity protection, and user experience design, have been studied thoroughly in the past, they have not yet been combined to propose a solution to the user experience problem Online Identity Managers face. As example, Online Identity is often an extension of someone’s legal identity, containing numerous personal information and protected by human rights but do not state how an online identity is best managed. Further, Bahri, Carminati, and Ferrari (2018) describe on their own the roles of information management, that includes online identity management, but do not link user experience of Online Identity Managers with them. Lastly, Self-Sovereign Identity as stated by Mühle et al. (2018), provides the principles on protecting online identity users by giving the user full control, but does not extend to user experience design principles. This thesis therefore focused on the problem of user experience for Online Identity Managers by combining these topics into a useful user experience design artifact through design science research.

The thesis main objective was to design a design artifact in the form of a user experience design framework for Online Identity Managers called "OIM.UXD Framework". The focus was on usefulness, which is stated as containing both utility and usability of a UX Design (Nielsen, 2017). The main objective was further dissected into two sub objectives for better focus during the research process and were translated into the following main research question:

*"What are the fundamental user experience needs from 55 - 65 y.o. seniors for an Online Identity Manager and how do they process into a useful Online Identity Manager user experience design?"*

First, the fundamental user needs of seniors 55 - 65 y.o for Online Identity Managers needed to be analyzed. Seniors 55 - 65 y.o, and probably older as well, have been identified as the most probable demographic to have low computer technical abilities. Focusing on this group for research ensured a better understanding in identifying and processing fundamental user needs that would, in theory, satisfy the fundamental user needs of others as well. Second, the analyzed user needs needed to be processed into a user experience design framework for Online Identity Managers. The design was evaluated at the end to determine its usefulness for online identity users and whether the main objective has been completed. This would allow entrepreneurs and affiliated to better understand user experience in relation to online identity, online identity protection and online identity management, being one step closer to more independently managed online identities.

To meet the sub objectives of this thesis, several research-, and design methods were applied, these are provided under chapter 2. Methodology (p.9). Literature research was conducted first to understand the applied topics better from academic point of view, and is provided under chapter 3. Literature Review (p.14). Next, expert interviews on the topics were conducted to combine the literature research with practical, real-time point of view, and is provided under chapter 4. Expert Interviews (p.19). From both the literature review and expert interviews were design paradigms created that were used in designing the OIM.UXD Framework. These are mentioned under chapter 5. Design Paradigms (p.23). The design paradigms are followed by a condensed version of the design framework, mentioned under chapter 6 (p.27). Condensed Design Framework, the full version is displayed under Appendix A. OIM.UXD Framework (p.44). Further, the usefulness of the design framework was tested where user testing and user experience expert evaluation was conducted, mentioned under chapter 7 (p.34). Design Evaluation. A discussion follows at, chapter 8 (p.37). Discussion, based on the experiences acquired during this study. The thesis concludes at chapter 9. Conclusion for final notes and recommendations (p.39).

# Sub-Questions

To fulfill the main research question, several sub questions were applied. The sub questions gave an understanding in the applied topics and how they are related to the applied senior research group as fundamental user needs. Further, how the user needs were processed through several design steps into a useful user experience design.

- Which fundamental functions does an Online Identity Manager fundamentally need to contain for 55 - 65 seniors?
- Which fundamental simplicity needs does a 55 - 65 seniors user have from an Online Identity Manager?
- How do the fundamental user needs translate into fundamental product requirements?
- How do the product requirements process into interaction design models and information architectures?
- How do the interaction design models and information architectures process into information design, navigation design, and interface design?

# 2. Methodology

This thesis used the Information Systems Research Framework Method (ISRF) by Hevner (2010) as main design science research method. ISRF has as goal to come to an artifact that is usable in Information Systems context and validated by both users and experts as well as literature. Although ISRF design research is mainly meant for information systems, it can also be applied to user experience design as well as it is a component of information systems. The research framework was therefore deemed ideal to be used for designing the Online Identity Manager User Experience Design Framework (OIM.UXD Framework). Only the "Business Needs" from the model were named as "User Needs". The applied conceptual research design framework was derived from the ISRF method, see figure 1 below.

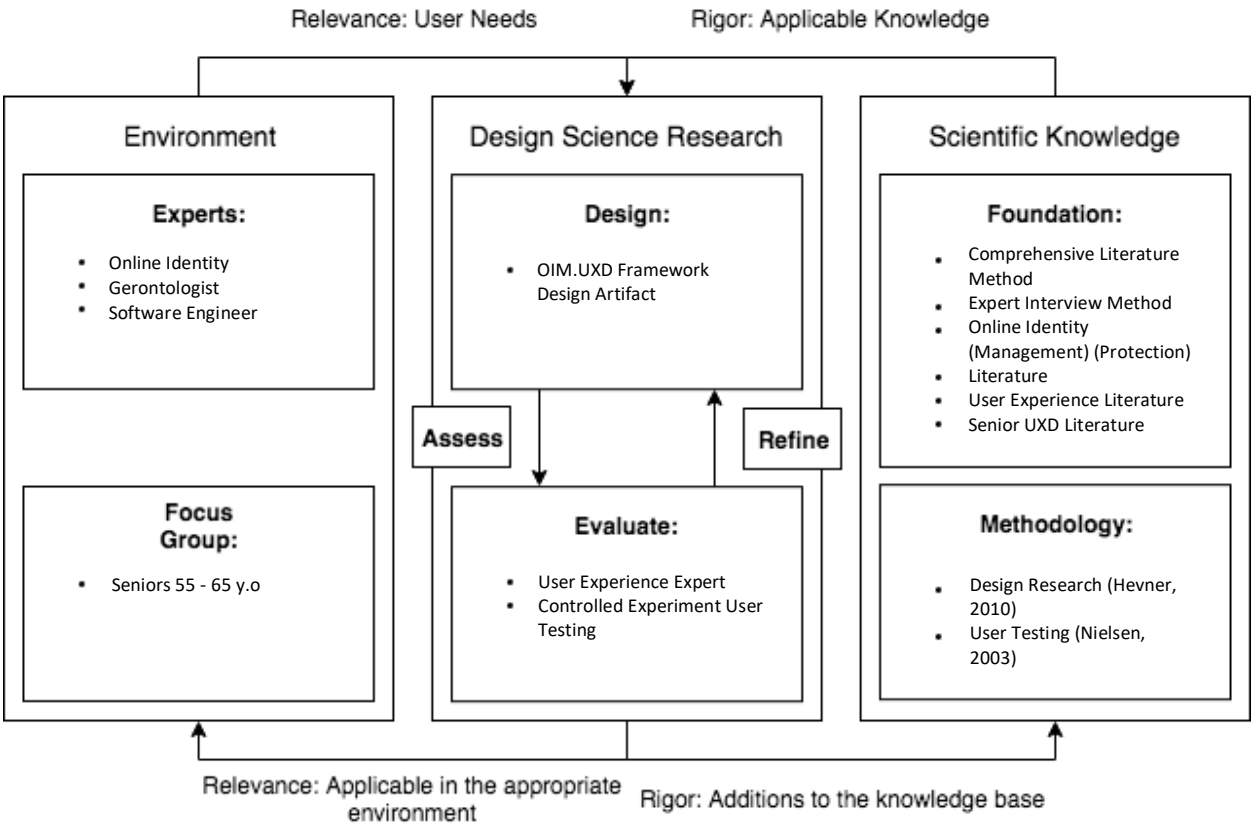


*Figure 1: Research Design*

Using the ISRF method (Hevner, 2010), qualitative literature research as foundation (Rigor Cycle), as well as expert interviews with topic experts (Relevance Cycle) were combined into the design of the OIM.UXD Framework (Design Cycle). The Rigor Cycle used the Comprehensive Literature Review (CLR) by Onwuegbuzie and Frels (2016) to ground the design with qualitative scientific knowledge, see 2.1 Rigor: Literature Research for more method information. The Relevance Cycle used the Expert Interview Method (EIM) by Bogner, Littig and Menz (2009) to establish a practical understanding on further requirements for the OIM.UXD Frameworks' design, see 2.2 Relevance: Expert Interviews for more method information. The Design Cycle used the Five Planes of User Experience Method by Gartner (2011) to iteratively design the OIM.UXD Framework using created paradigms based on information from the Relevance - and Rigor Cycle, see 2.3 Design:

User Experience Design for more method information. The study went through three design iterations to come to a useful where the first two iterations were dedicated to User Needs and Product Requirements, and the third to UX Design. This combination of research - and design methods, and iteration, complemented each other well and the ISRF method (Hevner, 2010) as they were experienced flexible although lighter methods might have been useful as well.

At the end of the third design iteration, the usefulness of the OIM.UXD Framework was evaluated. First, the usefulness was evaluated through a user experience expert interview on the design frameworks' comprehensiveness and design simplicity, using the Expert Interview Method by Bogner, Littig and Menz (2009). The usefulness was further evaluated through user testing on the simplicity of the design frameworks' user experience design output, using the Usability Testing Method by Nielsen (2003), see 2.4 Evaluate: Controlled Experiments for more method information. Five participants from the research focus group (Seniors) used the clickable prototype for the user tests. This combination of design evaluation methods gave both a qualitative and quantitative understanding in the strengths and needed improvements of the OIM.UXD Framework.

## 2.1 Rigor: Literature Research

The Comprehensive Literature Review (CLR) by Onwuegbuzie and Frels (2016) is a dynamic literature research method that can be used for different types of studies, coming from different types of sources during every moment of the research. This combination of attributes made it ideal for the applied iterative design science research method (Hevner, 2010) as it was not always clear what type of information would be necessary during Relevance - and Design Cycles beforehand.

The applied literature topics consist out of: Online Identity, Online Identity Management, Online Identity Protection, User Experience Design, and Seniors. These were explored, interpreted and communicated using the CLR seven steps model. Mostly qualitative information was used during the literature review process coming from scientific articles, and informative content. Quantitative data was only gathered on computer literacy for the senior topic and usability metrics for the user experience design topic. This combination of topic information gave a broad picture on the user experience problem Online Identity Managers currently face and how it can be improved.

Topic literature was gather from sources using several types of source criteria, namely: inclusions/exclusions, search key terms, and deemed source quality. First, sources that were older than five years with lesser than five references were excluded, deemed as not to be of quality, except when it contained a more specific topic. Philosophical, psychological or anthropological sources were excluded as well, as deemed not to be practical enough. Sources that fitted into online identity (management) as sociological concept were included, as to broaden the context. Second, gathered sources needed to fit into either primary search key terms, secondary search key terms or tertiary search key terms at most to be deemed relevant enough. An overview on applied keywords is provided at table 1 at the next page.

The administration for literature gathering can be found under Appendix G. Literature Research Administration (p.93) The combination of inclusions/exclusions, search key terms and deemed source quality had proven to be sometimes too restrictive, requiring to loosen the criteria sometimes.

*Table 1: Search Keywords*

| Primary Searches | Secondary Searches | Tertiary Searches |
|---|---|---|
| Online Identity | Identity<br>Online Identity Protection<br>Online Identity Management | Online Identity Composition<br>Identity and Privacy Human Rights<br>General Data Protection Regulations<br>Self-Sovereign Identity |
| UX Design | Senior UX Design<br>Utility<br>Usability | Simplicity<br>User Needs<br>Product Requirements<br>Interaction Design<br>Information Architecture<br>Information Design<br>Navigation Design<br>Interface Design<br>Visual Design |

## 2.2 Relevance: Expert Interviews

The Expert Interview Method (EIM) as by Bogner, Littig and Menz (2009) is a comprehensive but flexible interview method in extracting information from experts for different research purposes including design research. The EIM method was therefore ideal for this study, and connected well with the other design - and research methods.

Expert interviews on the topics Online Identity, Online Identity Management, and Seniors were conducted exploratively, to try to expand upon the literature from the Rigor Cycle, see table 1 below for an overview. A last interview with a UX Expert was conducted for the comprehensiveness evaluation of the OIM.UXD Framework. Each interviewee was selected on their years of experience in the field, references available on Linkedin, and geographical distance. A candidate was considered a potential expert when he has at least five years' experience in their field, at least two positive references, and within 100 km travelling distance.

The combination of experts in relation to the literature topics from the Rigor Cycle were proven to be effective, although not ideal. The considered software engineering field was experienced to be not an ideal fit in terms of identifying senior user needs from online identity managers. A second online identity expert might have been more useful. The user experience expert interview was useful as well although an interview at the other design iterations might have resulted in a more useful design framework.

*Table 2: Interviews*

| Interview | Order & Moment | Motivation | Interviewee |
|---|---|---|---|
| Online Identity | 1st (Design Process) | Subject part of this research | S. Kemp, Founder and Chairman of IAM |
| Gerontology | 2nd (Design Process) | Expert in senior user needs | Dr. J.S. Jukema, Professor of Nursing |

| | | | |
|---|---|---|---|
| Software Engineering | 3th (Design Process) | Frequent user of management systems | M. Geurtsen, Software Engineer |
| User Experience | 4th (Evaluation Process) | Expert evaluation on comprehensiveness design framework | T. de Mooij, Freelance Interface Designer |

While each expert interview was mostly focused on the interviewees expertise in a semi-structured way, attempts to connect the expertises with each were made as well. To do so, the interviewer took on the role of lay-person for the expertise focused questions and the role of colleague for the expertise boundary spanning questions. Information of interviewees with motivation of choice can be found at table 2. The administration on the interviews can be found under Appendix H. Interview Administration (p.94). The role combination and interview structure were experienced useful with not specific remarks.

## 2.3 Design: User Experience Design

The Five Planes of UX Design Method by Garrett (2011) is a comprehensive, user experience design method that covers the UX Design Process from determining user needs to visual design through 5 different planes. The design process consisted out of three design iterations (Figure 2):
**1. User Needs and Basic Structure:** User needs were determined at the strategy plane through topic literature and expert interviews. Basic structure of OIM.UXD Framework was designed.
**2. Product Requirements:** User needs were refined and processed into product requirements at the scope plane.
**3**. **UX Design:** Product requirements were processed into more complete UX Design at the remaining planes.

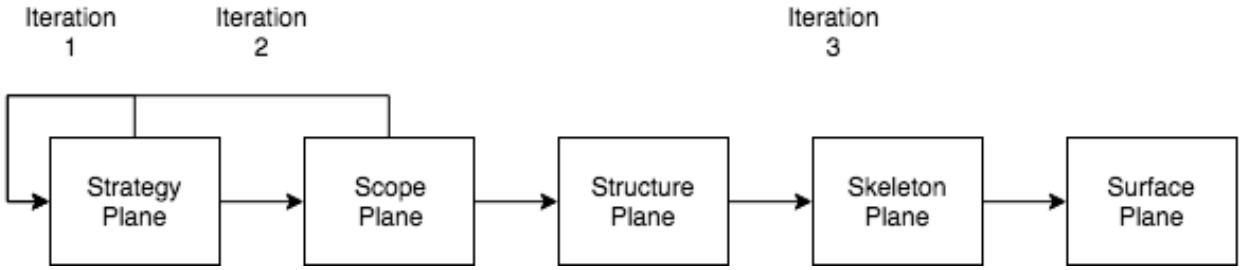

*Figure 2: Design Process*

The design iterations along with the Five Planes of UX Design Method (Garrett, 2011) were experienced a good fit with the Information Systems Research Framework Method (ISRF) by Hevner (2010). The Five Planes of UX Design Method (Garrett, 2011) was considered ideal enough in guiding the design process towards a useful artifact that it was embedded in the OIM.UXD Framework. The design model can be found at Appendix F. Design Process (p.90)

## 2.4 Evaluate: Controlled Experiments

The final OIM.UXD Framework design was evaluated among five participants within the research focus group of 55 - 65 seniors through controlled experiment user testing. Nielsen (2003) describes

five participants in user testing to be ideal as it allows quick results where every added participant will only provide marginal improved accuracy of results. The participant made usage of the developed clickable prototype during the user test to have a more accurate user testing environment. The used test process along with its features are provided under table 3. Elaborate results are found under Appendix C. User Testing Results (p.85).

*Table 3: User Testing Controlled Experiment Setup*

| **Test Process** | **Features** |
|---|---|
| Setting | • Natural Environment (Living room of participant)<br>• Comfortable seating<br>• Session between 12:00 and 18:00<br>• Only participant and and researcher in the room during the session |
| Pre-Test | • Casual conversation for improving comfort<br>• Study details provided<br>• Privacy of personal information assured<br>• Prototype filled with dummy data for each participant<br>• Null Measurement for determining Computer Literacy Level |
| Test | • Divided into four sections of OIM.UXD Framework<br>• 5-Second Impression Test per section<br>• Tasks provided on simplicity for each section<br>• Success Rate Test, Think Aloud and Time Measurement for each task<br>• Noticeable Behavior noted |
| Post-Test | • Report of test provided<br>• Questions on test answered |

The applied user testing method along with the controlled experiment setup and clickable prototype were sometimes perceived as slightly confusing to some participants in the beginning but did not affect the experiments themselves or its results. Further, five participants were considered to be a good number for the evaluation, although four might been sufficient as well.

# 3. Literature Review

This chapter summarizes the findings from the conducted literature review that was meant for the Rigid Cycle of the applied design science research method by Hevner (2010). The literature review allowed for creating a theoretical fundament on online identity and user experience design that the expert interviews from the Relevance Cycle could build upon towards the design of the OIM.UXD Framework from the Design Cycle. Literature information on online identity itself is first provided, along with the management and protection of it. Second, literature information on user experience design is provided, along with more specific senior experience design. Third, the two main topics are combined into a literature analysis that focusses on the answering the applied sub-questions. Administration on the literature review can be found under Appendix G. Literature Review Administration (p.93).

## 3.1 Online Identity

Online Identity is the first of the two main topics and covers literature information on online identity itself (3.1.A), how it is protected (3.1.B), and how it is managed (3.1.C).

### *3.1.A Online Identity*

Online identities are an artificial type of digital information that people create to represent themselves online to others. Pedro, Santos and Moreira (2015) describe an online identity as a "blurred representation of the self, disregarding physical constraints" (p.71) to be used in different social contexts. Ryan et al. (2017) describe an online identity as an extension of a person's everyday life and personality that can highlight a personality trait a person could not show to others offline. And Syed, Dhillon and Merrick (2018) mention an online identity as "some form of digital personally identifiable information" (p.2). A created online identity can therefore help people to be identified online by others in the form the online identity user wants.

Representation occurs in the descriptive form of a "profile" and contains the information of an online identity the user wants others to see (e.g. username, age, gender etc.). Profiles are created at the moment a person wants to make usage of a social site for the first time (Bahri, Carminati, and Ferrari, 2018). Aresta et al. (2015) describe two types of profiles: context-driven profiles, and user-driven profiles. Context-driven profiles are filled in with information users choose in context and characteristics of the site. User-driven profiles are filled in the way users see fit without constraints from a site and often are a mirror of their offline identity. Profiles can take on the form of a legal identity or a fictive identity called "persona" (Ryan et al.,2017), depending on the site (Aresta et al., 2015), and are used to interact with others online.

Online interaction with others is often the main goal for people to create an online identity, mostly on social sites (e.g. Facebook, Twitter). Boyd and Ellison (2007) describe that interaction with others on social sites generates two types of information: user information, and user connections. User information contains on its own user profiles and user-generated content (posts[1], and comments[2]). Connections on the other hand are the personal contacts a user maintains on a social site and are often given labels such as "friends", or "family" to help the user or others identify

1 A post is a publication a user made on a site. For example, a video that was uploaded by the user.
2 Comments are commentary messages that a user adds to the post of someone else.

the type of relationship Boyd and Heer (2006). People often use different social sites to interact with different types of people.

Using different social sites requires for people to create and maintain multiple online identities, although many people prefer this (Ryan et al., 2017). Ollier-Malaterre, Rothbard, & Berg (2013) provide the example of keeping private life and professional life separate. Ryan et al. (2017) describe from their study findings that some people want to maintain personas[3] next to their legal identities. Baym (2015) mentions that multiple online identities allow people to experiment with new forms of identity without damaging their known identities. Some social sites, however, such as Facebook, have provided tools to allow people to use their online identity, in this case from Facebook, on other sites, minimizing identity complexity.

While minimizing identity complexity provides convenience for using social sites, it has brought forth a problem called "context collapse", and affects many people that use social sites. Marwick (2012) mentions context collapse to be the phenomenon that describes the lack of context social sites at present provide on a user's identity. For example, Facebook user contacts are all labeled "friends", while in reality this might be a richer mixture containing family and neighbors as well (Marwick, 2012). People often apply creativity in solving context collapse by using niche communities[4] or by maintaining multiple accounts[5].

## *3.1.B Online Identity Protection*

An online online identity contains personal information about a user, and is therefore protected by several human rights. Human rights are summarized by Dinah (2016): "instruments that aim to protect individuals from interference in elective decisions and from discrimination based on biology" (p.5). These rights are described in the Universal Declaration of Human Rights (UN, 1948) signed by the founders of the United Nations in 1948 in response to the genocides taking place during the Second World War (Clapham, 2015; Dinah, 2016). Human rights offer protection through the Rule of Law, which is the implementation mechanism for human rights (Weisbrodt, 2017). Signed nations have to comply to the Rule of Law (Clapham, 2015; Weisbrodt, 2017). The right to identity[6] and the right to privacy[7] are an important part of the UDHR and enforced to nations through the Rule of Law.

The Rule of Law is enforced on the protection of online identity and online privacy in 2018 in the European Union through the General Data Protection Regulation (GDPR) (Martin and Kuhn, 2018). The GDPR is a new regulation, centralizing all existing regulations on personal information protection, including online identity created information as Papaioannou & Sarakinos (2018) mention. It can be summarized in six points: user consent in personal information processing, the right to access personal information, the right to be forgotten, improving personal information portability, notification on security breaches, and privacy by design (EUGDPR, 2018; Martin and Kuhn, 2018). The GDPR protects EU citizens by forcing organizations to be transparent, privacy friendly and secure in personal information processing.

The GDPR helps EU citizens to protect their online identities better, but it does not provide full protection, Self-Sovereign Identity however, does give online identity users full protection. Self-Sovereign Identity (SSI) is a set of ten principles stated by Mühle et al. (2018) and proposed

3 For example: Queer people in Saudi-Arabia.
4 A narrow scoped social site that aims at providing a specific social experience, often to a specific group of people.
5 The registered information at a social site that allows users to access the site and their own online identity.
6 Prohibits governments and private organizations to alter or determine the identity of individuals
7 Prohibits governments and private organizations to threaten the privacy of individuals

by Allen (2016) to give online identity users full control over their online identities. The principles are similar to the GDPR and add that an online identity must also be interoperable with other sites, and give full control in the handling, sharing, and analysis of online identity information (Mühle et al., 2018; Schanzenbrach, Bramm, and Schutte, 2018). The idea behind the combination of the principles is that if an online identity provider does not comply to all ten principles of SSI, then by definition is the online identity not self-sovereign (Muhle et al., 2018). The list of principles is provided under appendix I. Self-Sovereign Identity Principles. Whether SSI will become the norm as GDPR to EU citizens, remains yet to be seen however.

## *3.1.C Online Identity Management*

Online identities need to be artificially created by people, and therefore need to be artificially managed as well. This is called "online identity management". Bao, Boisvenue, and Vorvoreanu (2013) describe online identity management as an important part of people at present where careful representation, especially in a professional context, is required to improve overall reputation. It further plays a key role in making sure that social sites comply to regulations by providing users with the tools and information to have control and insight over their online identities (Takahasi and Bertino, 2010). Takahasi and Bertino (2010) also provide the argument that the internet of things[8] and (social) sites become more blurred with time, resulting in requiring an online identity to use certain devices. Online identity management is therefore an essential part for interaction with others online.

Online identities are a type of information, and online interaction with others generates information, online identity management therefore needs to be seen as a type of information management. Bahri, Carminati, and Ferrari (2018) describe information management to be a cycle of organizational activity. They describe the activities to be: the acquisition of information from different sources[9], the sharing of information to those who need it for analyzing and decision making, and the handling of information. This means in online identity management context that analyzing and decision making are part of the user's activities as he is the owner. Handling on its own are activities of altering, archiving or deleting information. (Bahri, Carminati, and Ferrari, 2018). Gerhart and Sidorova (2016) divide information management into three roles, namely: interpersonal, informational, and decisive. Interpersonal is the acquisition of information through interaction, informational is the sharing, handling and analysis of information, and decisive is the decision making based on acquired information. Online identity management is therefore summarized the acquisition and decision making on online identity information that can be shared with others and be analyzed as well.

While online identity management is an essential part of an online identity, it can be argued that the management activities are not the main emphasis for online identity users. Josang, Zomai and Suriadi (2007) mention that online identity management is a background concern for people where (Ryan et al., 2017) mention: "people do not consider the act of building an identity as building identity" (p.2). It is seen as a natural element of people in their pursuit for interaction with others (Ryan et al., 2017). Josang, Zomai and Suriadi (2007) mention further that identity providers[10] need to take into account that users have different motives and perspectives on the

8 Internet of Things (IoT) is the part of the internet that is used by devices to communicate with one another. For example: Amazon Echo.
9 In this case social sites.
10 Companies that allow users to create an online identity and can provide online identity management

online identity than the identity provider itself. Abdulwahid et al. (2015) mention that usability of service and protection of users in security and privacy must be emphasized. Online identity providers will need to make sure that the usability of their service and the protection of their users are aligned with the expectations of their users.

# 3.2 User Experience Design

User Experience Design is the second main topic and was reviewed to better understand the theory and practice of User Experience Design in relation to creating-, protecting-, and managing online identities at Online Identity Managers. First, literature information on User Experience Design itself is provided (3.2.A), with added specific literature information on Senior User Experience Design (3.2.B).

## *3.2.A User Experience Design*

User Experience Design (UXD) is the discipline within product development that aims at providing a fitting design to the user's expectations in the experience of a product or service. As Kremer, Schlimm, and Lindermann (2017) describe it: "User Experience Design addresses users' emotions - and psychological needs to create exciting product interactions" (p.1). Barnum (2011) describes UXD as the transition phase between user experience research (UXR) and the actual user experience (UX) perceived by the user. Following UXD as a transition, Garrett (2011) describes it as a process, where each phase fulfills its own purpose in the UX and completes the other phases.

User Experience (UX) itself refers to the quality the user of a product or service perceives. Barnum (2011). captures the concept of UX in one equation: "usefulness = utility + usability". The equation is recently expanded to include other parts as well[11], although utility and usability are deemed most fundamental to usefulness (Morville, 2004). Usefulness is being referred to as the actual perceived quality by the user which is summed from utility and usability. Utilities are the functions and features of a product or service and usability is the rate at which the user can actually use the product or service . Functions are the (sub)goals that the user can achieve with a product or service and features are the tools that can help the user accomplish that goal.

Usability is a more refined concept than utility and determines whether a product can actually be used well by the user. As Robier (2016) describe usability: "The user-friendliness / serviceability" (p.18). He mentions that usability at its fundament, products or service needs to focus on simplicity, where he describes simplicity itself as: "Reducing to the essentials within the context of experience of tasks, in order to enable us to process information more rapidly (Usability)" (Robier, 2016, p.13). To achieve simplicity, the product or service needs to minimize the amount of features to complete a function (Lindgaard, Fernandes, Dudek, and Brown, 2006; Norman, 2018). This focus is called the "heartbeat" and means that a product or service needs to understand their core concept that they provide to their market (Robier, 2016). If a product or service understand its heartbeat and can effectively simplify its offering, then usability for the user has increased.

11 Other parts: Credibility, Accessibility, Findability, and Desirability

### *3.2.B Senior User Experience Design*

Seniors 55 - 65 y.o. have specific needs from user experience designs as they are often not technically skilled enough to use products or services that are not focused on simplicity. The OECD (2016) study on computer literacy found that seniors 55 - 65 y.o. are most representative in either level 0[12] or level 1 computer literacy. Computer usage characteristics for senior level 1 are: the usage of familiar and widely available technologies, the usage of intuitive technologies, and the usage of simple technologies that only contain the necessary features to complete a function with minimal analytics (Grotlüschen et al., 2016; OECD, 2016). As Chapparo and Halcomb (2008) mention on seniors: "Interfaces for older users should avoid delays, minimalize information, emphasizing simplicity, avoid distractions, and undue manipulations" (p.192). Further, seniors are more easily distracted with irrelevant information or illustrations, increasing the change of information fatigue. To avoid distraction of information fatigue, has the The National Institute on Aging (2009) provided a usability checklist that can be summarized as: standardization of layout, consistent and explicit navigation, easily identifiable icons and buttons, simple but strong search functions, and user support contact options. Not meeting the specific simplicity needs of seniors can lead to frustration and decreased satisfaction with eventually abandoning the product or service.

## 3.3 Literature Analysis

An Online Identity Manager needs as fundamental functions to allow a person to create an online identity with profile information (Ryan et al., 2017; Bahri, Carminati, and Ferrari, 2018). The online identity needs to be able to be connected with other online services (Aresta et al., 2015) where the user uses the online identity to represent himself in the interaction with others (Pedro, Santos and Moreira, 2015). Further, the user needs to be able to manage the online identity where it has full access (Papaioannou & Sarakinos, 2018) and control to alter, transfer, or delete the online identity if he pleases (Bahri, Carminati, and Ferrari, 2018; Mühle et al., 2018) Fundamentally, the online identity needs to be protected by identity and privacy rights (UN, 1948), the GDPR in the absence of similar regulations, and Self-Sovereign Identity as ideal striven (Mühle et al., 2018).

In regards to User Experience Design, the fundamental simplicity needs for seniors are the minimization of information (Grotlüschen et al., 2016; OECD, 2016) with identifiable labels and intuitive navigation flows (The National Institute on Aging, 2009). Further, distractive information needs to be avoided, only focusing on the most relevant at location (Chapparo and Halcomb, 2008). Information manipulation need to be able to be made undone (Chapparo and Halcomb, 2008)..

The literature related to online identity and user experience design were deemed comprehensive and mature enough to apply to this research, although academic literature on GDPR and SSI were at moment of study sparse. It is personally believed that more literature will follow as GDPR and SSI are the most advanced and unique forms of regulations and principles for protecting online identity and privacy at moment of writing. Further, literature related to User Experience Design were deemed comprehensive although sometimes noticed to be in contradiction with one another, having to make choices based on amount of citations. No particular gaps in the literature were found however prior to the expert interviews.

12 Level 0 cannot make usage of a computer or barely.

# 4. Expert Interview Results

This chapter summarizes the findings from the conducted expert interviews that were meant for the Relevance Cycle of the applied design science research method by Hevner (2010. Adding practical information on top of the literature research from the Rigor Cycle allowed me to get a better understanding in online identity (management) and user experience design, to improve the design of the OIM.UXD Framework. They are arranged in the order of administration with an interview analysis at the end that analyses the interview results in relation with the literature review. Interview Administration can be found at Appendix H. Interview Administration (p.94)

## Interview Overview

Each interview contained questions on online identity, online identity management and user experience along with more specific questions for each expertise), see table 4 for interviewee overview.. First is the interview with an online identity expert mentioned. Online Identity is part of the main subject of this research and this interview was therefore held to gain a deeper understanding on online identity itself. The second interview was with a Gerontologist to gain a better understanding on seniors in relation to online identity and the user experience of online identity management. The last interview was on online identity management seen from a Software Engineers perspective. This interview was held to gain a deeper understanding in the user experience of online identity management systems.

*Table 4: Interviewee Overview*

| Interview | Name | Function |
|---|---|---|
| Online Identity | S. Kemp | Founder and Chairman of IAM |
| Gerontology | Dr. J.S. Jukema | Professor of Nursing |
| Software Engineering | M. Geurtsen | Software Engineer |

## 4.1 Online Identity Interview

An online identity is an important part of people in the information age, and consists out of multiple fundamental principles. Kemp (2019) mentioned that the first principle of an online identity is the representation of a person on the internet. As she states: "If an online identity cannot represent the user to others, then it has no purpose". Second principle is that "an online identity needs to be created by the person itself in order to be considered a real online identity". Third principle she mentions that the user of an online identity needs to have full authority over the online identity, as identity itself is a protected human right, being able to destroy or alter online identity information at will. Fourth and last principle she mentions as the "state of representation", where an online identity needs to be able to be truthful to the real identity of the user, or be able to be more anonymous, using pseudonyms[13]. The principles can be summarized as: purpose, creator, authority, and state.

Next to the fundamental principles, an online identity consists out of identifiers, attributes, and credentials. According to Kemp (2019): "identifiers are unique to online identity users, and

13 A pseudonym is a name or label that an individual assumes for a particular purpose.

contain for example contact information such as email or phone number". Attributes on the other are descriptions of online identity users, such as age, religion or search behavior. Lastly, credentials are a part of a user account and are focused on security information and contact information to make sure that the person who wants to access the online identity is the actual owner of it. These three components all have their own function but aim together to make an accurate representation of what the online identity user wants.

Next to the online identity itself, the online identity can store information on its own. Kemp (2019) affirms that an online identity can store user information and user connections. The distinction is as Kemp (2019) sees it: "user connections are used to transfer user information". She continues that user connections are therefore more than only contacts as the theory described (Boyd, 2010) but also the communities and sites that are used for interaction with the online identity. Kemp (2019) also sees chat messages as part of user information even though the theory does not describe them as such. Aside from user information and user connection, Kemp (2019) also mentions that user reputation should become more used on social sites in interaction with others as: "holding a user accountable for its actions through reputation recording could reduce unwarranted social behavior". User reputations however is still a vague concept in terms of usages and repercussions for the online identity user (Kemp 2019).

Having full authority over all online identities and all online identity information requires better online identity management solutions. Kemp (2019) mentions that: "most people are not concerned with online identity management even though they demand more from their online presence, online identity managers need to adapt their offerings to this idea". To do so, she provides four integral parts of a solution, namely: feature minimization, update minimization, usage simplicity, guardianship. Three of these focus on make making online identity managers as minimal and simple as possible. Guardianship is special as Kemp (2019) mentions that some people don't want, - or don't know on how to manage their online identities, therefore outsourcing the managing activities to trustees.

At the end of the interview, Kemp (2019) hints on the possible necessity for our society to impose de-anonymization of online identity through regulatory efforts, while maintaining the principles of Self-Sovereign Identity. This would mean that online identities will need to be verified in relation to someone’s legal identity in the background with reputation recordings as well. She advises that identity providers/managers would do best to at least prepare for such a shift in regulations as it can both prepare users for it and minimize needed adjustments in the background systems.

## 4.2 Gerontology Interview

Senior citizens are people in the age of 65 or older although in the context of information technology[14], the line can be more drawn towards 55 or older. Jukema (2019) mentions that senior citizens cannot be placed into one category as "seniors of 80+ have very other needs than 66+" experiencing their own problems in using online product or services, or devices in general, as "seniors of 80+ have very other needs than 66+". However, some general problems in user experiences for online products or services apply to almost all seniors.

General problems in user experience are mostly abstract and complex user interfaces of sites, requiring better solutions. Jukema (2019) mentions that "user interfaces often contain too

14 The type of technology that deals with transferring and storing information, where the internet and online identity managers are a part of.

many features that are not important to seniors, making them confused and insecure". This often leads to either abandoning products or services or resist changing to others. He believes that solutions in user experiences need to be simple, to-the-point and minimal in features or other distracting forms of attention. Just as Kemp (2019), Jukema (2019) mentions the solution of identity management outsourcing to trustees such as friend or family. General problems solutions are focused on simplicity, minimization and outsourcing of online identity management.

Although Jukema (2019) didn't provide specific problems to the senior 55 - 65 y.o age range research group, he did mention another problem on seniors' online behavior. According to Jukema (2019), most seniors often only use general online services such as Facebook or email. All others are often considered either noise or redundant. He mentions as necessity for Online Identity Managers to deal with this problem: "If an Identity Manager wants to be adopted and used by a senior, then it clearly needs to state its usage and importance, and run as much on the background as possible". If the Online Identity Manager does not realize its role and position to the user, than users might be annoyed by them.

Product navigation and product information are both a problem to senior citizens, but can be solved. On online navigation, Jukema (2019) mentions that navigation needs to feel intuitive with no obstructions, as it is often too vague or not logical. He describes: "The best navigation is where there is no navigation required". On online information, Jukema (2019) mentions that information is best categorized logically and labeled with lay-man terms. He recommends that in the relationship with navigation, having the most necessary and most direct information at the top where the senior can almost visually recognize his destination. If a senior still has problems, then easy to find user support should be available as well according to Jukema (2019).

## 4.3 Software Engineering Interview

The main role for management systems, including online identity managers, is to give the user the necessary authority to carry out their responsibilities, and nothing else. Geurtsen (2019) mentions for online identity managers that the user needs to be in full control over their identity, in a cycle of action/reaction and feedback. Action is making users able to create, alter and delete an identity at will. He adds with reaction, making users able to undo actions when the user regrets it. Providing feedback on changes the user made needs to be giving to keep the user informed over their online identity activity. The cycle of action/reaction and feedback enhances the authoritarian grip.

While the role of online identity managers is to give full authority to users over their online identity and giving feedback on their actions/reactions, the online identity managers needs to be on the background as much as possible as Jukema (2019) described as well. Geurtsen (2019) mentions that the giving feedback should not provide notifications[15] to users, however, the actions of others that can affect the online identity of the user should. He gives an example of: "when someone is being kicked out of a community or from a social site". An online identity manager needs to be on the foreground only when it affects the user's online identity.

Aside from background positions and authority need identity managers be careful in providing features as well. Geurtsen (2019) mentions that analytics and similar managerial features are supportive to online identity management and therefore not interesting to many groups of people, including seniors. He warns for the phenomenon "feature creeping" where many features are provided to users that the user does not use, making the user experience chaotic and more difficult. Keeping the user experience simply and effective is best for online identity managers

15 A message type that has as purpose to make a user aware on a particular event.

according to Geurtsen (2019). Best is to use different user experience for different types of people, or to create a feature hierarchy in the user experience.

Feature hierarchy is part of product navigation and product information where the focus needs to be on simplicity and importance. Geurtsen (2019) mentions that product navigation follows from product information which follows from product features. Product features should only be the following on an online identity: "creating, accessing, altering, connecting, deleting, and sharing". This applies to online identity information such as user information and user connections as well Geurtsen (2019). Following from product features, Geurtsen (2019) mentions on product information to add a Nested Doll Structure[16] and Flat Hierarchy Structure[17] for information structuring. A contact (user connections) is seen by him as the lowest level in the nested doll structure but recommends to add it to the highest hierarchical level as well as it is an important type of connection to people.

The interview ends with an advice from Geurtsen (2019) to use a widely used interface components library such as Material Design and Material Icons from Google. This standardizes icons and user interface elements across Identity Managers, making identity transfers, as by Self-Sovereign Identity, more likely to happen.

## 4.4 Interview Analysis

The information derived from the expert interviews was in line with the literature, occasionally providing more insightful interpretations on certain (sub) topics, as Kemp (2019) with first principles of online identity. Kemp (2019) additionally provides more refined composition and structuring of online identity compared to the literature. Further, the literature did not went into detail with online identity connections other than stating contacts as connections (Boyd, 2010). Kemp (2019) added communities and sites to the list of connections on top of the literature. An interesting remark is given that users are not concerned with online identity management, therefore the need to make Online Identity Managers background utilities which was confirmed by the other interviewees as well (Geurtsen, 2019; Kemp, 2019; Jukema, 2019).

Jukema (2019) provided information that was most in line with the processed literature. He added however on top of the literature, the need for seeking support in case of usage confusion. Jukema further confirmed Kemps' (2019) need for guardianship features to unburden the senior user of online identity management responsibilities. The interview with Jukema (2019) has been confirmatory to the findings of the literature review.

Geurtsen (2019) provided relevant additional to online identity management that could not be directly derived from the processed literature. In regards to information architecture, he mentioned the need for flat-, and nested information structuring in relation to the connectivity typology provided by Kemp (2019). This would result in more intuitive navigation structuring which could not be linked from the literature. He further added the concept of "feature creeping" which captures the warnings of Grotlüschen et al. (2016) and OECD (2016), stating as focal point to prevent less useful user experience design. Lastly, he makes a controversial remark, mentioning to make usage of an design language for the user experience design, designed by a notorious company known for online privacy infringement. However, although notorious, the design language is widely adopted, having made people already familiar with it, thus relevant to consider.

16 Nested Doll refers to Matroesjka Dolls where a smaller doll nests into a bigger doll.
17 Flat Hierarchy focusses on making sure that as few as possible information levels exist where the most accessed information exists on top, such as contacts in the case of identity management

# 5. Design Research Paradigms

This chapter provides online identity paradigms and user experience design paradigms that were created by analyzing the literature information (Rigor Cycle) from chapter 3 and the interview information (Relevance Cycle) from chapter 4, to design the OIM.UXD Framework (Design Cycle) at chapter 6. Not everything from the expert interviews and literature was used however in the design of the design framework as the design complexity of certain online identity concepts[18] were considered to be to complex given the available resources to be added in this version.

## Paradigms Overview

The paradigms are listed as a funnel where the most fundamental are listed first and most specific last. First, Online Identity itself is listed, providing information on the composition and structuring of online identities. Second, rights, regulations and principles on online identity protection are listed and prioritized. Online Identity Management is listed third with the functions necessary for carrying out online identity management. Then follows Online Identity Manager User Experience Design and lastly Senior Online Identity Manager Users as these are the most specific paradigms.

## 5.1 Online Identity Paradigms

Online identity is a fundamental part of people (Dinah, 2016; Kemp, 2019) where an Online Identity Manager needs to provide people the functions and features to create an online identity (Geurtsen, 2019; Kemp, 2019), or multiple (Ryan, 2017), that can be used to represent the user in interaction with others online (Pedro, Santos and Moreira, 2015; Kemp, 2019), see figure 3 for online identity composition. Before an online identity can be created, the user first needs an account which contains access credentials (contact information, security information) (Kemp, 2019) to access the online identity. The online identity itself needs to consist out of user information and user connections created through interaction and connection with others (Boyd and Ellison, 2007; Geurtsen, 2019; Kemp, 2019). The information part needs to consist out of the context driven profiles and user driven profiles profiles and content from the user as shown on the site (Aresta et al., 2015) itself which on their own contain the identifiers (name, age, sex) and attributes (e.g. hobbies, role) (Boyd and Ellison, 2007; Kemp, 2019). The connections need to be divided into: Site, Community, and Contact (Kemp, 2019). Site needs to consist out of communities and out of contacts (Kemp, 2019). All online identity information needs to contain meta-data on the date of creation or alteration, and location (Geurtsen, 2019).

18 As example: Online identity guardianship, through sharing the online identity.

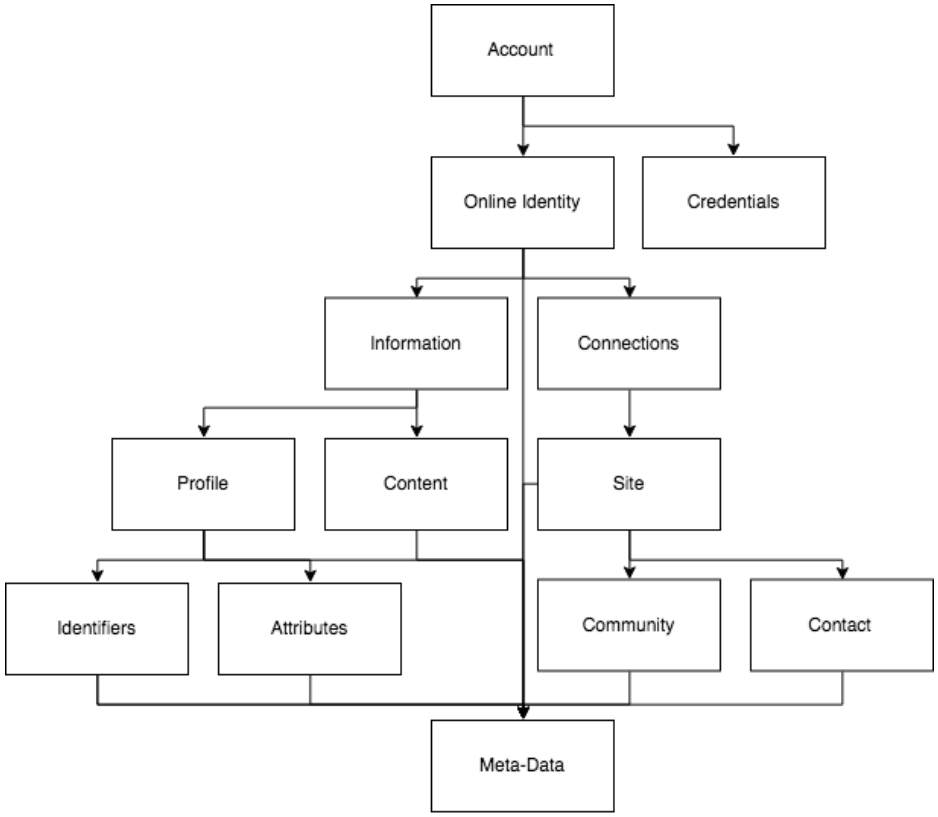


*Figure 3: Online Identity Composition*

# 5.2 Online Identity Protection Paradigms

The concept of identity and privacy are protected by human rights (Dinah, 2016), therefore an Online Identity Manager needs to set these rights as most fundamental to the user experience (Kemp, 2019), see figure 4 for the online identity protection hierarchy. The details involve that an online identity user needs to be free in either creating a truthful identity or a persona, being able to freely associate with others everywhere as the user wishes without discrimination in privacy (Marwick, 2012; Baym, 2015; Kemp, 2019). The online identity manager needs to refine these rights further using online identity regulations and online identity principles (Mühle et al., 2018).

The most advanced online identity regulations at present are the General Data Protection Regulations (GDPR) (EUGDPR, 2018; Papaioannou and Sarakinos, 2018) and need to be implemented in the European Union regardless, although other regions need to consider these regulations as placeholder guidelines for future changes in local legal structures. The regulations involve the right to access an online identity at will along with all its information where the user is made aware which information is processed, by whom and to what purpose, where the user needs to be able to give consent first (EUGDPR, 2018; Papaioannou and Sarakinos, 2018. Further, the online identity manager needs to be transparent in the information process and on data breaches as well, providing explanations to online identity users on the workings and estimated consequences of them (EUGDPR, 2018). Lastly, the online identity user needs to be able to transport the online identity as well or delete it completely when the user wishes (EUGDPR, 2018). The GDPR still leaves room for improvement, especially in the control of privacy over an online

identity, the online identity manager needs to apply more advanced online identity principles as well (Mühle et al., 2018).

The latest type of online identity principles are the Self-Sovereign Identity principles. The principles complement the GDPR and provide additionally that an online identity needs to be used wherever the user wishes, which complements the human right on community (Mühle et al., 2018; Schanzenbrach, Bramm, and Schutte, 2018). SSI further provides more control options to online identity users in privacy management and where the user must have full access, being able to look up, manage and hide an online identity as the user pleases (Mühle et al., 2018). Self-Sovereign Identity complements human rights and GDPR and need to be seen as the most advanced and refined set of principles for the online identity manager user experience design.

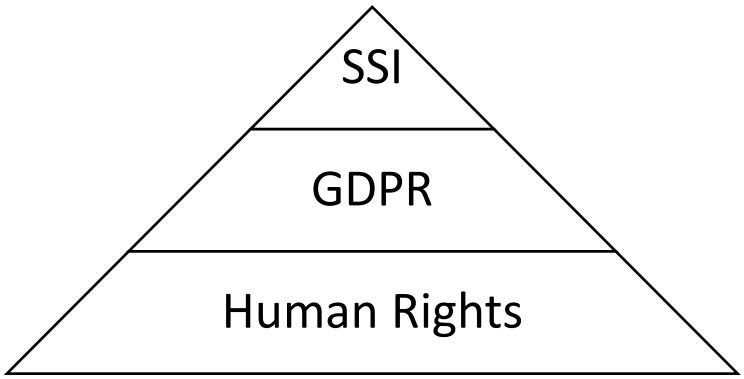


*Figure 4: Personal Rights, Regulations, and Principles Hierarchy*

## 5.3 Online Identity Management Paradigms

An online identity needs to be only managed by the user, giving him full authority over the online identity (Mühle et al., 2018, Geurtsen, 2019; Kemp, 2019). Full authority in online identity management comes through three different types of management roles: Interpersonal, Informational, and Decisive (Bahri, Carminati, and Ferrari, 2018). Interpersonal needs to allow the online identity user to connect the online identity, interact with others, and manage the privacy of user information to user connections (Boyd and Heer, 2006; Kemp, 2019). Informational needs to provide features to the online identity user to manage his online identity, and his user information and user connections, being able to alter, delete, share them (Geurtsen, 2019). Informational further needs the feature of transferring the online identity to other Online Identity Managers at the user's will (Allen, 2016). Further, Decisive needs to provide the features on making decisions regarding events that can influence the online identity (Geurtsen, 2019). To do so best, the online identity user needs to be alerted (notified) on such events at moment of occurrence (Jukema, 2019; Geurtsen, 2019).

## 5.4 User Experience Design Paradigms

Regarding the user experience design of an online identity manager, need online identity managers understand that the Online Identity Manager itself is not the emphasis of the online identity user to use the online identity (Kemp, 2019), but to make interaction with others for the online identity

user possible (Jukema, 2019; Geurtsen, 2019). This means that the Online Identity Manager needs to be on the background as much as possible (Jukema, 2019; Geurtsen, 2019), only alerting the online identity user on online identity influencing events coming from others (Geurtsen, 2019). For further usefulness of the Online Identity Manager, needs the Online Identity Manager to add only directly relevant functions and features to the creation - and managing of an online identity (Kemp, 2019; Jukema, 2019; Geurtsen, 2019), and to focus on usage simplicity first for easier learnability of it (Lindgaard, Fernandes, Dudek, and Brown, 2006; Robier, 2016; Norman, 2018). If the basic utilities are provided in a simple user experience that can be learned easily by the online identity user, then the change of people adopting the Online Identity Manager will increase (Lindgaard, Fernandes, Dudek, and Brown, 2006; Robier, 2016).

In terms of User Experience Utility, the Online Identity Manager needs only provide functions and features that help to create an online identity and manage it (Geurtsen, 2019). The Online Identity Manager functions and features are best divided into categorical sections: Access, Manage, Support, and Decide (Bahri, Carminati, and Ferrari, 2018; Kemp, 2019; Jukema, 2019; Geurtsen, 2019), for easier distinction between their purposes. Further, the online identities user's information and user connections need to contain meta-information to provide people with a greater context on their online identity usage (Geurtsen, 2019).

In terms of User Experience Usability, the Online Identity Manager needs to focus on simplicity as fundamental usability principle to increase usage learnability . Online identity users need from an Online Identity Manager that the navigation of the Online Identity Manager is intuitive and in multiple levels ranging from an overview, to the lowest connection level User Contacts (Jukema, 2019; Geurtsen, 2019). This form of navigation needs to be accomplished through nested-doll - and hierarchical information structures where user contacts are placed at overview level to as user contacts are important to online identity users in online interaction (Geurtsen, 2019).

## 5.5 Senior Online Identity Manager UX Design Paradigms

To make sure that everybody can use an Online Identity Manager, excluding people with certain handicaps, need the Online Identity Manager to focus on the senior 55 - 65 y.o. demographic group as these are considered to be the highest representative group in low computer literacy. Analytics and other non-direct functions and features would be redundant and distracting to senior online identity users with the exception of support features to aid senior online identity users in using the online identity (Chapparo and Halcomb, 2008; OECD, 2016; Jukema, 2019). Second, the Online Identity Manager needs to make the Support Section directly navigational from the Manage Section where the Support Section contains chat - and app functionalities (Jukema, 2019). Third, the Decide Section needs to combine the functions of Alert and Decide into one user interface component, providing easy resolve (Jukema, 2019; Geurtsen, 2019). Fourth and lastly, the user interface needs to contain simple labels and easily to recognize icons that are ideally already familiar to the senior user from other sites, requiring a popular design library such as Google Material Design and Google Material Icons (National Institute on Aging, 2009;Geurtsen, 2019).

# 6. Design Framework

This chapter covers a condensed version of this thesis main research objective, the Online Identity Manager User Experience Design Framework (OIM.UXD Framework) [19] that was designed using the design paradigms from chapter 5. The Design Framework contains both general - and specific user needs with processing to an effective user experience design (UXD). First, context information is provided to understand the Design Framework better. Next, an overview of the design frameworks' structure is mentioned where after the condensed design framework is displayed. This chapter ends with a short description - and display of the Online Identity Manager Prototype[20], that was developed from the Design Framework to evaluate the Design Framework's effectiveness.

## Junify

During the interview with the Geurtsen (2019) expert interview, it was mentioned that connections follow a hierarchy of: Site, Community, Contact, with contact as lowest. To illustrate the connection hierarchy better in the OIM.UXD Framework, will Junify be used as context site. Junify is an online community platform designed and developed by myself and my team, independent and parallel to this thesis research, to promote and empower online communities more. With Junify, a user can connect with communities and with contacts from those communities, making it an ideal example to illustrate the comment of connection hierarchy from Geurtsen (2019). Other sites[21] can however have a different connection hierarchy although main principles still apply.

## Overview

The OIM.UXD Framework consists out out of 5 different phases called "planes" of user experience (UX) that range from strategic user needs to user needed visual elements. The composition and order of the designed OIM.UXD Framework is mentioned under figure 5 on the next page. The planes were filled in iteratively where first user needs were determined. Next were the user needs translated into product requirement where in the third these were processed into a useful user experience design, establishing the design framework. First, strategic user needs are described as Online Identity Manager functions at the Strategic Plane. Second, the Online Identity Manager functions are dissected into product required features that fulfill the functions at the Scope Plane. Third, the abstract functions and features are bridged by translating them into user interaction with the Online Identity Manager and others at the Structure Plane, where Information Architecture is also provided. Fourth, the user interactions and information structure are combined into Information Design, Navigation Design and Interface Design, at the Skeleton Plane. Fifth and last, conceptual visual design is mentioned[22] that was applied to the test prototype.

19 The full version OIM.UXD Framework can be found at Appendix A OIM.UXD Framework (p.44)
20 Elaborated upon at Appendix B. OIM.UXD Framework Prototype (p.80).
21 An example: Whatsapp
22 This however is not a direct need to the organization as it is up to the market strategy of the organization to fill this in (e.g. Branding, Target Market).

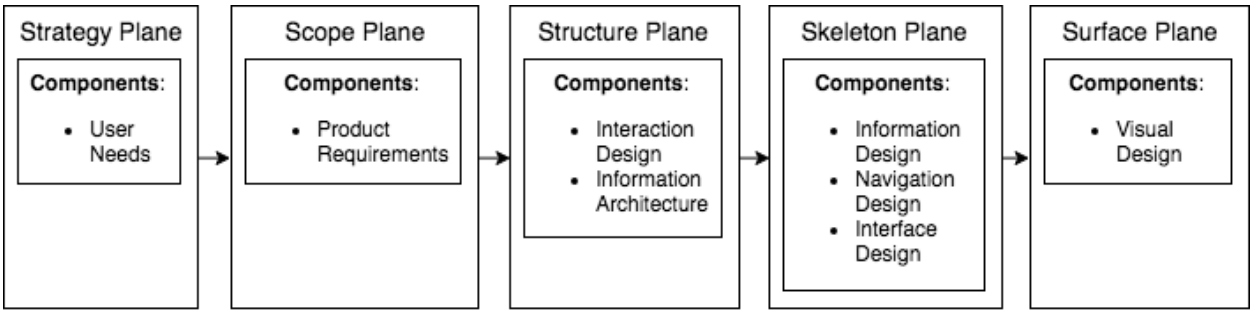


*Figure 5: OIM.UXD Framework Composition (Based on UX Planes by Gartner (2011))*

# 6.1 Strategy Plane

The Strategy Plane (p. 44) is the entry plane of the Design Framework, and list and describes the strategic (senior) user needs as Online Identity Manager functions, where further planes will build upon. It is divided into three types of user needs, namely: Utility, Usability, and Foundation. Utility and Usability are derived from the User Experience Usefulness equation: Usefulness = Usability + Utility and focus on the Online Identity Manager itself. Utility consists out of the fundamental functions that the Online Identity Manager needs to fulfill for the user. Usability consists out of the fundamental principles that make the functions from Utility usable. Foundation is derived from the rights, regulations and principles that apply to identity, community and privacy and form the three components of the foundation. While not every criterion from Foundation is at this version of the Design Framework applicable, they are all mentioned to make sure that they will always be incorporated into the design process of every OIM.UXD Framework version.

## *6.1.A Foundational Needs*

The Foundation is divided into the Human Rights of Identity, Privacy and Community, the European Union General Data Protection Regulation (GDPR), and the Self-Sovereign Identity principles (SSI). Every user experience design point needs to be placed into context with the human rights as these apply to every citizen in the world in every type of situation. Further, the GDPR is the most advanced regulation system for protecting internet users as of date and therefore added to function as a placeholder for future regulations in other parts of the world. Lastly, Self-Sovereign Identity (SSI) is the most user centered data principle set as of date and complements human rights and the GDPR. These three together form a tight grip on what needs to be done with user data and who has full authority.

## *6.1.B Utility Needs*

Utility covers the functions the user needs to create and online identity and manage it, and is divided into six categories: Create Identity, Access Identity Support, Interpersonal, Informational, and Decision. Together, the user can create and access an Identity, use it to connect - and interact with others online, handle the made user connections and user information and have control in events that influences the user's online Identity, or contact support when the user gets in managing his online identity.

### *6.1.C Usability Needs*

Usability needs are divided into Accessibility and Simplicity, two fundamental usability principles. Accessibility describes the level of computer literacy the Online Identity Manager needs to cater to at a minimum, in this case Computer Literacy Level 1 (CL1), in order to be experienced more usable. Simplicity describes the needs that make the Online Identity Manager simpler in usage.

## 6.2 Scope Plane

The Scope Plane (p.48) translates the function needs from the Strategy Plane into product features and content requirements that are applied to the user experience design. The Scope Plane is divided into three sections, namely: Foundational Specifications, Feature Specifications and Content Requirements. Foundational Specifications elaborates on the broadly mentioned Online Identity Manager Foundation. Feature Specifications highlights the features from the functions that come from both Utility Needs and Usability Needs. Content Requirements mentions the type of content that need to be displayed at the Online Identity Manager to complement the Online Identity Manager features.

### *6.2.A Foundational Specifications*

Foundational Specifications contains the relevant Human Rights and GDPR regulations as well as Self Sovereign Identity principles that function as the backbone for the user experience design of the Online Identity Manager. Human Rights contains the rights on Identity, Community, and Privacy where the GDPR continues to cover the regulations to protect those rights. Self-Sovereign Identity (SSI) complements the rights and regulations, where the 10 SSI principles are combined as principles for the portability, access and transparency of online identity.

### *6.2.B Feature Specifications*

Feature Specifications comes from Utility and Usability User Needs of the Strategy Plane and follows the same categorization. The six user need function categories are described further as the type of activity the user performs at a certain moment, which is: Access, Connect, Handle and Decide. Create Identity is combined with Access Identity to Access as an online identity user needs an Identity first before it can be accessed. Access focusses on where the user can register, create Identity, access, login and logout when desired. Connect offers contextual information on where the user needs to be able to connect to. Handle provides the features for handling the online identity and Decide offers the notification and opportunity features to have control in Identity influencing events.

### *6.2.C Content Requirements*

Content Requirements comprises all the information that needs to be included into the Identity Manager. It is divided into two categories, namely: Organizational Content and User Content. This division covers both the organization side and user side of the Identity Manager. Organizational Content comprises the Human Rights requirements for displaying the user his personal rights. It further comprises the content requirements from GDPR to provide transparency in applied

algorithms towards the user and the listing of processed information. User content comprises all the user his connections with services and created information.

# 6.3 Structure Plane

The Structure Plane (p.53) provides the transition between the user needs and product requirements to the user experience design criteria in the upcoming two planes. The Structure Plane is divided into two sections: Interaction Design, and Information Architecture. Interaction Design visualizes, and describes the position and relationships between the Identity Manager's functions, and Information Architecture models structures the required content.

## *6.3.A Interaction Design*

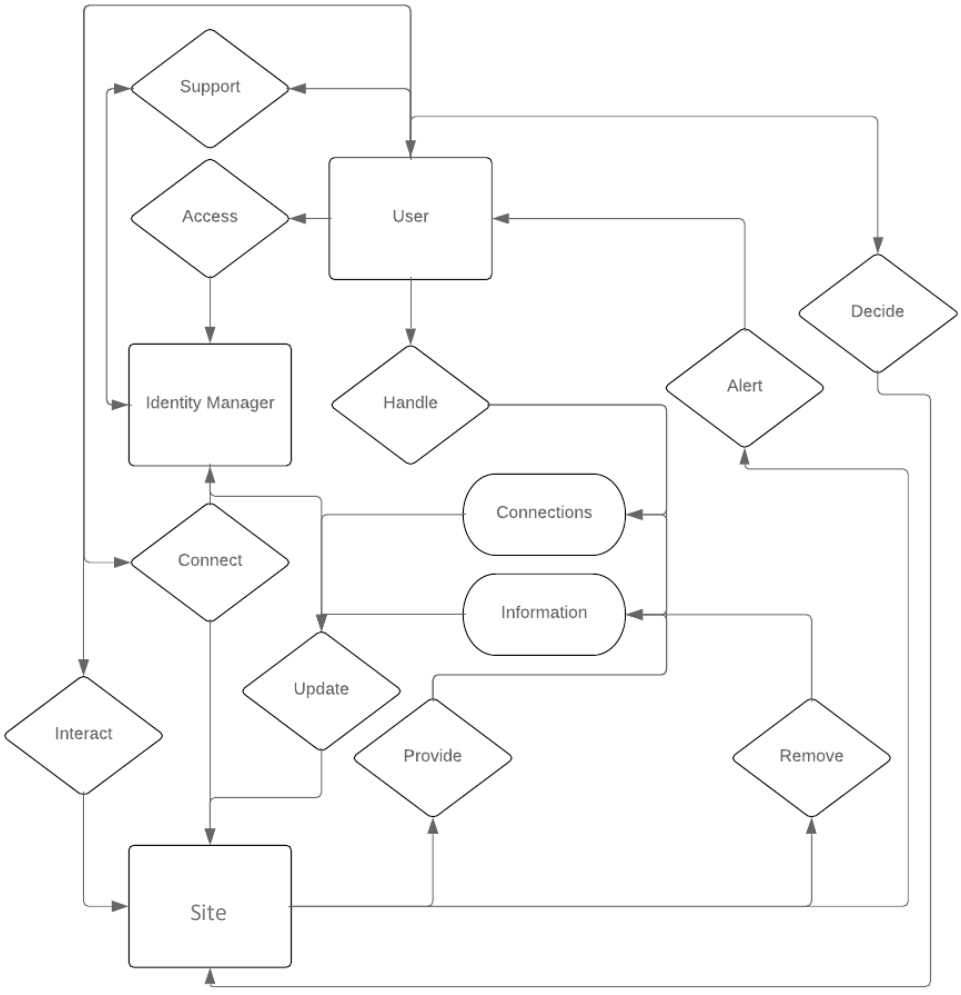


*Figure 6: Interaction Design Conceptual Model*

Interaction Design comes from the Feature Specifications from the Scope Plane and combines them in Entity Relationship Diagrams to visualize the relationships and interactions that take place

between the user, the Identity Manager, and the connected social site. First, the conceptual model is displayed at figure 6, previous page, and contains a general overview of all the main entities, relationships and functions that make the Identity manager. The conceptual model is explained further below. Second, smaller, more detailed interaction models are provided that explain the features per mentioned function.

### Conceptual Model Usage Example

The online identity user is the center of the Online Identity Manager where the user creates an account and online identity to access the Online Identity Manager. For this example, the user connects the Online Identity Manager with Junify, an online community platform. The user can than interact on Junify with others and create user information and user connections, that is being provided by Junify to the Online Identity Manager. Since, the user has full authority over his online identity, the user can handle his online identity as he wishes. When he has done so, the Online Identity Manager provides Junify an update on the changes the user has made to his online identity. If the user doesn't really know how to handle his information, he can contact User Support from the Online Identity Manager. When Junify removes something from the user online identity on Junify, for example a post, then the user will be alerted on the event. He can make a decision whether the user agrees or requests a second revision.

## *6.3.B Information Architecture*

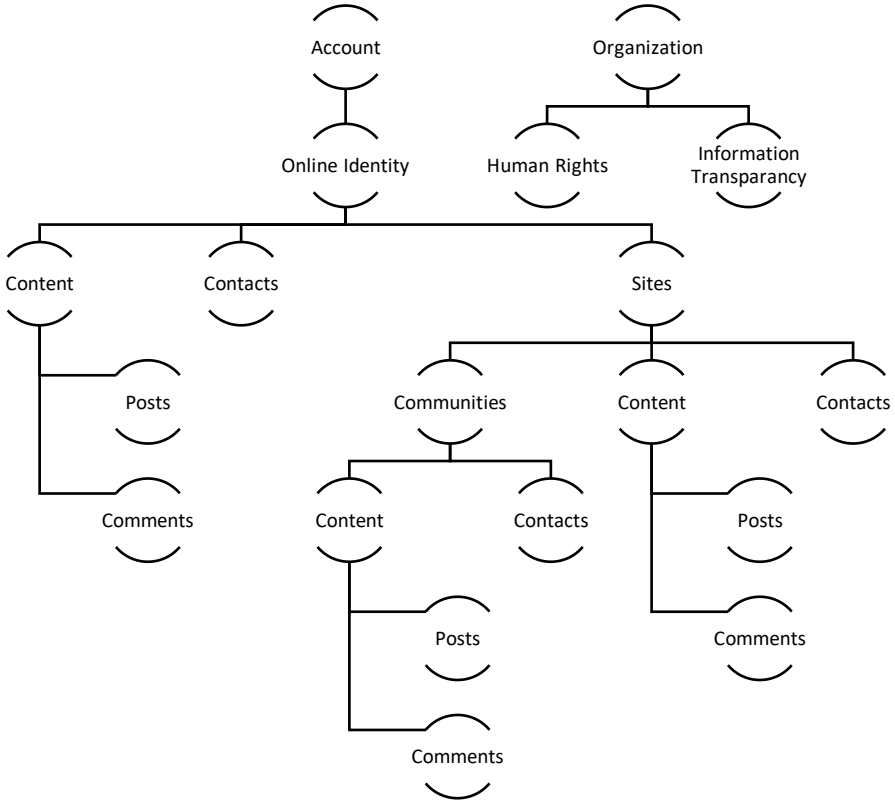


*Figure 7: Information Architecture*

The Information Architecture is created from the Content Requirements from the Scope Plane and is divided into two different branches, see figure 7. The first branch, Account Branch, covers the

utility side of the Identity Manager and is based on flat,- and nested information structuring principles. It contains the online identity and the user account, as well as all the user information and user connections that are created in the interaction with others. Contacts are rated to be more in line with the senior needs for minimal navigation, putting important connections and information on top. The second branch, Organization Branch, covers relevant information about the Online Identity Manager and the rights and regulations the Online Identity Manager was designed from.

## 6.4 Skeleton Plane

The Skeleton Plane (p.62) translates the interactions models and information architecture from the Structure Plane into more refined user experience design criteria. The Skeleton Plane is divided into the four different sections that make up the Online Identity Manager, namely: Access Section, Manager Section, Decide Section, and Support Section. The Access Section comes from the Access Detailed Interaction Model and is dedicated to providing the user access to the Online Identity Manager when the user is not logged in, not registered yet, or doesn't have an online identity yet. The Manager Section comes from the Handle Detailed Interaction Model and applies both branches from Information Architecture. It shows the user his account, online identity and all user information and user connections, and provides the features to handle them. Decide Section is a subpart from the Manager Section and comes from the Decide Detailed Interaction Model. It contains the features to be alerted on identity influencing events and to decide on the reaction of them. Support Section is a subpart from the Manager Section and comes from the Support Detailed Interaction Model. The section contains the features to request support when the user does not know on how to use the Online Identity Manager.

Each Structure Plane section is divided into three design components: Information Design, Navigation Design, and Interface Design. Information Design covers the types of information that needs to be displayed in each section. Navigation Design covers the navigation structure that will allow the user to navigate through the section. Interface Design covers the Material Design components that are necessary for navigating and showing the information in that section. The three design components are interlinked to complete each other to form the skeleton of a section. All sections are accompanied with exemplar wireframes that show an ideal configuration of the design components.

## 6.5 Surface Plane

The Surface Plane, on page 78, is the final plane and provides the guidelines that makes the user's experience of the Identity Manager complete. It fills the Structure Plane sensory (visually only for now) in. The guidelines are combined into one section, Visual Design, as similar with others (e.g. Audible Design) require specialized usability user research. Visual Design provides the guidelines as to what would be a familiar and learnable visual presentation of the user's experience. It is comprised out of Typography, Color Scheme, an Iconography. Typography covers the "save" text/labels formatting. Color Scheme covers the neutral colors that function well with the background attitude the Identity Manager needs to take. Iconography covers the necessary icons that come from the Material Icon Library from Material Design Language. Some icons are improvised however as some situations didn't had an icon existing already.

# OIM.UXD Framework Clickable Prototype

A clickable prototype[23] was developed from the OIM.UXD Framework to evaluate the simplicity of the UX Design among the target research group, seniors 55 - 65 years old, through user testing. It is divided into the four sections of the Structure Plane. Visuals screens from the Access Section, Manager Section and Decision Section are displayed below to give an impression on the visual outcome of the prototype.

Note: The prototype was developed in Dutch as the test participants were Dutch speaking citizens. Further, the prototype was developed for iPhone as this is the researchers own phone.


*Figure 8: Access Section Register Screen*


*Figure 9: Manager Section Identity*

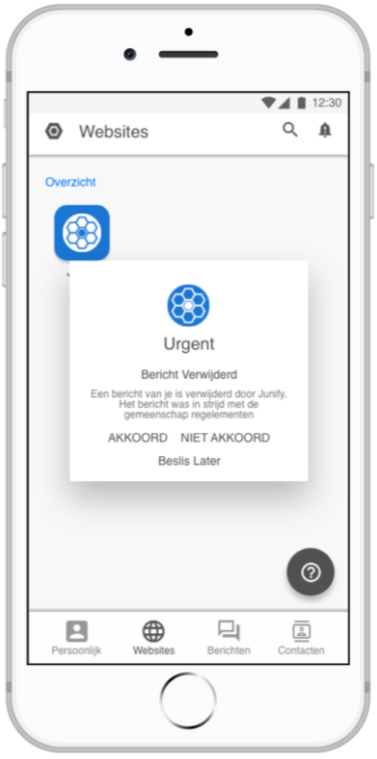


*Figure 10: Decision Section Notification Dialog*

Figure 8 displays the first screen of the Access Section. It provides the user with the options to create an account/identity or to login. Figure 9 displays the first screen of the Manager Section when logging in. Figure 10 displays the Notification Dialog of the Decision Section, which is a popup form of notification, requesting immediate attention.

23 The full prototype can be found under Appendix B. Identity Manager Prototype (p.80).

# 7. Evaluate

This chapter covers the evaluation results of the Design Framework that was gathered through usability testing, and by a UX expert evaluation, see table 5 for interviewee information. For the usability testing, the Design Framework Visual Prototype was used. The UX Expert evaluated both the Design Framework and the prototype. The UX expert evaluation is mentioned first followed by the usability testing results. A summary at the end combines the evaluations.

*Table 5: Evaluation Interviewee*

| Interview | Name | Function |
|---|---|---|
| User Experience Design Expert Evaluation | T. de Mooij | Freelance Interface Designer |

## 7.1 User Experience Design Expert Evaluation

Overall, de Mooij (2019) was satisfied with the quality and comprehensiveness of the Design Framework although a more lean format would have been welcome. The expert approved the applied design process that is a part of the Design Framework, and liked the supportive texts such as the user stories at the Strategy Plane, mentioning comprehensiveness and fundamentality as positive remarks. However, he mentions some remarks for improvement, see table 6 below. First, the Access Section would "benefit from a separate login screen as login and registration are now combined, making it confusing for people with low digital insight" (De Mooij, 2019). Next, more text fields for confirmation of user input need to be added as well as a date picker instead of a text field for age as: "the user has difficulty identifying the right format for input when using text fields" (De Mooij, 2019). The separation of the Identity Manager into four sections is interesting to the expert in: "it gives a good overview of the specific tasks and environments for each part of the Online Identity Manager" (De Mooij, 2019). In the end, the tips was given to use a more independent design language as Google's Material Design might send the wrong message to designers.

*Table 6: Framework Evaluation*

| Category | Improvement Remarks |
|---|---|
| Access | • Separate register from login<br>• Apply more text fields for confirmation of input<br>• Use date picker instead of text field for age |
| Terminology | • Get rid of "account" and only use "identity"<br>• Use "applications" instead of "sites"<br>• Use "Accept/Decline" instead of "Agree/Oppose" for decision notifications |
| Buttons | • Use a Top App Bar Icon Button for Support instead of a Floating Action Button |
| Design Language | • Use own language instead of Material Design for more independence. |
| Framework Format | • Present the framework in a more lean format such as a Canvas. |

# 7.2 User Testing Evaluation

User testing was conducted in the form of controlled experiments to evaluate the usability of the Design Framework Visual Prototype among five participants in the senior age range of 55 - 65 years old. The Design Framework Visual Prototype was made and used for this purpose. The experiments were divided among the four sections of the Design Framework, namely: Access, Manage, Decide, and Support. At each section, each participant went through three tests of which two active and one observational. First, a 5-second usability test was conducted first to determine the participants first impressions. Second, actual testing was conducted where the user success rate in performing given tasks was determined, see table 7 for results. Tasks ranged in simplicity from going to a particular location to transferring the identity to another Identity Manager. Third and lastly, observations were conducted and registered on particular behavior performed by the participant during the tests. More elaborate results and information are provided under Appendix C. User Testing Results (p.85).

*Table 7: Participant Scoring List*

| | Access | | Manage | | | | Decide | Support | | Avg. |
|---|---|---|---|---|---|---|---|---|---|---|
| Participant / Test Tasks | 1A | 1B | 2A | 2B | 2C | 2D | 3A | 4A | 4B | |
| Participant 1 | S | S | S | F | F | F | S | S | S | 67% |
| Participant 2 | S | S | S | S | S | F | S | S | S | 89% |
| Participant 3 | S | S | S | S | S | F | S | S | S | 89% |
| Participant 4 | F | S | S | S | F | F | S | F | S | 55% |
| Participant 5 | S | S | S | S | S | S | S | S | S | 100% |
| Success Rate | 80% | 100% | 100% | 80% | 60% | 20% | 100% | 80% | 100% | |

**Overall Score: 90% Success Rate**

In general, the design is successful in terms of simplicity. Although some tests came out with low ratings (2D, 20%), three out of four sections are above the 50% average rating by Nielsen (2003) with an average of 90%. For the Access Section, the participants were overall pleased with the user interface of the Access Section, having a 90% average scoring. The only criticism was remarked on the distinction between identity and account (1A). All participants knew where they were however and what the intent of the section was. The Manage Section more diverse in results, ranging from 20% (2D) to 100% (2A). This diversity could be due to the complexity of this section, providing all the necessary managing tools to manage an online identity. Most participants knew the intent of the section within the 5-second usability test, however. The interface felt familiar to other apps and overall navigation went normally. Three out of four given tasks were rated positive. The fourth (2D) was rated lowest with 20% and was about transferring the identity to another Identity Manager. Four out of five participants could not find the location of the button to transfer the online identity to another online identity manager. Given the 100% success rate of the participant, it can be argued that other tests result in over lower scores. Discomfort was noticed here. The Decide Section and Support Section with 90% average scoring were near perfect where every participant mentioned that is was clear with no particular remarks or observations.

## 7.3 Evaluation Analysis

The OIM.UXD Framework can provide Online Identity Managers simple enough to be used by 55 - 65 year old senior users, making them likely to be simple enough for others as well. The user testing did show an anomaly where participant 5 displayed higher computer literacy than stated pre-test. The 90% usability test results therefore would be more in the range of 75% to 90%, although not officially measured. Further, there are still points for improvement which need to be addressed in the next version of the design framework. First, the term account needs to be emerged with identity, making it as one. Second. The identity transfer button needs labels, so by consistency, all other buttons need labels. The subsection label of content requires more attention as it might confuse some older users. The applied terminology needs to be more neutral and direct. The term for account is best to be merged with identity for less confusion. Lastly, the possibility of a more independent design language needs to be explored.

# 8. Discussion

This design science research study focused on the user experience problem for Online Identity Managers, scoped down to the fundamental needs of seniors 55 - 65 years old for research focus. The problem was addressed by a methodology combination of literature research, expert interviews, design processes and lastly a design evaluation, using the Hevner (2010) design science research method. The design - and research went through three iterations as a process, with the design evaluation at the end of iteration three through expert evaluation and user testing with five senior participants. As a result, a designed artifact was created in the form of a user experience design framework (OIM.UXD Framework) that could help Online Identity Managers solve the user experience problem.

The design framework consists out of fundamental user needs for Online Identity Managers and out of a user experience design that processed the user needs. It combines literature from multiple fields and topics: User Protection, Online Identity (Management), User Experience Design, and Seniors. The literature was combined with expert interviews from: Online Identity (Kemp, 2019), Seniors (Jukema, 2019), Software Engineering (Geurtsen, 2019), and User Experience (De Mooij, 2019). This overall combination had proven to be useful where was experienced that the literature complemented each other well and where the expert interviews either expanded upon the literature or confirmed it, with no significant contradictions. However, this might be due to an elementary usage of the information, although this was deemed most effective given the amount of available recourses and that it is the first version of the design framework with a focus on fundamentals. Future research however, is recommended to research the fields and topics deeper and to focus on a broader research group, to analyze additional fundamentals or other.

The evaluation of the design framework came out positive where a 90% usability testing score in simplicity was achieved. In comparison, Nielsen (2003) states an average usability benchmark of 50% as usable design, although it can be debated that certain online services (e.g. Facebook, Google) require higher average usability ratings due to their broad target groups. However, participant 5 showed above anticipated results due to be higher computer literate than stated, distorting the accuracy of the test results. A more accurate statement therefore would be that the usefulness of the design framework is between 75% to 90%, although not officially stated. A user experience expert deemed the design framework useful as well (De Mooij, 2019), mentioning comprehensiveness and fundamentally as positive remarks. These results were not anticipated where was expected that the design framework would contain more flaws in regards to simplicity given the amount of iterations and recourses this study contained. The high score might have been due to the emphasis on fundamental user needs in relationship to the simplicity principle as these are strongly related to each other. It is therefore expected that as the design framework evolves to satisfy additional needs from other research groups as well, the usability testing score might decline, especially for seniors as they prefer simpler solutions.

Although the user experience design framework was tested successfully, it was limited in design by only focusing on fundamental user needs and more specifically on senior user needs. OECD (2016) stated that higher computer literates require more analytical tools as well, therefore experiencing the current version of the design framework as limited. Further, User Experience Design covers more than utility and usability as stated by Morwille (2004). These limitations limit the usefulness of the design framework for Online Identity Managers as online identity users can have different needs other than seniors have and can require more than only the fundamentals.

Further, the design evaluation only tested the quality of the design framework on the simplicity of its derived prototype, limiting the usability understanding. However, these limitations provided gave this study focus on analyzing and processing the fundamental user needs, thereby give future research the opportunity to expand upon the design framework rather than starting from scratch. Future research can focus on additional user needs and on broader user groups, but will have to evaluate the design framework on more usability-, and other usefulness principles to determine its quality more accurately.

Additionally, the design - and research process consisted out of three design iterations with one design evaluation. Though it falls in line with Hevner's (2010) method toward a valid artifact, experience from this study has learned that one design evaluation at the end limits the understanding in the design frameworks usefulness as findings from the evaluation could not be processed into the design framework anymore. While multiple user tests would have been difficult given the available recourses, user experience expert evaluations would have been possible during every iteration however. Future research will first therefore have to process the evaluation findings into the design framework and test them, before proceeding to expand the design framework, with the advice to add user experience expert evaluations at each design iteration.

# 9. Conclusion

This design science research study had as main objective to design a design artifact in the form of user experience design framework for Online Identity Managers (OIM.UXD Framework). The main objective was dissected into two sub objectives for focus. First, the fundamental users' needs of seniors 55 - 65 y.o for Online Identity Managers needed to be analyzed. Second, the analyzed user needs needed to be processed into a user experience design framework for Online Identity Managers. The following main research question was applied based on the two sub objectives:

*"What are the fundamental user experience needs from 55 - 65 y.o. seniors for an Online Identity Manager and how do they process into a useful Online Identity Manager user experience design?"*

The fundamental user experience needs for seniors 55 - 65 y.o. were found to be in three forms: foundation, utility, and usability. Foundational needs are the protection in online identity, online privacy, and online community. Utility needs are the creation - and managing of an online identity, and the ability to connect and interact with others on connected sites and communities. Usability needs are the simplicity - and supportive design the Online Identity Managers needs to provide.

The user needs were found to be processable into a useful Online Identity Manager user experience design by making a distinction in three interactable entities that were analyzed, and by designing a hierarchical information architecture with embedded nested-doll principles. A more usable fundamental user experience design is further achievable by processing the analyzed entity interactions and the information architecture into four sections of information design, navigation design, and user interface design. Lastly, a complete useful user experience design is achievable by processing the now created four sections of the Online Identity Manager into visually usable user experience design, where the Material Design Language is effective to use.

With the research question filled in, a knowledge gap in the user experience design of Online Identity Managers has been partially filled. Future research can build upon the findings from the results of this study to research user needs from other online identity user groups or additional user needs. Further, User Experience Design is a specialized field that normally requires significant time and financial investments to understand and apply effectively to a product or service. The OIM.UXD Framework allows entrepreneurs to skip partially these investments to focus more on the development of their Online Identity Manager. Lastly, while this design framework brings online identity users one step closer to improved online identity protection and management, the end of the road to useful Online Identity Managers is not yet in sight, though we are heading in the right direction.

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# Appendix

# A. OIM.UXD Framework

## *Strategy Plane*

The Strategy Plane is the entry plane of the Online Identity Manager User Experience Design Framework (OIM.UXD Framework) and provides the global perspective on the user's needs from an Identity Manager. Further planes will build upon the criteria that come from the Strategy Plane.

The Strategy Plane is divided into three types of user needs, namely: Utility, Usability, and Foundation. Utility and Usability are derived from the UX Usefulness equation: Usefulness = Usability + Utility and focus on the Identity Manager itself. Utility consists out of the fundamental functions that the Identity Manager needs to fulfill for the user. Usability consists out of the fundamental principles that make the functions from Utility usable. Foundation is derived from the Human Rights, regulations and principles that apply to identity and privacy and form the three components of the foundation. While not every criterion from Foundation is at this version of the OIM.UXD Framework applicable, they are all mentioned to make sure that they will always be incorporated into the design process of every design framework iteration.

Types and needs are mentioned in ascending order, meaning that everything that succeeds must respect the preceding as authoritative.

### Foundational Needs

The Foundation is divided into the Human Rights of identity and privacy, the European Union GDPR regulations, and the Self-Sovereign Identity principles. Here, every design point needs to be placed into context with the Human Rights for privacy and freedom of identity as these apply to every citizen in the world in every type of situation. Further, the GDPR is the most advanced regulation system for protecting internet users as of date. The GDPR is added to function as a temporary placeholder for similar regulations in other parts of the world. Lastly, Self-Sovereign Identity (SSI) are the most user centered data principles as of date and fill in the Human Right endorsement gaps left in regulations such as the GDPR. Together these three components form a tight grip on what can/needs to be done with user data and where the actual ownership lays.

- The user needs his Human Rights on identity and privacy to be respected
- The user needs to enjoy the protection of the GDPR
- The user's online identity needs to be self-sovereign as by Self Sovereign Identity

The three foundational components are unraveled into features at the Scope Plane.

### Utility Needs

Utility is divided into Create Identity, Access Identity and Support plus the three roles of management, namely: Interpersonal, Informational, and Decision. Together, the user can create and access an Identity, use it to connect and interact with others online, handle the made connections and information and have control in events that influences the user's Identity. Or contact support when the user doesn't know what to do next.

### Create Identity

*Identity*

- *The user needs to be able to create an Identity*

  The Identity Manager needs to make sure that an Identity can be created. Here the Identity needs to be separated into Basic Information (*Surname, Last name, Age, Portrait Picture*) and Profiles (*Ambiguous Information*[24]). Basic Information needs to be created at the Identity Manager to make interaction possible and Profile Information needs to be created through interaction with other sites.

### Access Identity

*Access*

- *The user needs to be able to access the Identity*

  The Identity Manager needs to make sure that an account (Contact Information, Password) can be created to be registered at the Identity Manager where the user can access his own Identity.

### Interpersonal

Interpersonal covers the external, interactive side of the Identity. Here, Connect was added as the Identity Manager and the desired site need to systematically link with each other first. Connect and Interact will only be briefly mentioned in this iteration of the OIM.UXD Framework to make a logical linkage between creating and handling the Identity, as it will require its own research

*Connect*

- *The user needs to be able to connect the Identity with other sites*

  The Identity Manager needs to make sure that a connection is established between the Identity Manager and the sites the user wants to use. Further, when a connection with a site is made, connections with others need to be possible as well. This includes groups (e.g. Communities) and individuals (Contacts) the user wants to connect to. The connections need to be shown to the user in the Identity Manager.

*Interact*

- *The user needs to be able to interact with others through the Identity*

  Interaction can only occur outside the Identity Manager. The Identity Manager needs to show all the information that is created through interaction (e.g. Posts, Comments).

24 With Ambiguous Information means that it is not static as with Basic Information but that it is variable to what the user puts into it through interaction with other sites.

### Informational

Informational covers the functions that allow a user to actually manage the Identity. Here, the user can handle their connections and information. Handle is part of the three informational management tasks where sharing and analyzing information are also a part of. These two will not be added to this version of the OIM.UXD Framework as these require their own research.

#### *Handle*

- *The user needs to be able to handle the Identity*

  The Identity Manager needs to make sure that the user can alter/delete his information, disconnect from a sites or others, or transfer the Identity to another Identity Manager.

### Decisional

Decisional covers the functions that allow a user to take control in Identity influencing events. Here, Alert was added as a user first need to be informed on such an event before being able to make a decision.

#### *Alert*

- *The user needs to be alerted on Identity influencing events*

  The Identity Manager needs to alert (notify) the user on events that occur beyond their control but do have an effect on the Identity (e.g. content removal).

#### *Decide*

- The user needs to be able to decide on Identity influencing events

  The Identity Manager needs to give the user the possibility to have control in an Identity influencing event.

### Support

- *The user needs to be able to contact support on identity management when requested*

  The Identity Manager needs to make sure that users can get personal help from the Identity Manager's Support team.

## Usability Needs

Usability needs are divided into Accessibility and Simplicity. Accessibility describes the level of literacy the Identity Manager needs to cater to at minimum. Simplicity describes the needs that make the Identity Manager simpler in usage.

*Accessibility*

- *A user with Level 1 Computer Literacy or higher needs to be able to use the Identity Manager*

  The Identity Manager needs to accommodate to a broad user group, identifying and cater specific needs to different levels of computer literacy without diminish usability to lower levels of computer literacy.

*Simplicity*

- *The user should have to worry as least as possible about identity management, only being alerted when necessary*

  The Identity Manager needs to be unobtrusive other than in Identity influencing events.

- *The user should not be distracted by additional features such as analytics or sharing options*

  The Identity Manager needs to understand that analytics or other additional functions are not working in the benefit of CL1 users.

- *The user needs a horizontal information architecture that is both intuitive as well as cumulative*

  The Identity Manager needs to make sure the user can easily navigate towards its goal with minimal distractions or side routes to take.

- *Content needs to be displayed in the format as on the connected site itself*

  The Identity Manager needs to make sure that a user can easily recognize pieces of content.

- *Handling functions need to be at every piece of information or connection*

  The Identity Manager needs to provide handling tools directly underneath every connection or piece of information for enhancing simplicity.

- *Decisional functions need to be combined as much as possible*

  The Identity Manager needs to make decisions easy to comprehend and easy to make for a user.

## *Scope Plane*

The Scope Plane translates the user's needs from the Strategy Plane into product requirements processed further in the OIM.UXD Framework. The Scope Plane is divided into three sections, namely: Foundational Specifications, Feature Specifications and Content Requirements. Foundational Specifications elaborates on the broadly mentioned Foundation points. Feature Specifications highlights the features from the functions that come from both Utility Needs and Usability Needs. Content Requirements mentions the type of content that need to be displayed at the Identity Manager.

### Foundational Specifications

Foundational Specifications contains the relevant Human Rights and GDPR regulations as well as Self Sovereign Identity principles that function as the backbone for the design of the Identity Manager and need to be taken as stated below.

#### Human Rights

- *The system needs to be indiscriminate and neutral in users and user activity*
- *The system needs to make the user aware on his Human Rights applicable to identity and privacy*

#### GDPR

- *The system needs to process solely information for the specified purpose*
- *The system needs to process the minimal amount of information necessary to accomplish the task*
- *The system needs to erase or rectify the information that is incomplete to fulfill the specified purpose without delay*
- *The system needs to erase the user's information that was used for processing after the specified task has been completed*
- *The system needs to protect the user and his information from unlawful or unauthorized processing and against accidental loss, destruction or damage*
- *The system needs to assure the user that minimal data for accomplishing the task at hand is applied*

#### Self-Sovereign Identity

- *The system needs give user control over their identities where the user is the ultimate authority*
- *The system needs to provide access to all of the user's data. No hidden data or other forms of data can exist*
- *The system needs to store the identity as long as the user wishes*
- *The system needs to make the identity transportable*
- *The system needs to make the identity globally accessible*
- *The system needs to only provide information to sites when the user gives permission to do so*
- *The system needs to protect the needs of the user over the needs of the platform in case of conflict*

## Feature Specifications

Feature Specifications comes from Utility and Usability User Needs of the Strategy Plane and follows the same categorization. Here, the five function categories are labeled further as the type of activity the user performs at a certain moment, which is: Access, Connect, Handle and Decide. Create is added to Access as a user needs an Identity first before it can be accessed. Access focusses on an information loop where the user can register, create Identity, access, login and logout when desired. Connect offers contextual information on where the user needs to be able to connect to. Handle provides the features for handling the Identity and Decide offers the notification and opportunity features to have control in Identity influencing events.

### Design

*Access*

#### Register

- *The system needs to give the user the opportunity to register (create) an account*

  The Identity Manager needs to request at least a unique identifier (Contact Information) and a security credential (Password) from the user for identification.

#### Create Identity

- *The system needs to give the user the opportunity to create an Identity*

  The Identity Manager needs to request at least a surname, a last name, the user's age and a portrait picture of the user. This needs to be known as the Basic Information of the Identity.

#### Access

- *The system needs to give the user access to all his information and connections*

  The Identity Manager needs to make all the user's information and connections belonging to the Identity findable, searchable and handable. Access need to be only granted when both an account and Identity have been created.

#### Login

- *The system needs to give the user the opportunity to login to the account*

  The Identity Manager needs to request the information that was given at register for permitting the user to login.

#### Logout

- *The system needs to give the user the opportunity to logout*

  The Identity Manager needs to provide the user with the possibility to end the accessing session.

*Connect*

Site

- *The system needs to give the user the opportunity to connect the Identity with sites*

Non-Site

- *The system needs to give the user the opportunity to connect the Identity with a group (Community) on a site*
- *The system needs to give the user the opportunity to connect the Identity with another Identity (Contact) on a site*

*Handle*

Disconnect

- *The system needs to give the user the opportunity to stop a connection*

  This includes the disconnection from sites as well as from a group or other individual that are connected through a site.

Alter/Delete

- *The system needs to give the user the opportunity to alter or delete information*

  This includes the account, Identity, content and personas from the user.

Transfer

- *The system needs to give the user the opportunity to transfer the Identity*

  All information and connections need to be transferred as well along with the Identity as it belongs to that Identity.

Reverse Handling Action

- *The system needs to give the user the opportunity to reverse its handling action*

  When something has been handled, that decision needs not to be absolute but needs to be reversible, making the action undone.

*Decide*

Alert

- *The system needs to alert the user when an Identity influencing event has occurred*

  The system needs to be able to send a notification to the user when the event occurs.

- *The system needs to combine Alert and Decision together when alerting the user*

The Identity Manager needs to combine both the alert and decision tools in one notification

- *The system needs to make alerts obtrusive*

  The Identity Manager requires a decision before the user can continue using the Identity Manager. Here, the user needs to make the decision immediately, or choose to do so later.

Decision

- *The system needs to give the user the opportunity to agree or oppose to an Identity influencing event*

  The system needs to provide the user with the tools to make a decision where the decision needs to be send to the site where the alert came from.

*Support*

Call

- *The system needs to give the user the opportunity to call Support*

Chat

- *The system needs to give the user the opportunity to chat with Support*

## Content Requirements

### Organization Content

*Human Rights*

- *The system needs to show the user his Human Rights on Identity and Privacy*

*GDPR*

- *The system needs to show the user the algorithms used at the Identity Manager*
- *The system needs to show the user what information is processed, when and to what purpose with the reassurance that no record will be held after the task is complete*

### User Content

*Access*

- *The system needs to show the user all his information and connections*

*Handle*

Disconnect

- *The system needs to stop showing disconnected connections*

Alter/Delete

- *The system needs to show the new state of altered information*

- *The system needs to stop showing deleted information*

### Transfer

- *The system needs to stop showing transferred Identity*
- *The system needs to show the location of transferred Identity*

### Alert

- *The Identity Manager needs to provide a list of all events that still require a decision or when a decision is ongoing*

# *Structure Plane*

The Structure Plane provides the transition between the abstract user needs and product requirements from the previous two planes to the more concrete design criteria in the upcoming two planes. Here, Structure Plane is divided into two sections, namely: Interaction Design and Information Architecture. Interaction Design visualizes the position and relationships between the Identity Manager's features, and Information Architecture models structures the required content.

## Interaction Design

Interaction Design comes from the Feature Specifications from the Scope Plane and combines them in Entity Relationship Diagrams to visualize the relationships and interactions that take place between the user, the Identity Manager, and the connected site. First the conceptual model will be displayed, figure 10. It contains a general overview of all the main relationships and interactions. Second, smaller, more detailed models will be provided that explain the conceptual model in more detail. Every model comes with sequences that explain the interactions steps applied to that model. Every model will start from the user's perspective except the Decide Model that starts from the site's perspective. The models need to be read from there on

### Conceptual Model

*Conceptual Sequences*

Access Sequence

1. User accesses Identity Manager => User can connect, interact, handle, be alerted, decide and can receive support when requested

Connect Sequence

2. User connects Identity Manager with Site => User interacts with Site => Site provides information and connections to Identity Manager => User can handle information and connections

Handle Sequence

3. User handles information and connections => Identity Manager updates handled connection or information to site

Decide Sequence

4. Site removes user information => Alert is given to user => User decides on event => Identity Manager updates the site on decision

Support Sequence

5. User requests support from the Identity Manager => Identity Manager provides support to the user

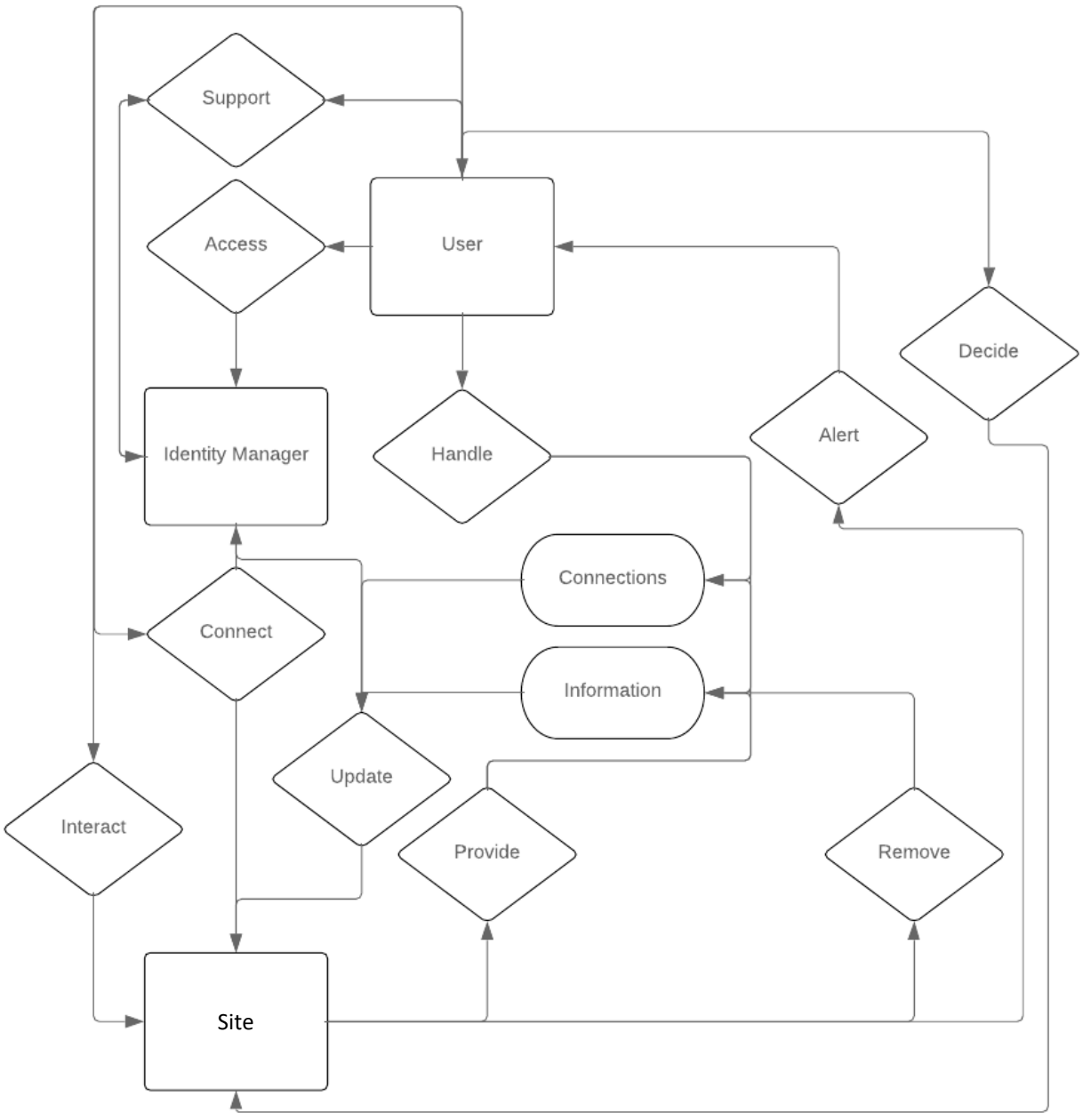


*Figure 10: General Entity Relationship Model*

## Detailed Models

### *Access Sequences*

Access Sequence
1. User registers account => User creates Identity => User has access to Identity Manager

Login Sequence
2. User logs in to Identity Manager using account => User can use Identity Manager => User can logout from Identity Manager

Logout Sequence
3. User uses Identity Manager => User logs out of Identity Manager => User is logged out of Identity Manager

### *Access Model*

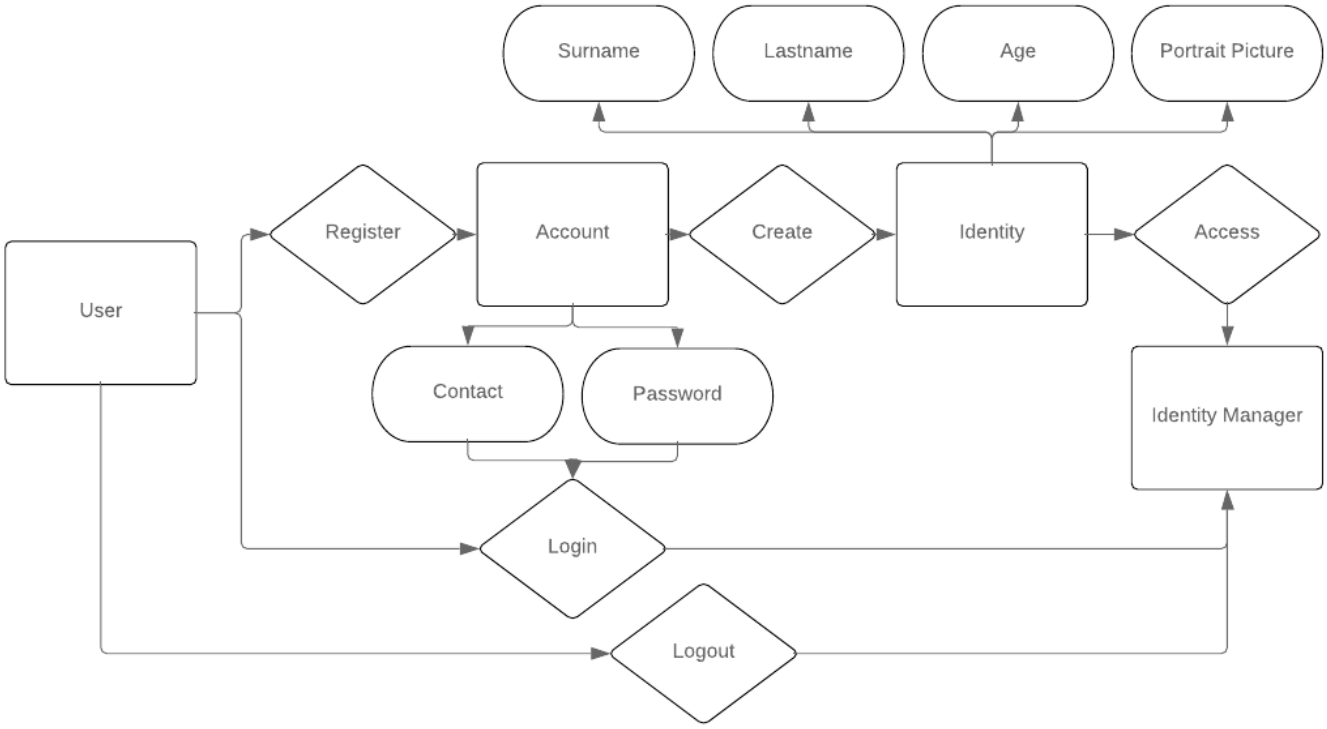


*Figure 11: Access Model*

## Connect Model

*Connect Sequences*

Connect Sequence

1. User uses Identity Manager account to connect site with Identity Manager => Site provides connection to Identity Manager => Identity Manager provides Identity to site

Interact Sequence

2. User interacts with site => Site provides connections and information created during interaction

*Connect Model*

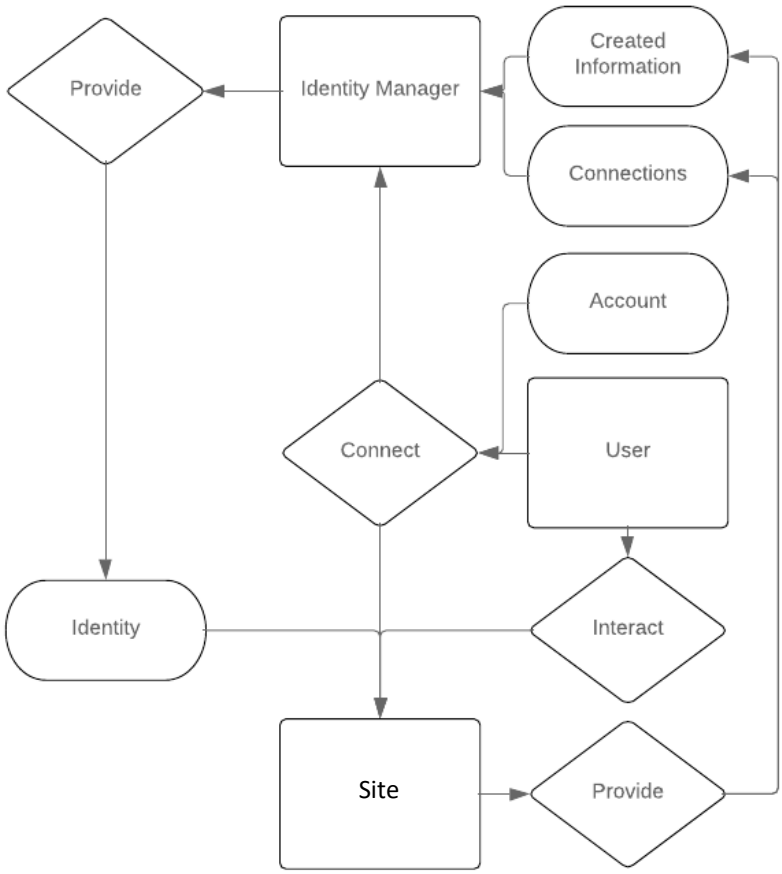


*Figure 12: Connect Model*

## Handle Model

*Handle Sequences*

Disconnect Connection

1. User disconnects site/community/contact => Identity Manager updates disconnection to site

Alter/Delete Information

2. User alters/deletes information => Identity Manager updates alteration/deletion to site

Transfer Identity

3. User transfers Identity => Identity Manager transfer Identity along with its information and connections to other Identity Manager => Identity Manager updates transfer to site

*Handle Model*

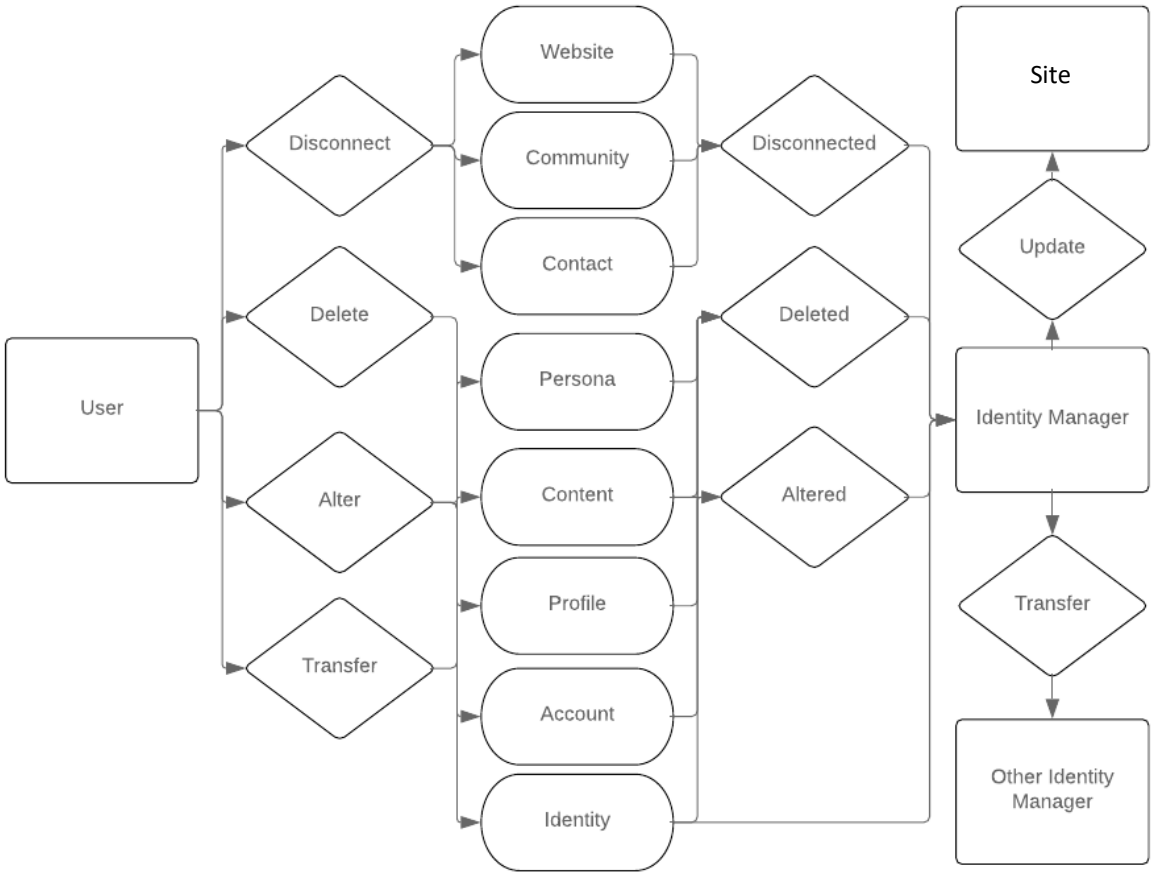


*Figure 13: Handle Model*

### Decide Model

*Decide Sequences*

Alert

1. Site removes content => Site alerts information removal to Identity Manager

Decide

2. Identity Manager notifies user => User either opposes the information removal or agrees => Identity Manager updates decision to site

*Decide Model*

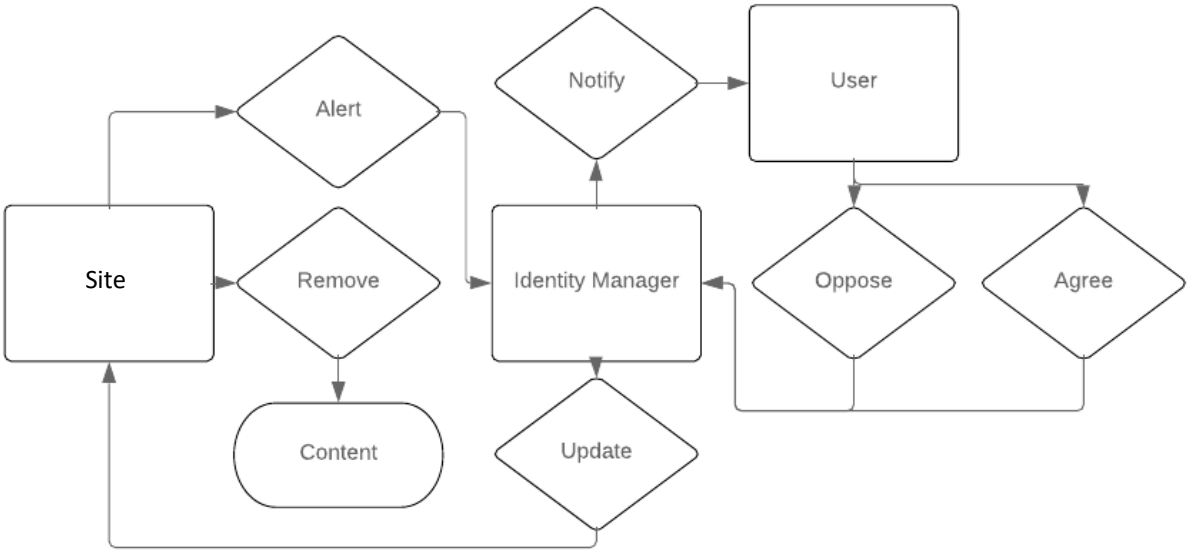


*Figure 14: Decide Model*

## Information Architecture

The Information Architecture, figure 15, is created by the Content Requirements from the Scope Plane and is divided into two different branches. The first branch, Account Branch, covers the utility side of the Identity Manager. Here, all information and connections that the user creates is gathered including the Identity and the account. The second branch, Organization Branch, covers relevant information about the organization and the principles the Identity Manager was built upon.

From the information architecture, meta-data is provided to give contextual information about connections and user information to the user. Further, a controlled vocabulary is provided to offer standardization in applied terms to the Identity Manager.

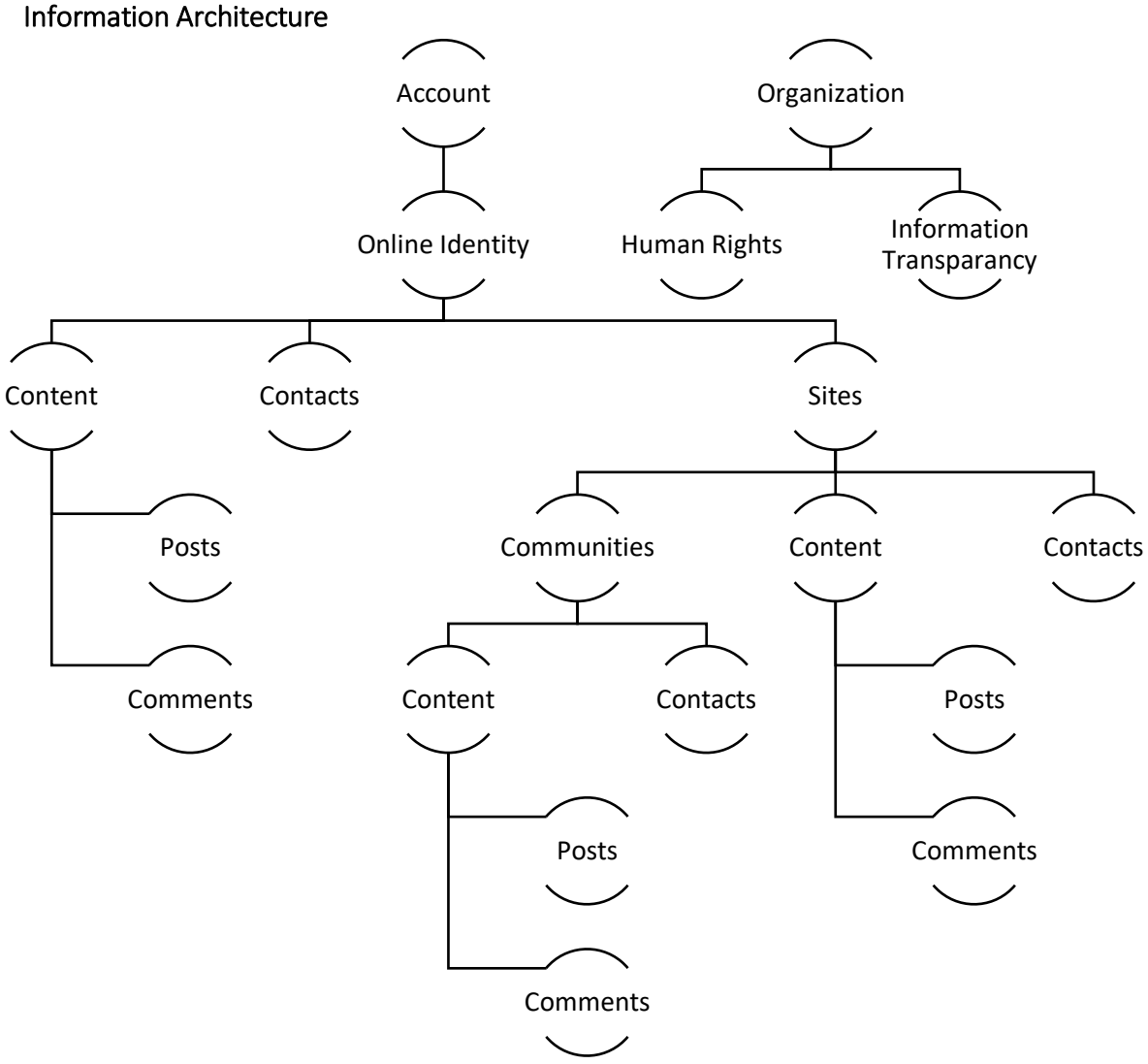


*Figure 15: Information Architecture*

### *Account Branch*

The Account Branch ranges from most fundamental (account) to most refined (community) user information and connections. Here, the logic applies that an Identity cannot exist without the account and the connections or further information cannot exist without the

Identity. The Account Branch Needs to be dynamic in information architecture as it is reasonable to think that every site will wish its own structure (e.g. Junify with its communities).

The Account Branch needs to follow two information structuring systems. The first is the Nested Doll System for a logical refinement of information where one piece of information is placed into a bigger arch of information (e.g. content from community => community => content of service => content of Identity). The second principle is the Flat Hierarchy System for allowing content and contacts to stand outside sites and communities in an overview. This will allow content and contacts to be accessible even when a user is disconnected from a community or site.

The Account Branch needs to be divided into three levels of information. First, "Overview", needs to contain all the user's information and connections. Second, "Service", needs to contain all the user's information and connections from a site. Third, "Community", needs to contain all the user's information and connections from a community.

### *Organization Branch*

The Organization Branch follows a simple hierarchical information architecture where the regulations, rights, principles and algorithms applied to the Identity Manager are placed under the organization information.

### Meta-data

Meta-Data is created by the 5W questions to provide information about the user's connections, information and notifications. The Meta-Data only applies to the Account Branch as this is the user oriented branch.

*Connections*
Connect
When connected (Time / Date)

*Information*
Create
When created (Time / Date)
Where created (Site / Community)

Alter/Delete
When altered / deleted (Time / Date)

Transfer
Where transferred (Identity Manager)
When transferred (Time / Date)

*Notifications*
*Outside Identity Manager*
When notified (Time / Date)

### Nomenclature

Nomenclature provides standardization in applied terms to the Identity Manager. Here, a controlled vocabulary is added to group all the terms that are applied to the OIM.UXD Framework. A thesaurus can be added to tailor the vocabulary to the desired target market.

### Controlled Vocabulary

Based on user/site actions with the additions of support, meta-data and others. The vocabulary needs to be aligned with the type of user action or information location. The controlled vocabulary is provided at table 5 below.

*Table 5: Controlled Vocabulary*

| **Access** | **Create** | **Connect** | **Handle** | **Alert** | **Decide** |
|---|---|---|---|---|---|
| Access | Account | Community | Alter | Alert | Agree |
| Age | Basic Information | Connect | Delete | Notification | Oppose |
| Contact | Comment | Connection | Disconnect | Removal | Update |
| Last Name | Identity | Contact | Reverse | | |
| Login | Post | Provide | Transfer | | |
| Portrait Picture | | Site | | | |
| Register | | | | | |
| Surname | | | | | |
| | | | | | |
| **Support** | **Meta** | **Other** | | | |
| Call | Status | Human Rights | | | |
| Chat | Not-Removed | Identity Manager | | | |
| Operator | Removed | Information Transparency | | | |
| Response | When Connected / Created / Altered / Transferred | Organization | | | |
| Support | Where Connected / Transferred | Self-Sovereign Identity | | | |
| | Who Connected | | | | |

## *Skeleton Plane*

The Skeleton Plane translates the models, sequences and information architecture from the Structure Plane into the more concrete design criteria for the arrangement of the information and features that the user comes into contact with.

The Skeleton Plane is divided into four different sections that make up the Identity Manager. The four are numbered according to the moment the user can access that section.

**1. Access Section**

Access Section comes from the Access Model of Interaction Design and is dedicated to accessing the Identity Manager when the user is not logged in, not registered yet or doesn't have an account yet.

**2. Manager Section**

Manager Section comes from the Handle Model of Interaction Design and applies both branches from Information Architecture. It shows the user all his information and connections along with the features to handle them. Future versions of the OIM.UXD Framework can apply analytics and sharing options in this section as well.

**2.1. Decide Section**

Decide Section is a subpart from the Manager Section and comes from the Decide Model of Interaction Design. The section contains the features to decide and the notification of an Identity influencing event.

**2.2. Support Section**

Support Section is a subpart from the Manager Section and comes from the Support Model of Interaction Design. The section contains the features to request support when the user does not know on how to use the Identity Manager.

**Section Composition**

Each section is divided into three design components: Information Design, Navigation Design, and Interface Design. Information Design covers the types of information that needs to be displayed in each section. Navigation Design covers the navigation structure that will allow the user to navigate through the section. Interface Design covers the Material Design components that are necessary for navigating and showing the information in that section. The three design components are interlinked to complete each other to form the skeleton of a section. Each section is accompanied with exemplar wireframes that show a possible configuration of the design components.

**Section Hierarchy**

Each section, except the Decision Section which contains only Design Components, contains a hierarchy of information/connection display and navigation, see figure 16 next page. Here, the section itself is highest as it contains all that is necessary for that section. Along, the locality of access is determined. Local means that something can only be accessed from within the same level while global means that something can be accessed from anywhere within the section. Level stands for the level of information aggregation (Overview, Service, Community). Subsections contain a category of information or connection from a user (e.g. personal information) and resides within

levels where a user can navigate between subsections at that level. Every Subsection contains at least one Subpage per information/connection type where the Subpage stands lowest and contains information or connections that can no longer can be divided into a smaller category of information or connection. The user can however navigate within the Subpage by scrolling through the Subpage. From a connection Subpage (e.g. Site), can the user navigate however to a lower Level. From every Subpage can the user navigate to a different Subpage within the same Subsection or to a different Subsection within the same Level.

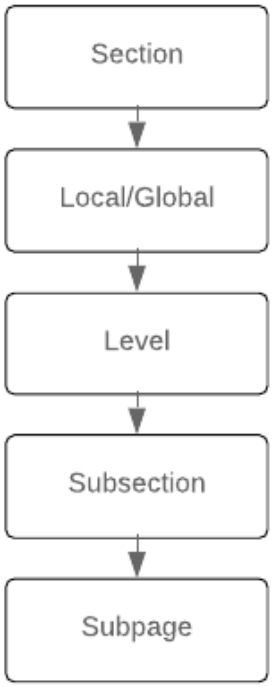


*Figure 16: Design Hierarchy*

## Access Section

The Access Section covers features for registering, create Identity and login to the Identity Manager. The Access Model from Interaction Design is applied here. The Access Section makes usage of Subsections and Subpages.

### Wireframes

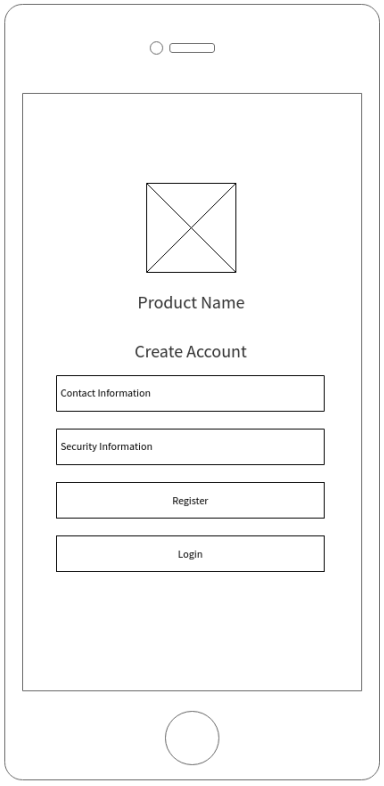


*Figure 17: Register Screen*

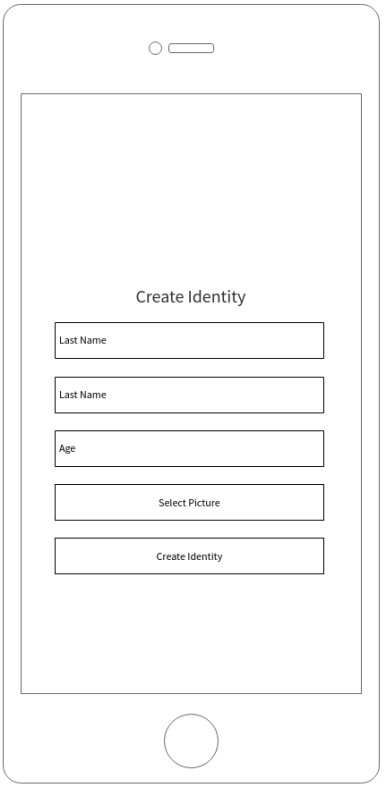


*Figure 18: Identity Screen*


*Figure 19: Login Screen*

### Information Design

*Register*

- Product Logo
  The product logo increases recognition of the Identity Manager.

- Product Name
  As with the product logo, the product name increases recognition of the Identity Manager.

- Register Text
  The register text provides direction and clarity to where to register.

*Identity*

- Create Identity Text
  The create identity text provides direction and clarity to where to fill in information for identity.

*Login*

- Login Text
  The login text is meant for providing direction where to login

### Navigation Design

The navigation of the Access Section follows a simple sequential structure where the only navigation possibility exists in the form of login. The Manager Section is available from the Access Section.

### Interface Design

*Input Controls*

- Buttons
  The input buttons are meant for registration, selecting a portrait picture and completing Identity creation.

- Text fields
  The text fields are meant for filling in account, - and Identity information. Here, there needs to be a text field for contact information, security information for the account as well as surname, last name and age for the Identity.

*Navigation Components*

- Button
  The navigation button is meant for login to Identity Manager

*Information Components*

- Illustration
  The illustration is meant for the Identity Manager logo

- Text
  The text is meant for the name of the Identity Manager as well as for a directive registration and login text

## Manager Section

The Manager Section covers handling features and shows the user all his connections and information. Both the Account Branch and the Organization Branch from the Information Architecture are applied here as well as the Handle Model from Interaction Design. The Manager Section makes usage of all the hierarchical levels of the Section Hierarchy.

### Wireframes

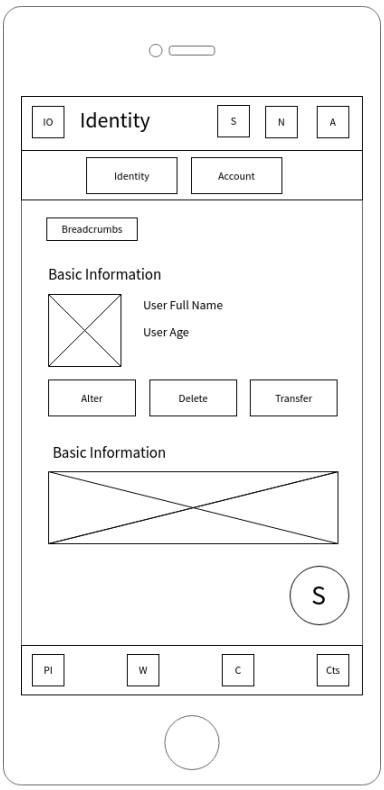


*Figure 20: Identity Screen*

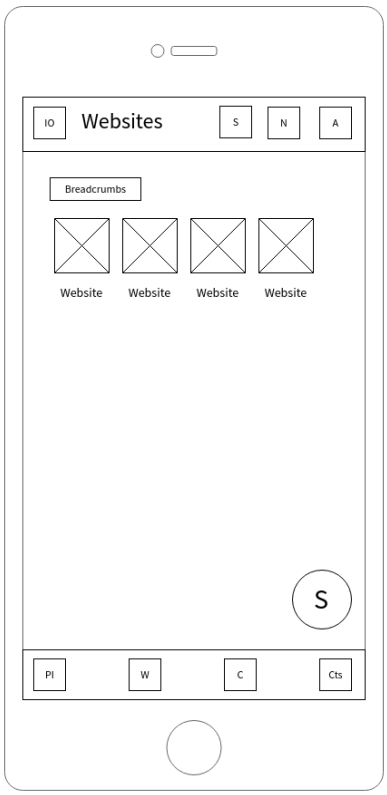


*Figure 21: Site Screen*

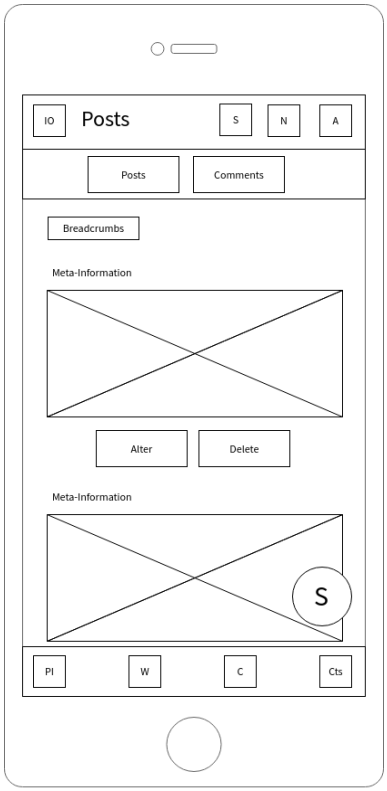


*Figure 22: Posts (Content) Screen*

### Information Design

The Manager Section contains all the information from the Account Branch. There need to be three levels as by the Information Architecture where the 1st is the Overview, containing the most fundamental information (Nested Doll Principle) and the greatest overview of content and contacts (Flat Hierarchy Principle). 2nd level is the Site Level where all the connections and information from that site are shown. 3rd is Community Level, containing all the connections and information from that community.

Information from the Organization Branch needs to exist outside the logic of the Account Branch therefore making it globally accessible. The organization branch will not be further treated at Information Design of this version of the OIM.UXD Framework and up to the organization to decide how fill in best.

*General*

In general, every subsection and subpage needs to show the user the location and connections/information meant for that part along with its metadata and handling options.

General
- Subsection Title
- Meta-Data

*Overview Level*

1. Personal

Personal needs to contain the account and Identity of the user in their own separate Subpage to distinguish the two.

Identity
- Basic Information Subtitle
- User's Surname and Last Name
- User's Age
- User's Portrait Picture

Account
- Contact Information
- Security Information

2. Site

Sites needs to contain all the sites the user is connected to in its own Subpage

Site
- Site Logo
- Site Name

3. Content

Contents needs to show the posts and comments in their own Subpages to distinguish the two. Content need to be shown as is created on site to increase recognition.

4. Contacts

Contacts need to show all the user's connected people in its own Subpage.

Contact
- Surname and Last Name
- Portrait Picture

*Site Level*

1. Site

As of this version, only meta-data needs to exist here. In later versions, analytics and sharing options could be placed here. Needs to be places in its own Subpage.

Site
- Meta-Data

2. Community

Sites needs to contain all the sites the user is connected to in its own Subpage.

Community
- Community Logo
- Community Name

3. Content

Contents needs to show the posts and comments in their own Subpages to distinguish the two. Content need to be shown as is to increase recognition.

4. Contacts

Contacts need to show all the user's connected people in its own Subpage.

Contact
- Surname and Last Name
- Portrait Picture

*Community Level*

1. Community

As of this version, only meta-data needs to exist here. In later versions, analytics and sharing options could be placed here. Needs to be places in its own Subpage.

Community
- Meta-Data

2. Content

Contents needs to show the posts and comments in their own Subpages to distinguish the two. Content need to be shown as is created on site to increase recognition.

3. Contacts

Contacts need to show all the user's connected people in its own Subpage.

Contact
- Surname and Last Name
- Portrait Picture

### Navigation Design

The navigation of the Manager Section needs to be split between Local Navigation and Global Navigation. Here, Local Navigation needs to contain all the user's information and connections while Global Navigation needs to contain the logout, notifications, search and organization information. These need to be global for convenience and accessibility reasons. Only the user's account needs to be both globally accessible and locally as it is both a site custom to have an account globally accessible but also a user information piece must therefore be locally accessible. From the Manager Section, the Support Section and Decide Section are available.

#### *Global Navigation*

The global navigation, figure 23 below, gives access to the organizations information. Further, the global navigation needs to provide the user with the opportunity to search their information or connections from anywhere. Notifications needs to be displayed here as time is an important factor in deciding on an Identity influencing event. The account (Subpage 1.1.B on Local Navigation) need to be accessed from here as the user needs to be able to logout no matter where the user is in the section. When the user is on a different local than the Overview Level, a return button must also be provided globally. The navigation diagram below displays the global navigation design.

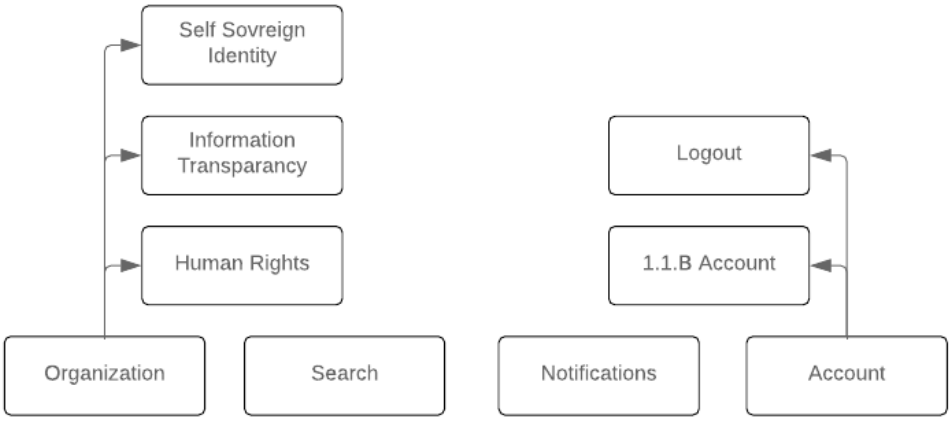


*Figure 23: Global Navigation*

#### *Local Navigation*

Local Navigation, figure 24 next page, first contains the three levels of information from the Account Branch at the Information Architecture. From there the user is able to navigate to the according information and connections as by the same architecture. The navigation diagram on the next page displays the local navigation design.

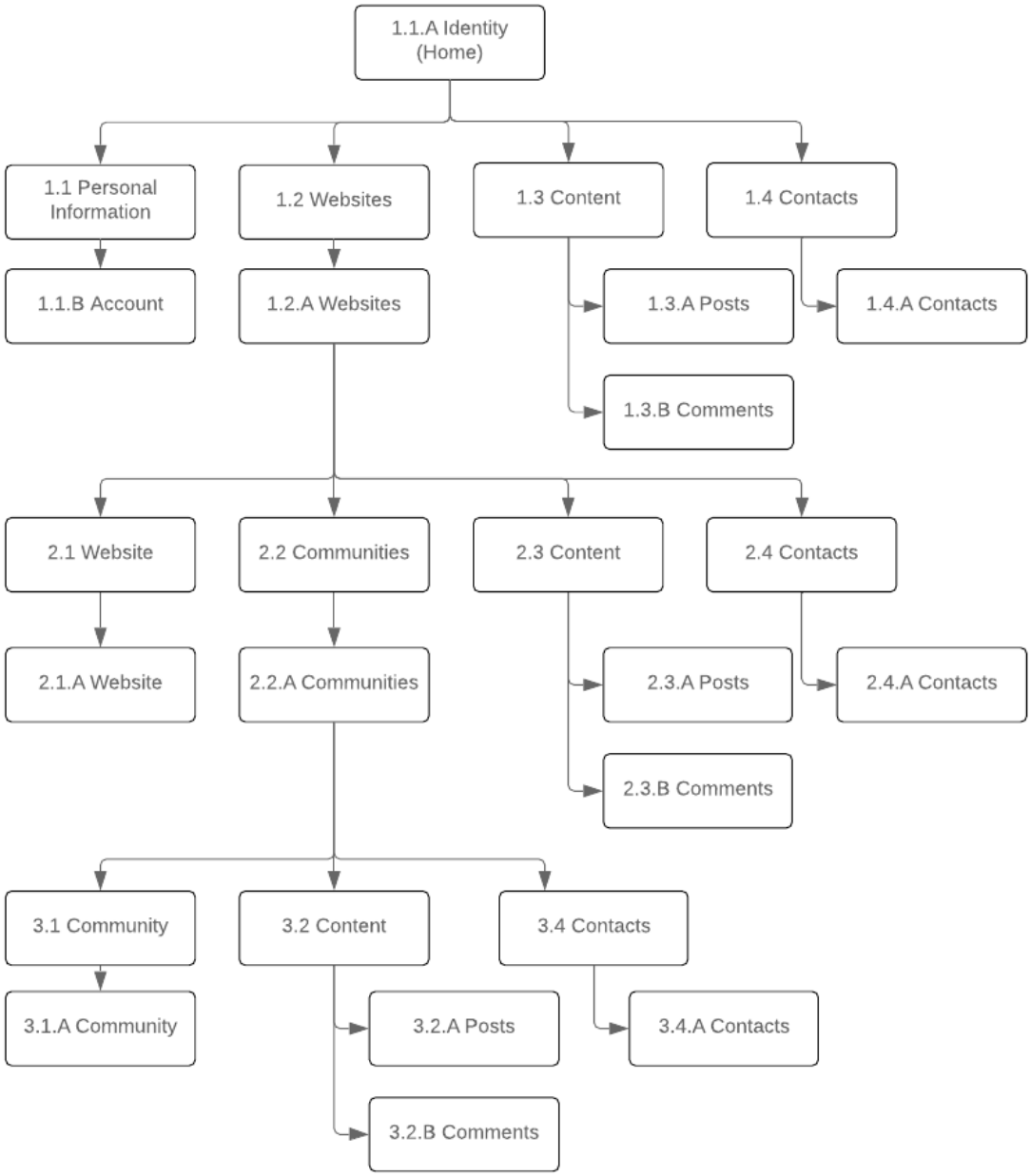


*Figure 24: Local Navigation*

Everything at the Local Navigation contains a code (1.1.A) where the first number stands for the level, the second for the subsection, and the letter for the subpage location within subsection. 1.1.A is the Home, meaning that when the user logs in from the Access Section, the user sees this Subpage first. For convenience and recognition, this needs to be the Identity itself and is a part of the Personal Information Subsection. 2.1.A is the Site Subpage and needs to be the the first to see when going to the Site Level. Same goes for 3.1.A, Community Level.

### Interface Design

With the interface components from the Manager Section, the user needs to make actual sense of his information and connections with the possible handling options. There are several types of components that are necessary for different types of navigation as mentioned below. Input Controls are fairly standard as the same input/action applies to each type of information or connection.

#### *Input Controls*

The input controls are divided between Subpages that contain information and Subpages that contain connections. The controls need to be placed at every piece of information or connection. Further, the user's actions/input that cannot be places among these two are places under "Other".

Information Subpages
User Actions

- Buttons
  The buttons are meant for user altering / deleting information, transferring an Identity or to reverse the action.

User Input

- Text fields
  The text fields are meant for altering user information and to signify the other Identity Manager.

Connection Subpages
User Actions

- Buttons
  The buttons are meant for disconnecting a connection or to reverse the action.

Other
User Actions

- Buttons
  The buttons are meant to logout.

#### *Navigation Components*

Navigation Components is divided between global navigation and local navigation.

#### Global Navigation

Between Subsections

- Top App Bar
  The top app bar is meant to navigate to global information and features and to reverse navigate between levels. The Subsection Title is also displayed here.

Between Subpages

- Drawers

The Drawers are meant to navigate to organization information and account information.

#### Between Manager Section - Support Section

- Floating Action Button
  The floating action button is meant to open the support section.

#### Notifications

- Lists
  The list is meant to gather all open events from section Alert

#### Search Information

- Search Field
  The search field is meant to find user,- or organization information.

#### Local Navigation

#### Between Levels

- Illustration Buttons
  The buttons are meant to navigate forward between levels.

- Breadcrumbs
  Breadcrumbs are meant to trace back previous levels.

#### Between Subsections

- Bottom Navigation
  The bottom navigation is meant to hor. navigate between subsections

#### Between Subpages

- Tabs
  The bottom app bar is meant to hor. navigate between subpages.

#### Within Subpages

- Scroll
  The scroll is meant to vert. navigate subpages.

### *Information Components*

Information Components is divided between the user's information and his connections. The cards need to be meant to show the user his information while the lists need to be meant to show the user his connections.

#### User Information

- Cards
  Cards are meant to present the user's information to the user in a distinctive way.

- Illustration
  Illustrations are meant to present the portrait picture of the user.

- Text
  Text is meant to present all the user's information meta-data, identity managing tips, and further.

User Connections

- Lists
  Lists are meant to present user's connections to the user in a structured way

- Illustration
  Illustrations are meant to present the portrait picture of the connection.

- Text
  Text is meant to present all the user's connections information, meta-data.

## Decide Section

The Decide Section covers the notification and decision features necessary to maintain control in Identity influencing events.

### Wireframes

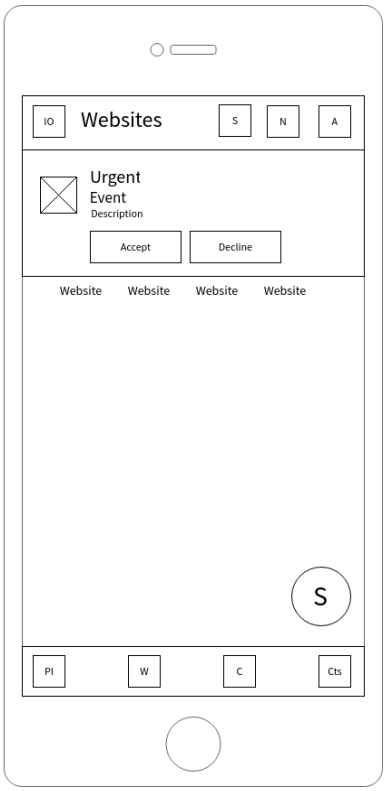


*Figure 25: Notification List*

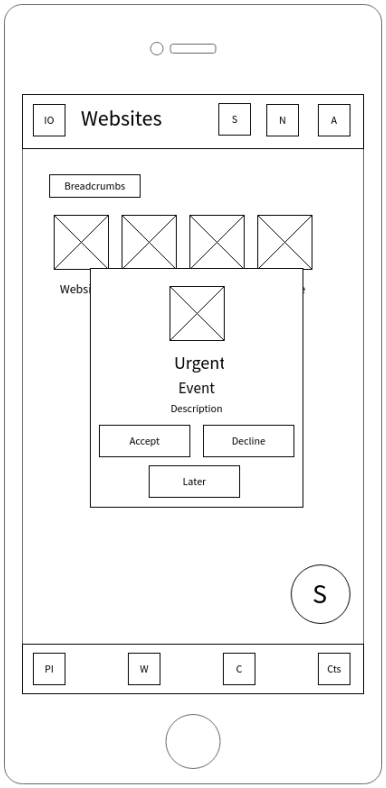


*Figure 26: Notification Dialog*


*Figure 27: Notification*

### Information Design

The Decide Section needs three types of information provision, namely the List figure 25, the Dialog figure 26 and the Notification figure 27. The Dialog needs to provide in-app notification that require an immediate user action. The dialog can be dismissed and will need to be listed at the Notifications List. The Notification needs to provide outside-app notifications where the user can make a decision without having to access the app. Logos need to be provided to make the origin of the event recognizable. Urgency titles are meant to make the user aware on the time factor. A header needs to be provided to display the type of event that has occurred. A reasoning text needs to be provided to give the user context on the event.

*Dialogs*

- Site logo
- Urgency title
- Identity influencing header
- Reasoning text

*Lists*

- Site logo
- Urgency title
- Identity influencing header

*Notification*

- Site logo
- Identity influencing header
- Reasoning text

### Navigation Design

The Decide Section does not have a navigation design as the user does not navigate within the section or between sections.

### Interface Design

The input controls and information components are the most important in the Decide Section. With the input controls, the user needs to be able to make a decision on identity influencing events or dismiss to decide later. The dialog, list and notification components nest the input controls and information as can be seen at figures 20 - 22 from the wireframes. One button is provided in the list to open the dialog again.

*Input Controls*

- Buttons
  Meant to be able to agree or oppose the identity influencing event. A third button is meant for dismissing the notification for now.

*Information Components*

- Dialogs
  Meant for obtrusively requesting immediate attention in-app to decide on an Identity influencing event.

- Lists
  Meant for showing all the dismissed dialogs.

- Notification
  Meant to notify and request a decision for an identity influencing event outside-app.

- Illustrations
  Meant to display the site's logo for recognition.

- Text
  Meant to provide information on the event.

## Support Section

The Support Section covers the features to call or chat with Support of the organization. It is nested within the Manager Section and can only be accessed from the Manager Section. The Support Model from Interaction Design is applied here. The Support section only needs to contain one screen which acts as Subpage, Subsection and Section in one.

### Wireframes

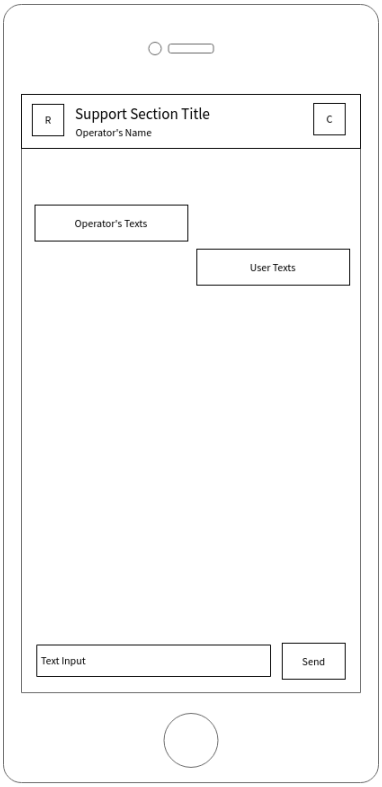


*Figure 28: Support Section*

### Information Design

The Support Section needs to consist of a separate screen (1 Subpage) that contains both the feature of Chat, - and Call Support, see figure 28 Call needs to contain only a user action for calling and Chat needs to contain a chat screen similar to WhatsApp for familiarity. Chat will need to display both the user's chat messages and the Support Operator's chat messages. The Operators name needs to be displayed for recognition.

*Chat*

- Chat messages
- Support Operator's name

*Other*

- Support Section Title

### Navigation Design

The user needs to be able to navigate between the Management Section and the Support Section, see figure 29 below. Support needs to be accessible from anywhere at the Manager Section.

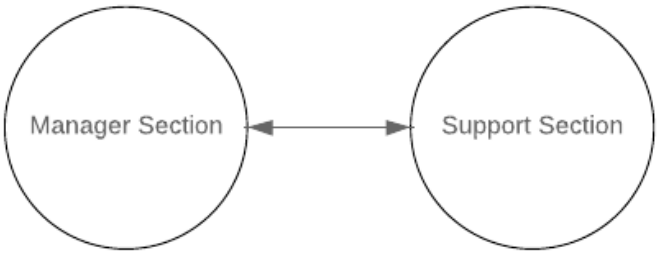


*Figure 29: Manage - Support Navigation Model*

### Interface Design

The user needs a button for going back to the Identity Manager, a button for calling Support and a button for sending the chat message to the operator. These need to be nested in a Top App Bar. Further, there needs to be a text field for the user to enter the chat message. These need to be nested in a Bottom Bar. The chat messages need to be displaced from both the user and the operator at the interface and will need to be nested in Cards.

#### *Input Controls*

- Buttons
  Meant for sending the chat message and calling Support.

- Text fields
  Meant for typing the chat message.

#### *Navigation Components*

- Top App Bar
  Meant for nesting the call feature and reverse navigation button as well as displaying the Section Title and Operator's name.

- Buttons
  Meant for going back to the Manager Section.

#### *Information Components*

- Cards
  Meant for nesting the chat messages.

- Text
  Meant for showing the various types of information to the user.

## *Surface Plane*

The Surface Plane is the final plane and provides the guidelines that makes the user's experience of the Identity Manager complete. It fills the Structure Plane sensory (visually only for now) in. The guidelines are combined into one section, Visual Design, as similar with others (e.g. Audible Design) require specialized usability user research. Visual Design provides the guidelines as to what would be a familiar and learnable visual presentation of the user's experience.

Note: The user's content should be shown as it is created on the connected site to increase recognition.

### Visual Design

#### Typography

Material Design makes usage of its own font "Roboto", it is therefore advised to apply this font to the visual design of the Identity Manager.

*Table 6: Typography Design*

| Information Type | Font size | Font weight | Hexcolor |
|---|---|---|---|
| Subsection Header | 20 | Medium | #313131 |
| Subpage Header | 20 | Medium | #313131 |
| Breadcrumbs | 14 | Medium | #818181 (Not current Level)<br>#313131 (Current Level) |
| Meta-Data | 12 | Medium | #818181 |
| User's Name/Age and Contact Names | 14 | Medium | #313131 |
| Chat Messages | 14 | Medium | #313131 |
| Site/Community Labels | 14 | Medium | #313131 |
| Button text | 14 | Medium | #FFFFFF |

#### Color Scheme

The following non-textual Material Design components are advised to be colored as follows.

*Table 7: Color Design*

| MD Component | Color |
|---|---|
| Button (Regular) | #515151 |
| Buttons (Icon) | Inactive #818181<br>Active #515151 |
| Cards | #FFFFFF |
| Floating Action Button | #515151 |
| Navigation Components | #FFFFFF |
| Screen Background | #F8F8F8 |

### Iconography

Material Icons as below, or similar, is advised to be applied to the Identity Manager.

*Table 8: Iconography Design*

| **Local** | | |
|---|---|---|
| *Icon* | *Name* | *Usage* |
|  | Account Box | Personal |
|  | Language | Sites |
|  | Forum | Content |
|  | Contacts | Contacts |
|  | Home | Site Entry |
|  | Group | Communities |
|  | Backspace | Reverse Navigation |
| **Global** | | |
| *Icon* | *Name* | *Usage* |
|  | *(Own Placeholder)* | Organization |
|  | Search | Search Information/Connections |
|  | Notification | Notification List |
|  | Inbox | Account |
|  | Exit | Logout |
|  | Accessibility | Human Rights |
|  | Information | Information Transparency |
|  | Thumbs Up | Self-Sovereign Identity |
|  | Help | To Support |
| **User Actions** | | |
|  | Send | Send Message |
|  | Build | Alter Information |
|  | Delete | Delete Information |
|  | Forward | Transfer Identity |
|  | Block | Disconnect |

# B. Identity Manager Prototype

This Appendix provides information on the prototype that was developed to evaluate the usability of a platform that could be developed after the Online Identity Manager User Experience Design Framework (OIM.UXD Framework). The Appendix is divided into the 4 sections from the Structure Plane, namely the Access Section, Manager Section, Decision Section and Support Section. Some conceptual branding of our own Identity Manager "Avatar" was applied as well as Junify as test site to the prototype. Here, the name and the logo were added to have the prototype represent the OIM.UXD Framework without any irrelevant additions.

Note: The prototype was developed in Dutch as the test participants were Dutch speaking citizens. Further, the prototype was developed for iPhone as this is the researchers own phone.

## *Access Section*


*Figure 30: Register Screen*


*Figure 31: Identity Screen*

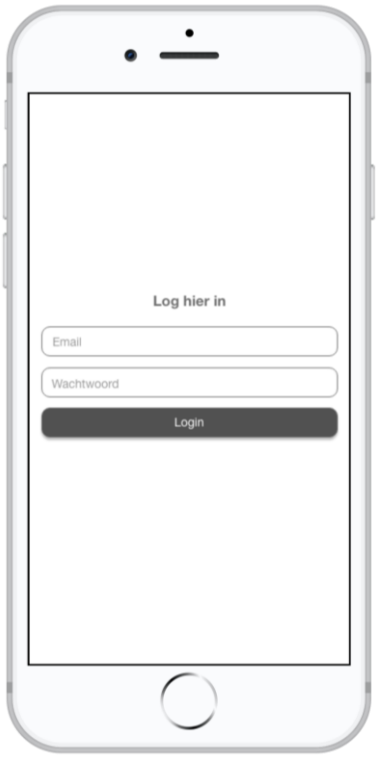


*Figure 32: Login Screen*

The register Subpage, figure 30 above is taken as mentioned at the Access Section. At the top, the brand logo of Avatar was shown along with the name right below. When the user is registered, it will be taken to a separate screen for the creation of the identity, figure 31 Here, name text fields as well as a text field for the age of the user is provided. Lastly, the user can pick a portrait picture with the grey button where it can complete with the white button. When the user wants to login, it can click on the button at figure 32 where it goes to the screen as by figure 33

## *Manager Section*

This section is divided in the Overview Level and the Site Level. Community Level is left out as it is in terms of layout nearly identical with the exception of not containing any navigation possibilities to a lower level. For the Manager Section, and following, we added the Material Design Icons Library to the visual design.

### Overview Level


*Figure 33: Identity Screen*

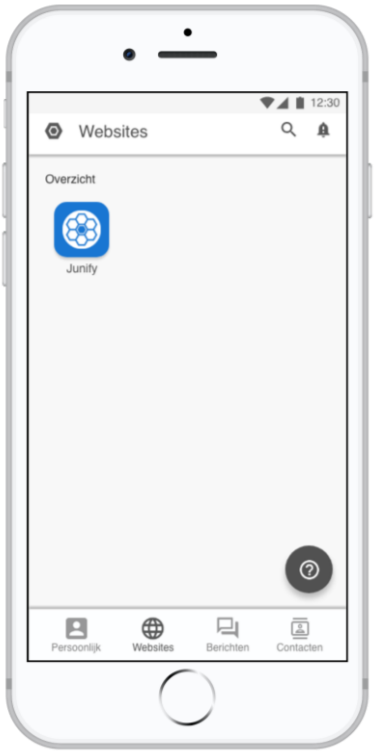


*Figure 34: Site Screen*

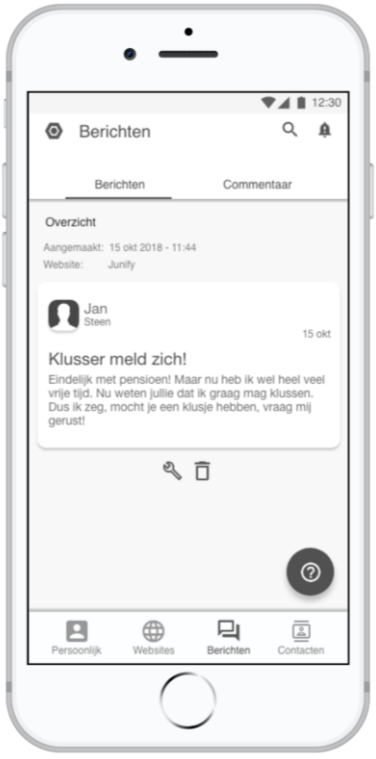


*Figure 35: Posts (Content) Screen*

From top down, the top app bar provides the user with global functionalities such as notifications, search, the subsection title and the organization information. As with the standard design of the drawer from Material Design, we added the account navigation and features to the organization information. Below the top app bar, the tab bar is provided where the user can navigate between Subpages within a Subsection. At "Persoonlijk", Personal in English, are the Identity and account presented, see figure 33 above. Here, the Subpage starts with the breadcrumbs to show the user the level where it is at. Below the breadcrumbs is the Identities' Basic Information displayed along with the handling functions of altering, deleting and transferring the Identity. In the right lower corner is a floater action button provided to allow the user navigate to the Support Section. At the bottom is the navigation bar where the user can navigate between subsections at the same level.

Figure 34 shows the Site Subsection where the user can navigate to a lower level within the app. The tab bar is left out as site doesn't contain any other Subpages than Site. The Site Subpage contains a list of sites where Junify is provided to allow the user go to Junify Subsections.

Figure 35 previous page shows mock-up content along with fictional meta-data when and where the content was created. The handling options are displayed below. The user can navigate here between the Posts Subpage and the Comments Subpage.

## Site Level


*Figure 36: Site Screen*

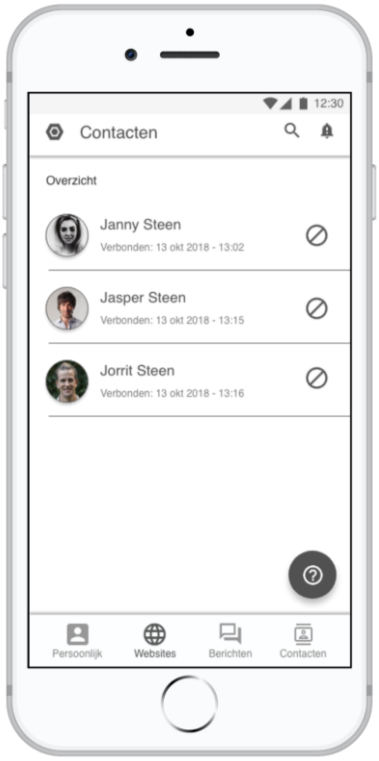


*Figure 37: Contacts Screen*

Similar to the Overview Level, the Site Level contains the Subsections for going to a lower level, content and contacts. The navigation layout and visual design are also similar in experience with the exception of a return button instead of an organization button. Different here is, as can be seen in figure 36 above, is the Site Subsection instead of the Personal Subsection where the user is provided with the meta data on the site along with the disconnecting handling option. The user can navigate here to Community Level and handle the content and contacts applicable to that site, see illustration figure 37.

## *Decision Section*

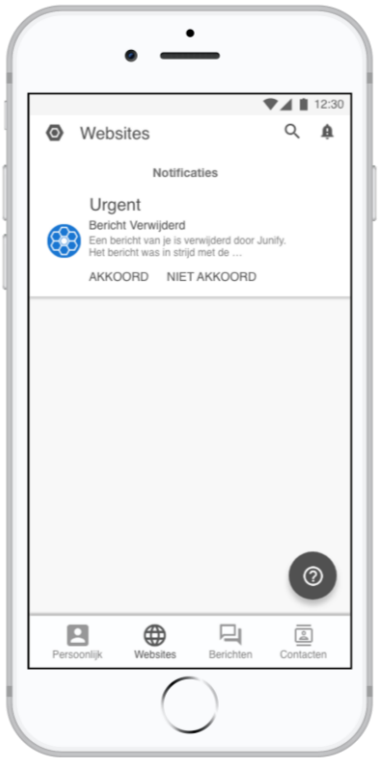


*Figure 38: Notification List*

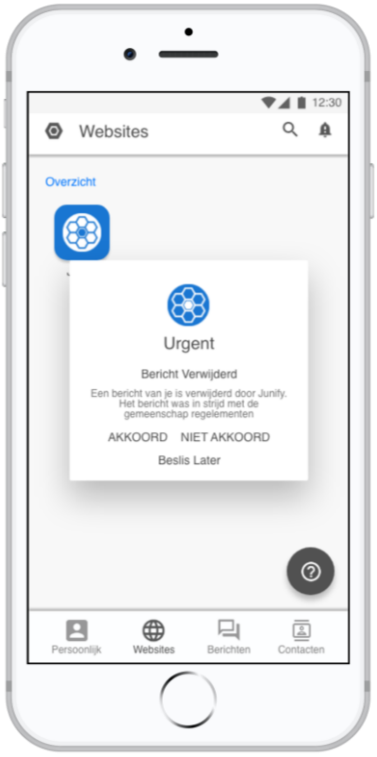


*Figure 39: Notification Dialog*

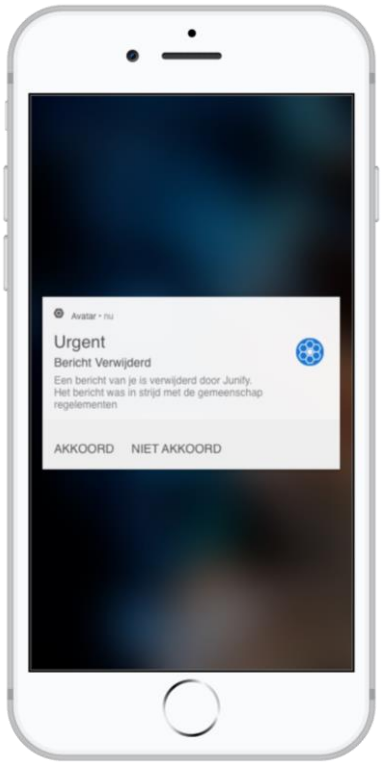


*Figure 40: Notification*

All features from the Decision Section were represented at the prototype where figure 38 provides the Notification List, figure 39 the In-App Notification and figure 40 the Outside-App Notification. As by the OIM.UXD Framework, the brand logo is displayed at all three for identification. Further, the type of message, in this case "Message Removed", was added along with the explanatory information for the action. The decision options are given where each can be dismissed in their own usual way (notification button for Notification List, action button for In-App Notification and swiping for Outside-App Notification.

## *Support Section*


*Figure 41: Support Section*


*Figure 42: iPhone Call Screen*

Support Section contains the chat and call options in their own separate Section as needed by the OIM.UXD Framework, see figure 41 and 42. Here, the user is provided with the sections title along with the call button on the top right in the top app bar. A return button is provided at the top right corner similar to the Site Level of the Manager Section. Text balloons represented in cards are displayed for the chat conversation between the operator and the user. Below the top app bar, can the user see the name of the operator the user is chatting with. The user can type and send a text message at the bottom. The user can call support when deemed necessary which provides the standard iPhone Call Screen.

# C. User Testing Results

## *1. Access Section*

### 5-Second Usability Test

The participants were overall pleased with the UI of the Access Section. The logo and name were clear and the participants knew what the meaning was of this section, "to login". Some participants were however not certain what the difference was between account and identity.

### User Success Rate Test

#### A. Create an identity

*4/5 succeeded entirely*
*The task was completed within 52 seconds on average. The participants that didn't succeed mentioned that it was not clear the distinction between identity and account.*

#### B. Go to identity

*5/5 completed entirely*
*The task was completed within 17 seconds on average.*

### Behavior Observations

During all sessions, no additional behavior was noticed.

## *2. Manager Section*

### 5-Second Usability Test

Most participants knew that they were at the part of the identity, having logged in. The UI components were familiar although the labels at the bottom could be a little bit bigger. Title was clear though.

### User Success Rate Test

#### A. Find the contact of your friend

*5/5 completed entirely*
*The task was completed within 15 seconds on average. The participants mentioned that it was clear where it would be, but that they were not familiar yet with the app.*

#### B. Go to Junify, a site

*4/5 completed entirely*
*The task was completed within 11 seconds on average. The participant that didn't complete the test mentioned that it wasn't easily findable as the participant was more focused on the site itself than on the fact that it is a site.*

#### C. Delete your last comment

*3/5 completed entirely*

*The task was completed within 18 seconds on average. The participant that didn't complete the test mentioned that the comments were behind the label "sociaal" (social) which caught the participants of guard although they mentioned that it is quite logical and simply takes "knowing" to do it next time right.*

#### D. Transfer your Identity to another app

*1/5 completed entirely*
*The task was completed within 19 seconds on average. The participant that didn't complete the test mentioned the button didn't contain labels, making it difficult to interpret the intention of the button.*

### Behavior Observations

The transfer task was clearly uncomfortable for several participants. A higher voice was noticed during Think Aloud on the task, where was mentioned that it is not clear on where the function was.

## *3. Decide Section*

### 5-Second Usability Test

Notifications were clear. Urgent label could be removed as this was seen as redundant by most participants. Argument for this is that they would pay attention anyway to the notifications. Buttons were also clear.

### User Success Rate Test

#### A. First read the text, then agree or disagree to it

*5/5 completed entirely*
*The task was completed within 8 seconds on average. The participants found the notifications logical and familiar, making them easy to interpret.*

### Behavior Observations

During all but one session, no additional behavior was noticed. One participant displayed laughter on the clear notification, mentioning why notifications are not more often as easy as what the prototype contained.

## *4. Support Section*

### 5-Second Usability Test

The support section looked familiar to the manager sections, which was a plus. The chat was similar to WhatsApp according to the participants.

### User Success Rate Test

#### A. Find the support options

*4/5 completed entirely*

*The task was completed within 6 seconds on average. The participants found the button easy to identity and necessary in its form. The one that didn't complete the task mentioned that it is actually quite logical but didn't expect it.*

### B. Call support

*5/5 completed entirely*
*The task was completed within 5 seconds on average. The participants found the button easy to identity and logical that chat is emphasized over call.*

## Behavior Observations

During all sessions, no additional behavior was noticed.

# D. Research Process

To come to a relevant artifact, a custom research process was needed along with the research framework that would generate and evaluate the OIM.UXD Framework, see figure 43.

**Define Phase**: Prepared for the rest of the process where a CL1 user group needed to be identified.

**Design Phase:** The OIM.UXD Framework was iteratively designed, with the design process as described below, where expert evaluation occurred with the first two iterations and at the completion of the design process

**Prototype Phase:** A prototype was built to be able to evaluate the quality of the OIM.UXD Framework.

**Evaluate Phase:** The prototype was tested through a controlled experiment among test participants that fitted the profile of the user group. The OIM.UXD Framework was also evaluated by a UX Expert on comprehensiveness, clarity and reliability.

**Finalize Phase:** The findings from the evaluation phase were documented and didactive texts were added to the OIM.UXD Framework.

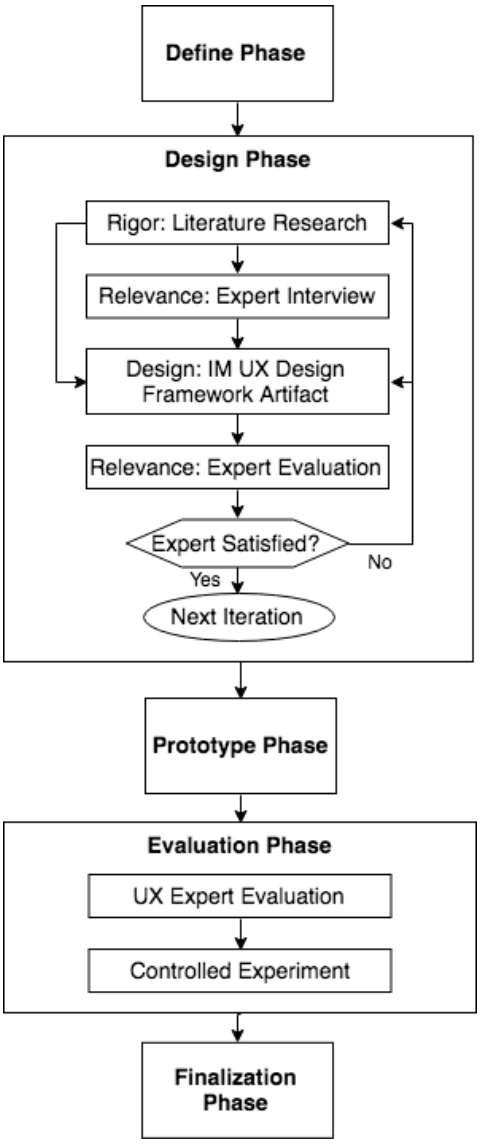


*Figure 43: Research Process*

# E. Design Process

Since an artifact needed to be designed, a design process during the Design Phase from the Research Process was necessary as well. See figure 44 for the process. The design steps of the process were divided into three iterations.

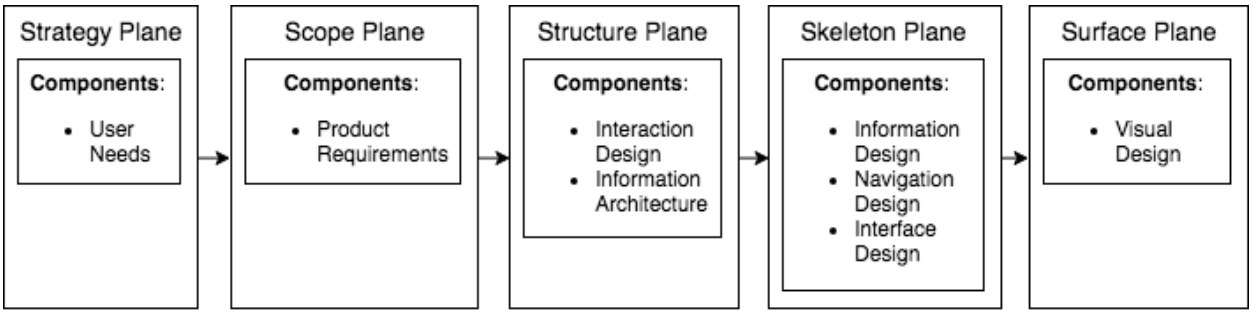


*Figure 44: Design Process*

## Iterations

**1. User Needs and Basic Structure:** User needs were determined through literature and through experts. Basic structure of OIM.UXD Design Framework was created.
**2. Product Requirements:** User needs were translated into product requirements.
**3**. **UX Design:** Product requirements were translated into UX Design.

# F. Research Methods

## *Design Research Method*

The main design research method of this thesis was based on the Information Systems Research Framework by Hevner (2010).

ISRF is meant for design research in information systems in general and can be applied to user experience design as well. The research framework was therefore ideal to be used for designing the IM UX Design Framework. Only the "Business Needs" from the model were named as "User Needs".

As by the research framework, this research went iteratively through three different type of cycles, namely: Relevance Cycle, Rigor Cycle, and Design Cycle. The Relevance Cycle was meant to establish a practical understanding on the requirements of the design. The Rigor Cycle was meant to ground the design with scientific knowledge. The Design Cycle was meant to develop per iteration a part of the OIM.UXD Design Framework using the resources from the Relevance, - and Rigor Cycle. The design research went through a total of three iterations where the two iterations were dedicated User Needs and Product Requirements, and the thirds to UX Design.

This research used the ISRF Guidelines, see table 9 as guide to research a valid artifact.

*Table 9: ISRF Guidelines*

| Guideline | Description |
|---|---|
| **1. Design as an artifact** | Design-science research must produce a viable artifact in the form of a construct, a model, a framework, or an instantiation. |
| **2. Problem Relevance** | The objective of design-science research is to develop technology-based solutions to important and relevant business problems. |
| **3. Design Evaluation** | The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods. |
| **4. Research Contribution** | Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies. |
| **5. Research Rigor** | Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact. |
| **6. Design as a search process** | The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment. |
| **7. Communication of research** | Design-science research must be presented effectively both to technology oriented as well as management oriented audiences. |

## *Literature Research Method*

The literature, necessary per Rigor Cycle, was explored, interpreted and communicated using the seven steps model from the Comprehensive Literature Review (CLR) as by Onwuegbuzie and Frels (2016). The CLR is a dynamic research method that can be used for multiple types of data coming from different types of sources during every moment of research. This combination of attributes made it ideal for the iterative design process of this design research. Here, only qualitative data was used during the process coming from expert interviews, scientific articles, and informative media.

The seven steps are as follows:

**Exploration**

1. Exploring Beliefs and Topics
2. Initiating the Search
3. Storing and Organizing Information
4. Selecting/Deselecting Information
5. Expanding the Search with one or more MODES[25]

**Interpretation**

6. Analyzing and Synthesizing Information

**Communication**

7. Presenting the CLR Report

The CLR requires administration of the literature research which can be found under Appendix G Literature Research Administration (p.93)

## *Interview Method*

For the Relevance Cycles, explorative interviews with experts on several fields were conducted to apply expert knowledge to the Design Cycle. Here, the Expert Interview Method (EIM) as by Bogner, Littig and Menz (2009) was applied. The EIM method is comprehensive in extracting the right knowledge from experts for different research purposes including design research. The method was therefore ideal for this design research.

Bogner, Littig and Menz (2009) define an expert in the context of knowledge production as: A person who is attributed as expert by virtue of his role as informant by the research to provide the deemed necessary knowledge which could not be explicitly acquired by other conventional means. They further define expert knowledge to be influential knowledge in an organizational- and functional context for structuring the conditions of action in a relevant way.

The interviews were conducted in a semi-structured way where the developed questions were of explorative nature to engage the interviewee in a monologues delivery of information. Here, the interviewer took on the role of lay-person where the task mainly was to acquire data and sources. The administration on the interviews can be found under Appendix H Interview Administration (p.94)

[25] Media, Observations, Documents, Experts, Secondary Data

Each interview per Relevance Cycle went through several steps as provided below:

1. Research Design
2. Data Generation
3. Data Analysis
4. Reporting

At step one, the goal, questions and expert were selected for step 2. Phase two involved the interview itself. Step three involved several tasks where the generated data was transcribed, paraphrased and headlined in order to be implemented to the OIM.UXD Framework. Step 4 involved the reporting of the extraction information.

## *Design Method*

To translate the user needs into a viable design artifact, the UX Design process as by Gartner (2011) was used. This design process is dissected into five different phases ranging from UX Strategy to UX Visual Design. The five phases are described below:

1. **Strategy Plane:** Describes the user needs the target user has from an product.
2. **Scope Plane:** Describes the product requirements, derived from the user needs, that need to be implemented in the current version of design.
3. **Structure Plane:** Translates the product requirements into interactions models and information architectures meant for the design.
4. **Skeleton Plane:** Designs the UX where the interaction models and information architectures are translated into Information Design, Navigation Design and User Interface Design which are combined into a conceptual UX.
5. **Surface Plane:** Translates the conceptual UX from the Skeleton Plane into the actual UX the user will receive.

## *User Testing Method*

To evaluate the OIM.UXD Framework, controlled experiments were conducted where high fidelity testing in the form of a prototype was applied. Here, the method by Nielsen (2003) elaborated further in the book of Barnum (2011). They state that around five test participants needs to test a prototype in order to be considered valid in usability. Several methods can be applied to do so. With this research, controlled experiments were applied where each participant had to complete several tasks in usability testing. The setting of the controlled experiments is described under chapter Evaluation.

# G. Literature Research Administration

**Exclusive Criteria**

- Philosophical, psychological or anthropological definitions and concepts except for any introductory purposes from the already gathered sources
- Purely quantitative sources except for computer literacy
- Sources >3 y.o with <15 references

**Inclusive Criteria**

- Identity Management as utility
- Online Identity in sociology
- Term definitions and concepts

*Table 10: Keyword Searches*

| Primary Searches | Secondary Searches | Tertiary Searches |
|---|---|---|
| Online Identity | Identity<br>Online Identity Protection<br>Online Identity Management | Online Identity Composition<br>Identity and Privacy Human Rights<br>General Data Protection Regulations<br>Self-Sovereign Identity |
| UX Design | Senior UX Design<br>Utility<br>Usability | Simplicity<br>User Needs<br>Product Requirements<br>Interaction Design<br>Information Architecture<br>Information Design<br>Navigation Design<br>Interface Design<br>Visual Design |

**Used Databases / Libraries**

- Nielsen Norman Group
- Google Books
- Science Direct
- Wikipedia

**Used Search Engines**

- Scopus
- Google Scholar

**Used Dictionaries**

- Cambridge Dictionary

# H. Interview Administration

**Expert selection criteria**

- >4 year active in field
- Dutch cultured
- LinkedIn page underlines expertise
- Schooling or entrepreneurial endeavors related to expertise

**Interview setting:** Closed, private room at expert's location of preference
**Interviewer position:** Lay-person
**Interviewee position:** Specialist

**Question type:** Narrative driven and naive supplementary questions

**Interviews application:** Theory generation and knowledge interpretation

## *Online Identity Expert Questions*

Conducted: Iteration 1
Interviewee: S. Kemp, Founder and Chairman of IAM

*How would you describe an online identity?*

*What components does an online identity contain?*

*What is the biggest problem internet users face in terms of online identity?*

*Why is this still a problem?*

*What can be done to solve this problem?*

*What user needs do you see in an online identity that follows Self-Sovereign Identity principles?*

## *Gerontology Expert Questions*

Conducted: Iteration 1
Interviewee: Dr. J.S. Jukema, Professor of Nursing

*How would you describe a senior?*

*What problems do internet users between the age of 55 - 65 currently have in internet usage?*

*In terms of usability, how can an identity manager be made as simple to use as possible to a senior?*

*What if the identity manager is not completely usable to a senior, how can they still make usage of it then?*

## *Software Engineer Questions*

Conducted: Iteration 2
Interviewee: M. Geurtsen, Software Engineer

*How would you describe identity or account management in an online context?*

*What fundamental user needs in terms of functions do you see in an online identity manager?*

*How would you design the navigation and information structure for the user experience?*

*If you were to design an identity manager to users that are low in computer literacy, what features would you not include?*

# I. Self-Sovereign Identity Principles

*Table 8: Self-Sovereign Identity Principles*

| Criteria | Explanation |
|---|---|
| Existence | Users must have independent existence and can never exist wholly in digital form. It only makes the existence public and accessible |
| Control | Users must be able to control their identities where the user is the ultimate authority over their own identity. Others may make claims about an identity but should never exist firm within the identity |
| Access | Users must have access to their own data. There must be no hidden data or other forms of data where a user has no access to. Some form of claims from others cannot be modified but the user must be aware of them. |
| Transparency | Systems and algorithms must be transparent both in how they function and how they are managed and updated. They should be free, open-source, well known and as independent as possible of any particular architecture. |
| Persistence | Identity must be long-lived for as long as the user wishes. |
| Portability | Information and services about identity must be transportable where no third-party entity can claim control over the identity |
| Interoperability | Identities should be as widely usable as possible. It should be able to cross national boundaries to create global identities without losing user control. |
| Consent | Users must agree to the use of their identity |
| Minimization | Disclosure of claims must be minimized where only the necessary data to accomplish the task at hand is requested and processed. |
| Protection | Rights of users must be protected over the needs of the provider in case of conflict. |