User Research and Development on Optical Fiber Network Installations

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	Examensarbete MMK 2016:167 IDE 191
KTH VETENSKAP OCH KONST KTH Industriell teknik och management	Användarstudier och utveckling av processen vid installation av nätverk med optiska fiber
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Sammanfattning

Detta examensarbete är ett projekt som genomförs på Infinera i Stockholm, Sverige.

Projektet använder tjänsten designmetodik tillsammans med användarcentrerad design. Syftet med projektet är att undersöka och förbättra det dagliga arbetslivet för installatörer av fiberoptiska nät. Den aktuella tjänsten följer ett systemdrivet perspektiv. Detta projekt undersöker olika sätt att ändra ett systemdrivet perspektiv till ett användarcentrerat designperspektiv.

Tjänstedesignmetoder används för att undersöka serviceprocessen och att samla insikter.

Projektet inleds med en förberedelsefas, följt av loop 1 och 2. Förberedelsefasen används för att få en djupare förståelse för fiberoptiska nät. Loop 1 och loop 2 inkluderar metoder såsom skuggning, en dag i livet, intervjuer och kartor över kunders resor. I dessa loop faser ingår interaktion med kund, analys av kundens interaktioner samt idealisering från dessa analyser och begrepp.

Fem huvudproblem identifieras i processen. Dessa delas in i två kategorier som processrelaterade problem och användarrelaterade problem. Resultaten visar att den främsta orsaken bakom processproblem är brist på kommunikation mellan avdelningar inom företaget. Dessa problem är bland annat projektledares beteckning, bristande redovisning av arbete och överlämnandet mellan försäljningsavdelningen och tekniker. Överlämnandet mellan försäljningsavdelningen och tekniker väljs som ett nästa steg för fördjupning. Webbapplikationer formas som ett koncept för att lösa det problem som väljs. Projektet avslutas med förslag på webbapplikationer avseende lösningar för utvalda problem.

Problemen identifieras relaterat till processen. Försäljningen till tjänsten överlämnande väljs för ytterligare förbättringar. Det genererade konceptet på detta problem förbättras och presenteras för företaget.

	Master of Science Thesis MMK 2016:167 IDE 191
KTH VETENSKAP OCH KONST / KTH Industrial Engineering and Management	User Research and Development on Optical Fiber Network Installations
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Approved 2016-09-28	Examiner Claes Tisell	Supervisor Mia Hesselgren
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Abstract

This thesis is a project that is conducted at Infinera located at Stockholm, Sweden. The project uses service design methodology alongside with user-centered design. The aim of the project is to examine and improve every day work lives of implementers of fiber optic networks. The current service is following a system-driven perspective. This project will examine ways to change this into a user-centered design perspective.

Service design methods were used to investigate the service process and to gather insights. The project started with an initial preparation phase, followed by loop 1 and 2. Preparation phase was used to get a deeper understanding on fiber optic networks. Loop 1 and loop 2 included methods such as shadowing, a day in life, interviews and customer journey maps. These loop phases included interactions with the customers, the analysis of these interactions, ideation from these analysis and conceptualization.

Five main problems were identified in the process. These were grouped into two as process related problems and user experience related problems. It is found out that the main reason behind process problems was lack of communication between departments in the company. These problems were project manager designation, lack of statement of work and the handover between sales department and technicians. The handover between sales department and technicians were selected as a next step to go on. Web applications were shaped as a concept to solve the problem that was selected. The project was finalized with suggestions on web applications regarding the solutions of selected problems.

The problems were identified related to the process. Sales to service handover was selected for further improvements. The generated concept on this problem was improved and presented to the company.

Keywords: service design, user-centered design, fiber, optic, networks

FOREWORD

I would like to thank Infinera for providing this opportunity to conduct my thesis project at the company. I gained so much knowledge about fiber optic networks and communications technologies. I hope my project will be useful to Infinera.

I would like to say thank you to my supervisors both at Infinera and KTH without them I would be lost. I had great time working with Robin Gador at Infinera where I learned a lot. I would like to say thank you for his guidance, time and feedback. Also, I would like to say a huge thank you to my supervisor at KTH, Mia Hesselgren, as she believed in me throughout this project. She guided me through Service Design path and thought me great knowledge.

All in all, I would like to say thank you for all people who helped me through this project from beginning to the end.

Beylem Cindoğlu

Stockholm, September 2016

Table of Contents

1. Introduction

This section introduces the project and what is included in the scope. This chapter consists of the background description, problem definition, aim and research question, goals, risks along with limitations and constraints and the methodologies selected to be used.

1.1 Background

Infinera, is primarily an American Company that produces equipment for long haul transmissions. Long haul transmissions are based on transmissions between overseas. Transmode AB was a communication company which was located at Stockholm, Sweden. In August 2015, Transmode AB was acquired by Infinera. The branch of Infinera that is located in Stockholm focuses on metro hauls, that are based on connections on land when long haul transmissions end.

The aim of the thesis project is to conduct a user analysis on implementers that were specialized on installation of fiber optical network equipment in order to get a deeper understanding of their day to day activities. Getting insights from daily lives of the implementers will lead further developments in the area to make their lives easier. Installation of fiber optic equipment requires highly qualified technicians. The goal of this project is to examine the implementation to gather insights on the process. These insights are used to reflect on the positive and negative sides of the project then improvements are formed.

Fiber optic network installation requires highly developed technical training. Due to the irregularities in the business hours and projects one after another leads to extra working hours for field technicians. The field work consists of different types of categories which are settled by the request of the customer. When conducting the fieldwork, technicians are required to be away from home, working through day and night shifts and drive between different locations in order to set the network. This user research is aimed to see through this process from first hand perspective and suggest improvements of how the process could be designed.

1.2 Problem Definition

Network installation process is not structured from user-centered perspective. In order to achieve user-centered process, the current procedure should be examined and re-designed with user-centered design principles. This will improve the efficiency of technicians as well as creating a holistic service for the whole work chain.

1.3 Aim and Research Question

The aim of this project is to analyze the installation process of optical fibers and evaluate it from user-centered perspective. This analysis will help to connect the two main departments inside the company. The results from the analysis will lead research and development team gain insights from field technicians' day to day activities.

- What are the day to day activities of a field technician?

- How can Infinera use this knowledge to adjust its process to make this more user-centered?

- How can everyday work lives of this technicians be improved?

1.4 Project Goals

The goals of this project is listed as below:

- Deliver insights from Professional services regarding the field work and every day work of the technicians.
- Analyze how user-centered approach could be used in this process.
- Analyze to find out the obstacles that affect installation process.
- Develop concepts for field technicians with service design perspective.

1.5 Limitations and Constraints

The flow of thesis work affected by some obstacles. One of these obstacles was conflict of site deployments. The dates of the installation projects were not settled yet. As the thesis work was based on these site visits, the delay affected the predicted timeline. The closest implementation work was settled at Germany and Switzerland. For this reason, first trip was to Germany and second was to Switzerland.

As the foundation of the company based on Electrical engineering and IT, there was points that were complex for an outsider. Therefore, particular parts of the project were harder to understand. This problem was solved with training sessions and additional briefing sessions.

1.6 Methodology

This project was conducted with user-centered methods with service design perspective. The structure was based on two iterative loops, first one being more extensive whereas the second one was more shaped and focused. The initial loop is consisted of customer interactions and gathering insights. This step was followed by insight combination which leads to ideation. After ideation phase, selected ideas were conceptualized and improved further in the second loop.

The perspective was kept as broad as possible in the first loop. This was to get better understanding of the situations and gather insights as much as possible. At each loop ideas were evaluated and the process continued with the selected few.

Prior to the loops, an initial preparation phase was also conducted in the project. This phase was used to get a deeper understanding of the company, learn about their products and knowledge about fiber optics. This phase included gaining knowledge by watching training videos for fiber

optics, stakeholder meetings and reading related material. Initial phase was followed by two loops which led to results where concepts were finalized and discussed.

2. Frame of references

This part represents the theoretical framework of this project. User-centered design, service design and fiber optic networks is selected to support the chosen methodology.

Service design methods are used in conjunction with user-centered design principles. This methodology helped to create the basis for a holistic and user centric process for field technicians. Involving the users which in this case is field technicians helped to get a deeper understanding of the process and also helped to get their feedback on each phase. This created a result that was functional for the users. Fiber optic network principles are added so the reader will get better understanding of systematic behind network projects. Motivations and risks of these methods are also discussed in this chapter.

Literature that is presented through this chapter is mostly gathered from KTH Royal Institute of Technology library and from additional academic resources. The materials used for fiber optic networks are obtained from Infinera.

2.1 User-centered Design

This chapter describes what is user-centered design and its methods to achieve this approach. This methodology is crucial as it helps to form a structure around the user. By this way, the products or the services will be easy to use and serve for the customer. User-centered design could also be referred as UCD.

User-centered design is a methodology where all the methods focus on a placing the customer to center while coping with usage and complication of services with using visualization techniques (Trischler & Zehrer, 2012). User-centred design is a methodology where all the methods focus on user needs, desires and limitations (Løvlie et al., 2013). The end users are crucial for this process as they are final destination of the developed product or service. This framework of methods could be described as multi-level problem solving approach which allows to create a holistic approach (Trischler & Zehrer, 2012). UCD not only uses designers but also users in the development process to test and see whether the developed product or service is valid and usable by the user. The generated ideas are tested on end users to see if there are any needs for additional updates or if anything needs to be taken out from the generated concepts (Brown, 2008). The fundamental difference of UCD from other design methodologies is that it focuses on the users and tries to optimize the product or the service for the users' benefits (Thomke & von Hippel, 2002). With this approach products and services are compatible with the user and the user does not have to change himself for the sake of using it.

2.1.1 Methods and Principles

There are different approaches and methods to achieve user-centered design. Some of the research methods are: contextual inquiries, ethnographic studies, prototyping and usability

testing (Trischler & Zehrer, 2012). These are continued with developing focused methods such as affinity diagramming and workshops. The design should be focused on users including their environments and missions. Users should be included in every stage of design and generation. The process is iterative (Sanders, 2005). UCD should be a guide for the whole development process (Nenonen, Rasila, Junnonen and Kärnä, 2008). In order to achieve a holistic understanding and generation, multidisciplinary perspectives could be practiced.

2.2 Service Design

This chapter divulges into what is service design and what methods are used for this approach. This approach is chosen as Infinera wanted to have a holistic and user centric process for their field technicians. Specific methods are chosen for this particular project by their suitability. This method is also new for Infinera as they do not have any internal service design department. This project connected fiber optic management system with service design perspective.

This method is comparatively new to the designing world. The aim of this approach is to comprehend the perspective of the users (Sanders, 2005). Service design uses methods such as: personas, shadowing, interviews and forms of visualization (Trischler & Zehrer, 2012). Users are the group of people that is using that specific service. All the techniques of this approach involves customers and the stakeholders. The reason behind is to get a holistic understanding of all participants who interact with the service. The service design methodology is an iterative practice which leads the project to evolve over time (Sanders, 2005). Each loop adds different insights to the project path which then helps to keep the fundamental ideas and drop the unsuccessful ones. The result of the project is gone through many stages with this approach and it is selected by the actual users of the service. By this way, it is assured that the end result will have higher customer satisfaction (Straub, Kohler, Hottum, Arrass & Welter, 2013).
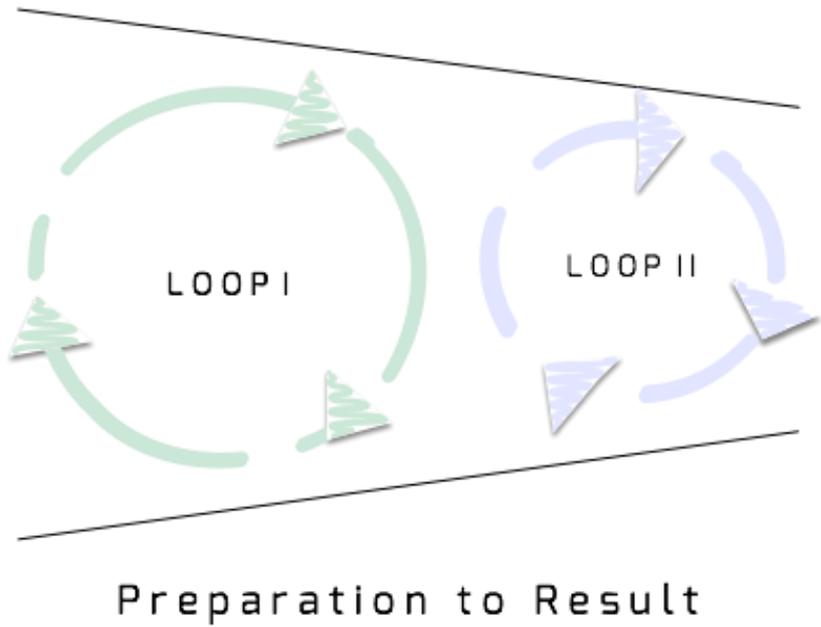

Figure 1. Phases

The fundamental part of service design is the interaction with the users. To achieve this, there are different methods in service design approach. In addition to these methods, also different interview techniques are used (Nenonen et al., 2008). Quantitative practices are useful for perceiving knowledge about the subject but not enough for turning this into an act that would be functional to the organizations. Qualitative methods are quite effective at creating actions from quantitative results (Løvlie et al., 2013). In other to get a holistic view, the usage of both methods are equally as important. The focus of the methodology is to understand the customer with all the aspects such as needs expectations and the behaviors. The sum of all creates the holistic perspective (Sanders, 2005).

The service design methodology lies on the needs of the customer. Getting a better understanding of the needs of the user helps to sort through the process from the user's perspective (Løvlie et al., 2013). This creates a better connection between the user and the service provider. Empowering this communication, lead the further development of the service. Through this approach the service gains a higher position in the market whilst creating a satisfactory experience for the users.

2.3 Fiber Optic Networks

This chapter represents principles of fiber optic networks that Infinera Sweden works on. These principles are divided into categories to make it easier to understand. This chapter gives the basic information about technologies that is observed throughout this thesis project.

2.3.1 Metro and Long Haul Networks

Business operations and everyday activities depends on high speed data connections. Public networks run by network operators and service providers. These connections are provided by companies such as Infinera. The data transactions are obtained by different methods where one of them is optical fiber connections. Optical fibers use light traveling through a glass protector. Compared to copper wires, optical fiber can carry more bandwidth and does not get affected by electromagnetic interference or signal attenuation (Transmode, 2013).

Optical connections have two main categories. "The long haul network interconnects different regions and countries, often covering distances of 1000's of kilometers." (Transmode, 2013). Long haul networks cover larger areas often connecting two continents together. These networks generally consist of alternative connections between certain cities or hubs.

Metro connections forms of connections between central venues in a city which is also connects mobile cell network connections, campuses and residential areas (Transmode, 2013). Metro networks can only expand from 10 to 1500 kilometers. Access networks are the last phase of the networks where they connect two nodes, from metro to users that uses a telecom service. Deployment of the fibers are done separate companies not by the network providers.
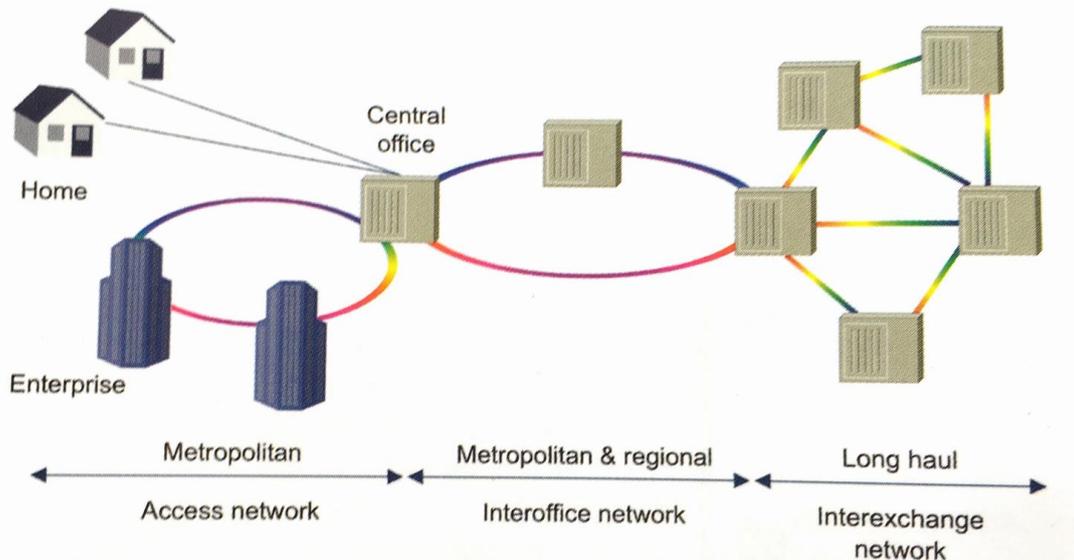
Figure 2. Overview of a National Fiber Network Structure

2.3.2 Fibers

Optical fibers consist of an inner core and an outside cladding where all is covered by a protective shell. This shell is usually made out of glass, although plastic could also be used it is less preferred. These fibers have two distinctive groups: multi-mode optical fiber and single-mode optical fiber. These groups are most important when it comes to toning attenuation and dispersion. Attenuation is the term that is used to define the strength of the light pulse and it is dependent on the wavelength of the light (Transmode, 2013). Dispersion is the diversion of the light into cables with respect to wavelength. Multi-mode optical fibers are technically more suitable for distances less than 1 km such as interconnections like routers or home entertainment equipments. Single-mode optical fibers are suitable for longer distances. These will work efficiently in couple of hundred kilometers. As single mode cables have smaller cores, it removes any distortion.

2.3.3 Wavelengths

In order to achieve the best result from systems, most efficient pairings are selected. There are two alternatives: single fibers and fiber pairs. Single fiber uses two separate wavelengths, one for transmission and one for receipt. This allows the single fiber to be bi-directional. Fiber pairs, on the other hand, are combinations of two fibers where one of them is solely used for transmitting and the other one for receiving. The selection between these two depends on fiber availability, network topology and traffic pattern.

2.3.4 Wavelength Division Multiplexing (WDM)

WDM is a method to integrate various signals onto a single fiber by using different wavelengths. WDM can be done in two different ways: Coarse WDM (CWDM) and Dense WDM (DWDM). Coarse WDM allows up to 16 channels. These channels can be used bi-directional creating 8

duplex connections. These 8 channels could be integrated both onto a fiber pair or single pair. Dense WDM could reach to 80 channels as it allows denser spacing for the transmissions. To choose between CWDM and DWDM, there are some selective criteria. This choice depends on; distance to bridge, the channels needed, the data rate used per channel and the numbers of fibers available (Transmode, 2013).

2.4 Infinera Glossary

Below are some terms that are used at Infinera for description of the projects. For getting a better understanding of the following chapters, a mini glossary is added.

Deployment plan: A plan that has a detailed overview when and where each section will be deployed.

Site plan: The detailed overview of the site with the location where the deployment will be done.

Node description: The document where all the details related to network node can be found. This document contains the equipment list, lay out and configuration.

Network plan: The complete description of a planned or an existing network.

Site preparation requirements: The list of requirements that needs to be set before the deployment of the node.

Pre-staging: The configuration and assembly of the fiber optic network equipment that is done in company premises.

2.5 Users

There are 9 different user types according to Infinera. These user groups are defined by the following criteria: responsibilities, needs and wants. One additional criterion is also defined to ensure the best service. This criterion is vision description. This defines the offer that Infinera wants to present. It is not limited to the product capacity in order to be able to create better products and services. The figure 3 below shows the user groups and categories.
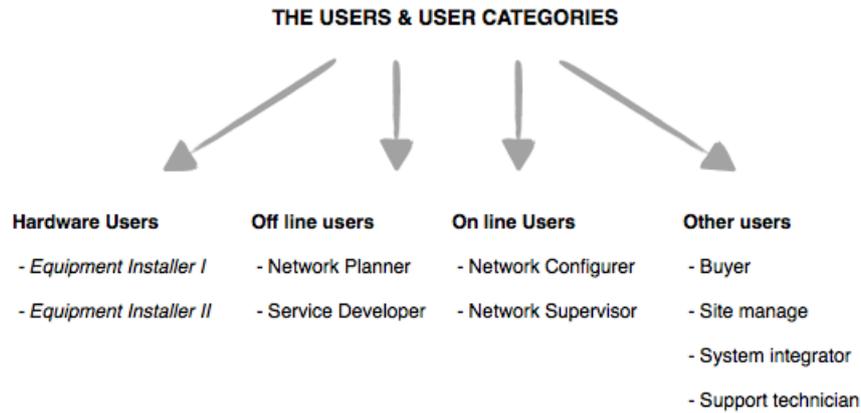
THE USERS & USER CATEGORIES

Hardware Users	Off line users	On line Users	Other users
- *Equipment Installer I*	- Network Planner	- Network Configurer	- Buyer
- *Equipment Installer II*	- Service Developer	- Network Supervisor	- Site manage
			- System integrator
			- Support technician

Figure 3. Users

2.5.1 Pre-Staging Technicians

This user is responsible from the installation and verification of the equipment that will be pre-staged. This process includes connecting fibers and power however not the optical parts configuration. The needs of this user is the site plan, installation guidelines, site access, network configurer and contact information of the site manager. All these documents include every detail that is required for the successful deployment. If something is missing, then this causes disruptions in the project. The desires of this user is to be efficient. For the desired outcome the site also needs to be well-prepared for installation.

Vision for the Pre-Staging Equipment Installer: The desired vision is an installation process without tools that only requires one person. For this process everything related to deployment will be sent with the shipment. Verification of the installation means that the site is finished and will not be returned.

2.5.2 Field Technicians (Professional Services)

This installer-user is responsible for installation, replacement, verification and configuration of the equipment. The needs for this user is site plan, node description, installation instructions, fiber handling equipment and patch fibers. They also need the contact information of the site manager and the network configurer. Field technician's desire is to be efficient and finish the work in the given time. They need to be sure that everything works before they can leave the site. The vision of this group is to have verification of the equipment automatically. If any part needs to be changed, this should be visible without node description. To be able to most efficient, node description and installation guides must be available before the site work.

2.5.3 Sales Engineer

They are responsible for planning the network including physical layout and capacity distribution. Node descriptions, network plans and deployment plans are created by this group.

They need the exact information from the customer regarding requirements and what is the intended use of the network, what is planned for the future and what is currently used as equipment. They present equipment lists with price estimations to shape the budget. The vision of this user is to have a tool that is automatically creates a design with the given parameters of geography and capacity.

2.5.4 Sales Manager

This user works with both the user and the customer. This means they get the customer order and transform this into technical data that the field technicians and Pre-staging technicians will use. In order to perform their work, they need specifications of the application and the description of the network. It is expected that they will give estimates for the quality of the service and the capacity. If there is anything that needs to be updated, they are the one to plan the upcoming work.

2.5.5 Network Configurer

This user is liable for applying the configurations. They perform software uptakes as well as guiding installers remotely when needed for the updating process. Their need is the service definitions and templates along with schedules and service conditions. They are also responsible for provisioning and verifications of the services. Their vision is to have a process that is simple and efficient.

2.5.6 Network Supervisor

This user is liable for monitoring the networks and acting upon the errors. The errors and log messages go through them. They restore the original settings through the phone usually guiding the installer. If something goes wrong, they also contact with the support technician. They have to know the agreements with the customer regarding the commitments and obligations so they can command the work according to this agreement. They need to access system logs and network plan to restore the error notifications. Their desire is to have an automated process for diagnosis. The forethought of network supervisor is to have isolated error report as then they can quickly act if anything needs replacing or updates.

2.5.7 Support Technician

This group works with the customers if there are any problems that can't be solved by the user. The customer gives allowance to the support technician in such cases to handle the error. For this work they need the documentation of the equipment that is used and how it is configured. With all given documentation and information the work of the technician will be obsolete.

2.5.8 Site manager

They are the people that are responsible for the equipment where it is located. They are liable for preparing the site before the installer arrives. They are responsible from the security and the

access for the site. In order to be ready as wanted they need site requirements, shipment details, node descriptions, power and temperature requirements and deployment plan.

2.5.9 System Integrator

This team is responsible for integration of the Infinera equipment with the software. They not only handle Infinera but also third party equipment and software. They use system integration guidelines.

	Needs	Vision
Equipment Installer I	Site plan, installation instructions, site access, contact information and network configurer	Automated process, all equipment should be shipped, one person quick installation
Equipment Installer II	Site plan, node description, installation instructions, fiber equipment and fiber patches, contact info & network configurer	Automated verification of updated equipment, all information embedded in the equipment
Network Planner	Budget goals, future plans, description of the equipment, requirements and intended use of the network	Planning tool that automatically creates network designs with given parameters. Should include site & deployment plans & network descriptions
Service Developer	Application specification. Network description	Tool that automatically designs parameters, traffic types & service endpoints
Network Configurer	Service definitions and templates. Schedules and service conditions	Provision and verification in one step Automatic software updates
Network Supervisor	Error notifications, system logs, network plan, contact info, hardware documentation & contact to support technician	Automated troubleshooting and diagnostics
Buyer	Product descriptions, network description, price estimates, equipment documentation, network design & deployment plan	Free access to network design tool of the company
Site Manager	Site preparation requirements, shipment descriptions,node descriptions & deployment plan	Not company employee
System Integrator	System integration guidelines	Fully standardised integration
Support Technician	Documentation, information about the users equipment and how it is configured	User documentation, troubleshooting and error messages clear enough for support technician

Figure 4. User Vision and Needs

The figure 4 above summarizes the user vision and needs.

3. Methodology

This section goes through the selected methodology for this thesis project. This chapter starts with general overview of the process and follows on with detailed description of the chosen methods.

3.1 Process overview

The chosen approach to this project is service design. The methods of service design have been used by many companies all around the world to achieve a user-centered approach to the projects. The experience of service consists of touchpoints with user interactions, and the unity of these interactions forms the service quality (Løvlie et al., 2013). Problem is analyzed with respect to the structure and the communication between the user and the product/service. These are iterative methods which allows constant improving for the better. User insights are gathered with various methods which leads then creation of different ideas and concepts.
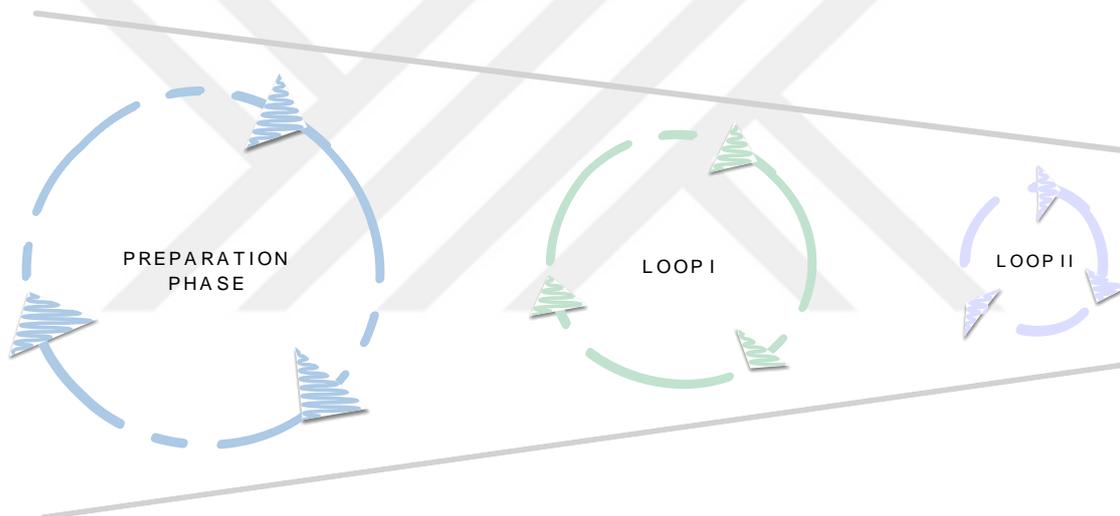
Figure 5. Phases

The whole project was divided into three main phases as shown in the figure 4 above. These phases started with preparation phase. This was important to learn the background of the company and the products and understanding the problems in depth. This phase led the project into two iterative loops. The first one was kept quite broad to learn as much as possible. These loops comprise of successive methods: interaction, insights, ideation and conceptualization. After these loops, ideas were created and chosen ones turned into concepts.

3.2 Methods

This chapter is to present which methods are used in this project and why they are chosen. How these methods are used is also discussed in this chapter. The methods will be presented respectively: Interviews, Stakeholders, Customer Journey Mapping, Shadowing, A Day in Life, Brainstorming and co-creation. The related usage of these methods discussed further in the upcoming chapters. The usage of these methods is discussed further in the subchapter "Implemented Work".

3.2.1 Interviews

Interviewing is one of the most fundamental methods in service design approach. This method helps the project team gather meaningful amount of insights. The features of interviewing will be discussed further below.

Interviewing

Interviews could be conducted in different environments. If they are conducted in the place where the interviewee works or the service is progressed, they are called contextual interviews. They are also called contextual inquiries (Stickdorn et al., 2011). Having the conversation whilst the service occurs helps the interviewee remember more details and share more insights (Trischler & Zehrer, 2012). Being in an environment that is already known also comforts the person of interest. Compared to normal interviewing technique, contextual inquires creates holistic perspective as the interviewer can also observe the context from the surroundings (Trischler & Zehrer, 2012).

Analyzing Interviews

At the end of all interviews, the data is collected and examined. Whilst the interviews being conducted, notes were taken. In addition to notes, the interviews are recorded with the permission of interviewees. All these documentation is looked through and summarized onto post-its. These post-it are sorted into groups according to their patterns (Løvlie et al., 2013).

3.2.2 Stakeholders

One of the other fundamental steps in service design approach. Understanding the stakeholders helps to get a deeper understanding of the project.

Stakeholder Map

This practice helps to visualize all the parties that are involved in the service process. Visualizing stakeholders helps to see the connection between them and establish an in depth understanding. It also helps to see the different roles of stakeholders regarding the service.

Stakeholder Workshops

Getting stakeholders together helps to shape different opinions and ideation. These workshops could be designed in different ways and for various purposes. In these workshops, participants such as front-line stuff, end users and even the managers could be involved (Løvlie et al., 2013). The involvement of the stakeholders is important as they can contribute to the flow of the project (Nenonen et al., 2008). These workshops are generally designed to get stakeholders opinions for the later stages like prototyping and such (Hagenaars & Huybrechts, 2013).

Bringing the stakeholders together in a collaborative environment, helps to boost creativity, create solutions and be on a platform with a common goal (Sanders & Westerlund, 2011). This process is a nonlinear iterative process that changes direction with the customers input.
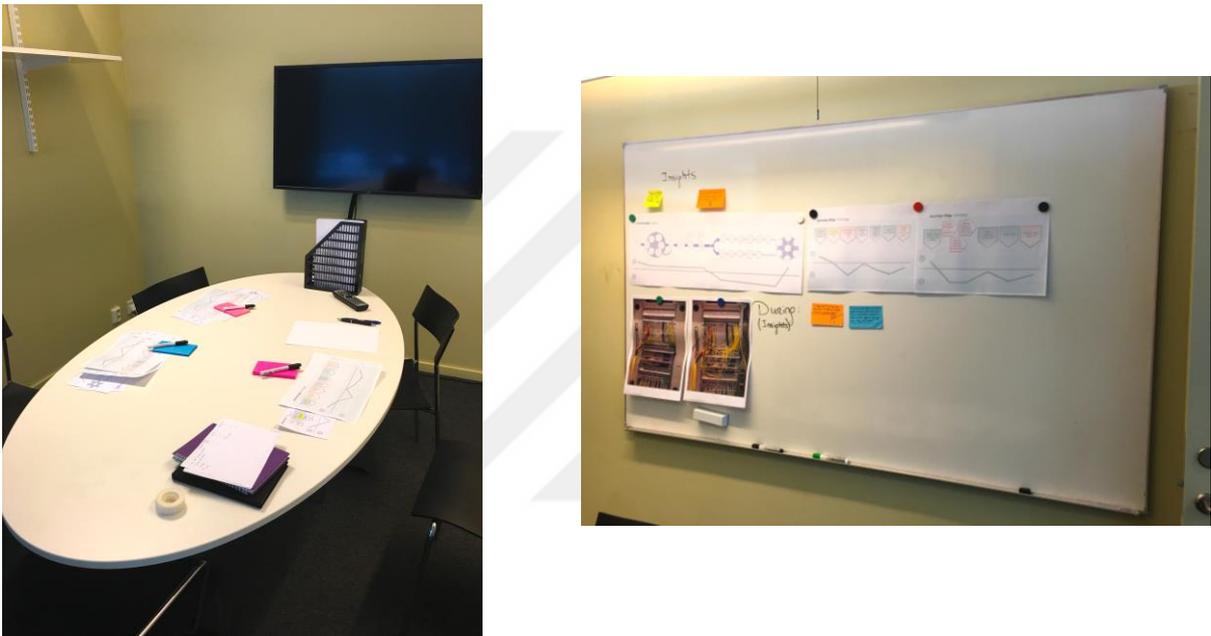

Figure 6. Pictures from Stakeholder Workshop

3.2.3 Customer Journey Mapping

This practice is used for analysis of the collected data. It is a fundamental method as it breaks down the process into smaller steps and shows the reactions of the user in these stages. It is an overview of the service that is broken down into its touchpoints (Reason, 2015). The map is established from the customer's perspective and also includes the emotions in every touchpoint (Trischler & Zehrer, 2012). The method visualizes the life cycle of the user from the beginning of the service or product use until the end that there is no need for the service or product. This method is an approach that shows which channels and touchpoints that the customers goes through and how the organization perceives this process (Nenonen at al., 2008). Addition of emotions help to see the problems and opportunities in the current service design. In addition, insights are added throughout the mapping (Reason, 2015).
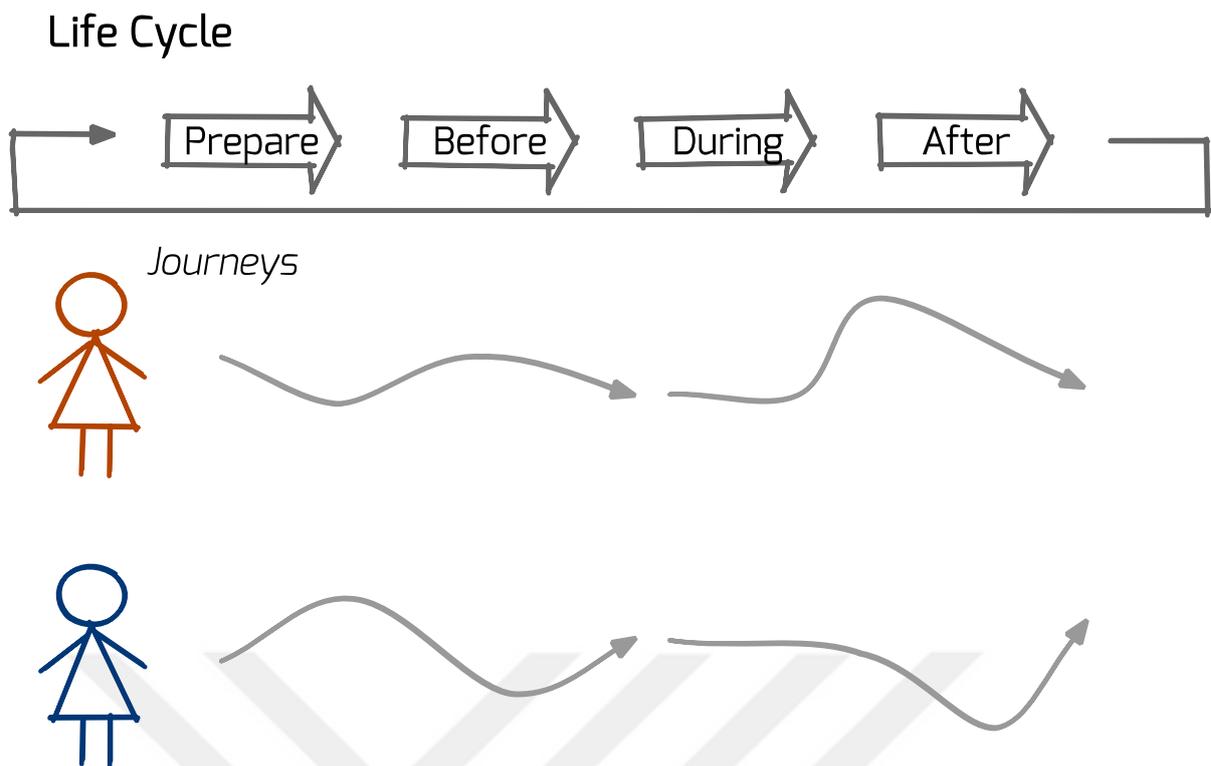
Life Cycle

Figure 7. Example Journey Map

3.2.4 Shadowing

This method is based on full observation of the conducted service. In this method, the observer spends time with customer. Observing the customers helps to build insist about their daily activities and how they engage with the specific touchpoints (Design Council, 2015). Observing the business will shape the perspective of how the professionals interact with the clients. Both of these would help to see where improvements could be added (Trischler & Zehrer, 2012).

This method could be conducted in two different ways. One would be spending time with the user without any interaction which could be referred as "fly-on-the-wall method" (Løvlie et al., 2013). The other method is being actively engaged with the user and interacting whilst observing. It is essential that shadowing must be done in the user's environment. This could be either a home, office or the special context of the activity (Stickdorn et al., 2011). Observations could be kept either short or long depending how in depth information is needed. Short observations are good to get a sense of general activities and flows. On the other side, longer observations could be helpful to get deeper insights. This method helps to collect data regarding user needs, understanding the experiences from user's perspective (Design Council, 2015).

Many times people act different from what they say. Interviews could provide insights to peoples word but not their actions (Thomke & von Hippel, 2002). This method helps to deliver insights from people's actions.

3.2.5 A Day in Life

This method could be used in different ways. Either the designer could take a journey with the user or the user could be asked for taking notes for their day to day activities. Both ways the designer gets insights to each activity the user goes through. Taking a journey with the user could sometimes turn into becoming the user or actively being present with the user (Stickdorn et al., 2011).

It is crucial to be open minded for this method. The users must not be disturbed in order to get best results. It is good to take notes during the activities without affecting the actual user. Documentation depends on the activity that is chosen for the observation. All in all, "A day in Life" is a method to shape insights for the daily activities of the user (Reason et al., 2015).

3.2.6 Affinity Diagramming

This method is useful for gathering the insights together. It creates a good base for brainstorming as it puts all insights together whilst sorting them in groups. This method is used in all different areas from contextual inquiries to any other qualitative data collection.

First all ideas are collected into notes. Then, these notes are sorted into groups regarding their categories. This procedure continues until all the notes are finished (Reason et al., 2015).

3.2.7 Brainstorming

This method is a very well-known method that is used amongst many designers. It is generally conducted with a team where all the team members contribute with their ideas. There is no negative criticism throughout the process as it is important to generate as many ideas as possible. It is great method to originate considerable amount of ideas in a short time period (Design Council, 2015). Depending on the situation, these ideas could be recorded with sketches and drawing to visualize things for the whole team (Design Council, 2015).

3.2.8 Co-creation

Co-creation is the crucial part of the service design ideology. It reflects the theory behind the collaborative aspect of service design. Creation could involve designers, stakeholders, front-line staff and other parties. This will create a holistic perspective for examination and development of the design (Sanders & Westerlund, 2011). The most important aspect of co-creation is a synchronized participation of all the parties. In order to achieve best results, the parties should harmoniously work together without the fear of being rejected or saying the wrong thing. Generally, designers are the chefs of this orchestra arranging all the interactions. Including all different groups leads to a creative environment where the products or the service could be further developed for the best (Sanders, 2005).

3.2.9 User Story Mapping

User story mapping is a method used in software development. It is used for describing the needs and the corresponding functions of the needs of the end user. This process is an iterative process where the system could be developed more and more depending on the input (Patton, 2009). It is crucial for defining "who", "what" and "why" of the basis idea of the software. It is generally used by system developers to define the needs and the requirements of the customers or the business users. Ideas are gathered by asking various different questions to the users which leads to creating stories around the needed functionality. The methods uses a matrix system where it starts with the bigger sections and goes to tiny details (Patton, 2009).
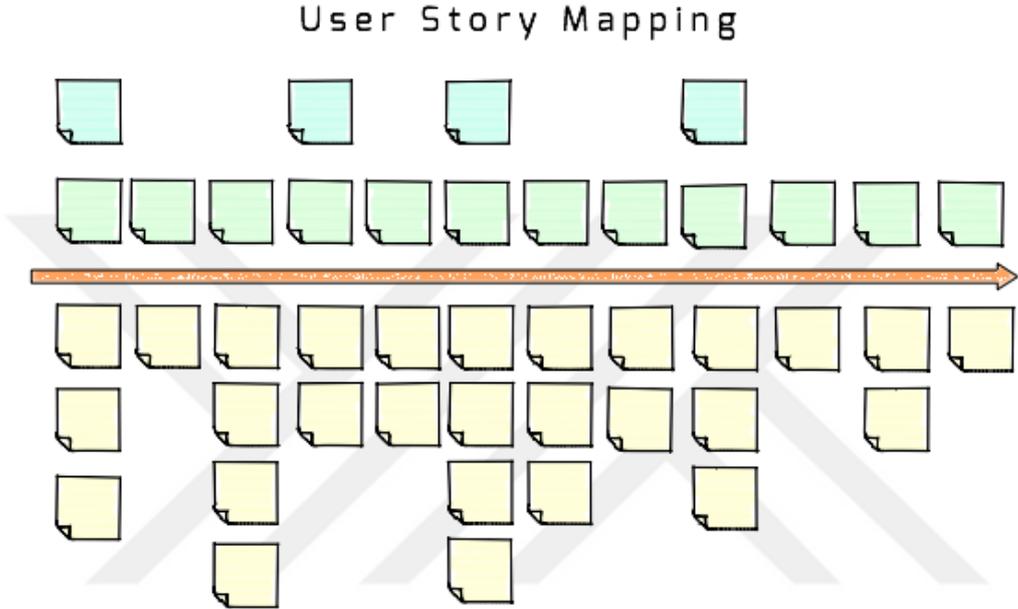

Figure 8. Example User Story Map

3.2.9.1 Benefits and Limitations

Benefits of using user story mapping could be listed as follows: This method helps to turn business values into needs that software developers could use more easily. It allows the developers to be in the same page with the clients. By using this method, the developed software does not need as many maintenance as compared to other methods. It allows the project to be broken into little fractions which is useful whilst turning these into a product (Patton, 2009).

This method does have some limitations. Three main limitations are: problem of scaling up, being informal and incomplete and lacking the requirements that are non-functional. As the general use of the method requires physical cards when new sections are added it becomes harder to control the scale of the project. Using user story mapping software for this method, helps the creator to maintain the scale of the project. As the informative cards are filled by using story methods sometimes the statements become less formal and complete. These causes to get vague expressions regarding the issue. Additional methods could be used to achieve more formal and complete statements. Another disadvantage of this method is absence of non-functional

needs. It is common that the method creates the basis to user acceptance tests which usually tests the functional or business requirements. The problem could be solved by the additional work of developers especially on constraints and the quality attributes (Patton, 2009).

3.3 Implemented work

This chapter gives a detailed view of the usage of chosen methods throughout this project. The description is divided into three chapters corresponding to the three phases of the project as shown in figure 4 previously. These chapters present the phases throughout the project. This chapter describes how the methods such as Shadowing, customer journey maps, interviewing and additional service design methods are practiced in this thesis project.
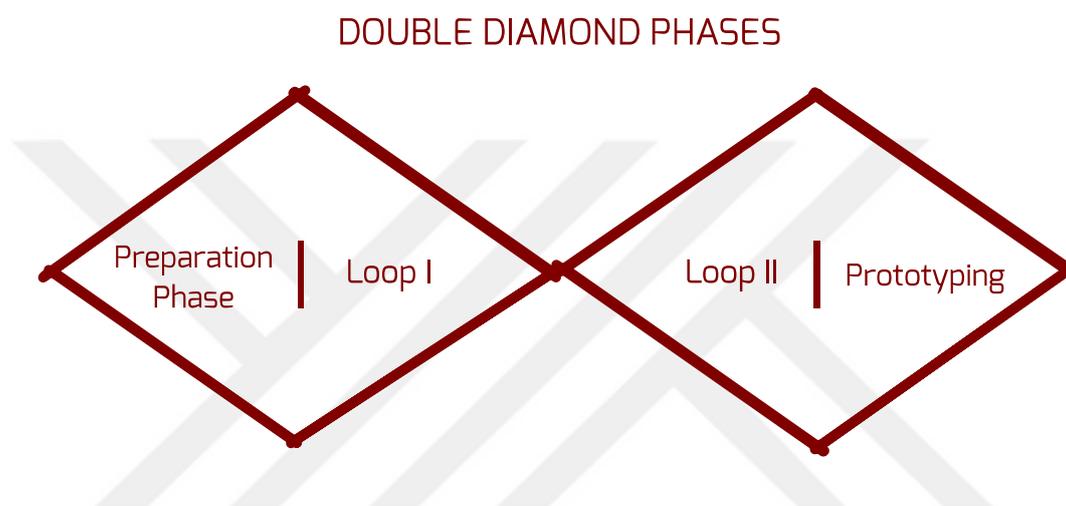

Figure 9. Double Diamond Phases

The followed design process is represented the figure above. For the preparation phase the research was kept as broad as possible. The ideas were narrowed down in loop 1 phase where project was more shaped. For the phase loop 2, to generate as many ideas as possible the spectrum kept as broad as possible. To shape the ideas more and to define them last phase was narrowed down (Design Council, 2015). This thesis project was finalized at loop 2. The further work would be creating a prototype to test.

3.3.1 Preparation phase

The purpose of this step was to gather as much information as possible related to the company and the chosen field of study. Fiber optic network principles were studied. In addition to learning fiber optic network principles also inner work flow in the company was also studied. It was important to get a hold on the roles of stakeholders and see how they connected to each other. Training for the fiber optical networks were done through video courses and booklets. Three two-hour sessions were held with experienced team members to get additional background. For an in depth understanding also informal interviews had been done to get acquainted with the

teams. In order to observe how the system works some time had been spent in Pre-Staging to see the equipment and to understand the principles of running.

Prior to methods in Loop 1, data was gathered concerning the field of study and the methods were focused on these.

3.3.2 Loop1

Initial loop was based on learning deeply about the working conditions and environment of field technicians. This loop created the fundamental understanding of their daily activities. The first loop kept as broader as possible to achieve an open mindset. In this phase positive and negative points of the daily life of field technicians were identified.

In order to get deeper information different service design methods are used. The first method used was interviews. Interviews were conducted with all field and pre-stage technicians. The interview guide was kept quite basic to get much more understanding and insights from the interviewees. Interview guide was kept as same for all the interviews (Appendix III). The interviews were also recorded as voice files with the permission of interviewees. These interviews were conducted in the company where the field technicians work. Interviews took generally 45 minutes to 60 minutes. In total 6 interviews were conducted. In addition to aforementioned methods, shadowing was also used. In total 7 shadowings were conducted. For shadowing two different locations were selected. First one was done around the Pre-Staging area in the company. Second observation was done in the field with the field technician.

The results of the first interviews created the first layer of insights. Experience maps were created with the interviewees to observe the process from their perspective. The notes and the recordings were reviewed. All the fundamental sentences, stories and comments were written onto little notes and gathered. These note clusters then turned into a diagram according to their focus areas (Appendix V). Customer journey maps were also used to observe the ups and downs in the service period. The notes were used as a base and emotions were added according to their cluster groups (Appendix I).

For the ideation phase a stakeholder workshop was held. This workshop helped to get stakeholders perspectives and ideas on the gathered data. For this workshop posters and experience maps were created (Appendix I). After the presentation of the gathered data, a brainstorming session was held. The results from the session was collected.

The ideas that would be used in the continuation of the project were selected in the stakeholders' workshop. One idea was selected out of all for second loop. The selected idea was turned into a concept and trigger material was created. Trigger material was made of thick whiteboard and some papers (Appendix VI). It was kept as rough as possible so the participants could engage with the idea. Trigger material assisted interviewees connect to the offered idea and add more from themselves.

3.3.3 Loop 2

The aim of the second loop was to further develop the selected idea. In order to improve this idea to the best standards different methods were used in this phase. By using these methods new perspectives were added and least usable ideas were removed.

Five interviews were conducted in the second loop. These took around 45 minutes period. At this stage, interviewees were explained about the selected idea and the trigger material was represented. The interview was focused on the trigger material that was created earlier and the questions were formulated around this. As the trigger material was a tactile object, it helped interviewees to touch and feel what would be like to use if it's actually made into a real design. Same as the first loop interviews, these also were recorded with the permission of the participants. The notes were taken from the interviews for further analysis. In this loop, shadowing and user story mapping were also used as service design methods. After the creation of the trigger material, once again shadowing method was used. This time 4 shadowings were conducted. This was done to see if the selected idea would be compatible with the actual field work.

Same methods were used for the analysis of the interactions. The notes were gathered and sorted through. They were clustered according to their focus areas. These were compared with trigger material. After this some of the features were taken out and some new features were added.

This phase is followed by user story mapping. By using this method, selected idea was further developed into a concept with definite features.

4. Results

This chapter explains the results from this thesis project. This chapter follows through the same outline as used earlier. It starts with the preparation phase followed by the loops 1and 2. The preparation phase included background study where courses were taken with additional observational training. Service design methods were used following this phase at the first loop. First loop was consisted of interactions with the users with methods such as shadowing, interviewing, customer journey maps. These interactions shaped the insights that were gathered in the analysis. Ideas were created from the collected insights with chosen methods. These ideas led the way through second loop where they were tested and conceptualized. Upon which recommendations of possible improvements of the installation process were developed.

4.1 Preparation Phase

As a result of preparation phase, a general knowledge was gained. This knowledge included how fiber optic networks work, how they are installed and what are the important steps regarding these topics. The knowledge that was gathered led the way to loop 1 where deeper knowledge was created.

4.1.1 Stakeholder Map

A stakeholder map, which is represented in figure 9, was created with the participation of Infinera employees. This step was crucial to understand the relationship between the teams. The stakeholder map included the customers, project manager, field technicians, Pre-Staging technicians and sales team. The roles of these stakeholders were mentioned under the category of "Users". Sales team plays a crucial role in this map as they are the main link between customers and technicians. Sales team turn customers wishes into technical information as well as creating budgets, proposals and lists. Another important stakeholder was the project manager. He is responsible for the management of bigger projects. Technicians are divided into mainly two categories; pre-staging and field technicians. Pre-staging technicians are responsible from pre-staging all the equipment before the pre-selected shipment date. Field technicians are required to setup and configure these equipments in the customer site. These sites could be both domestic and foreign. With the insights of all the stakeholders a general perspective was created for the project.
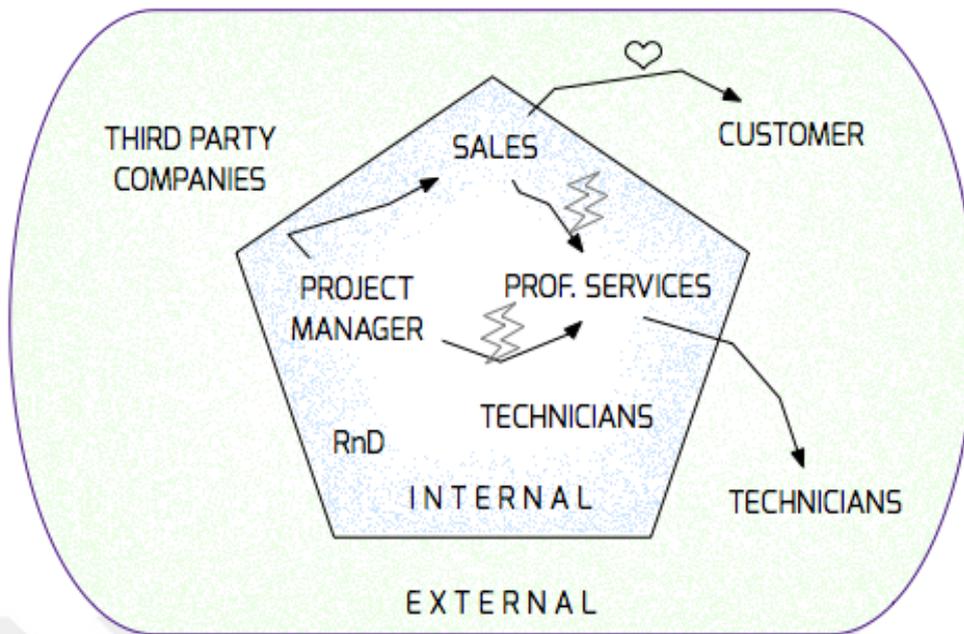
Figure 10. Stakeholder Map

4.2 Loop 1

Second phase was Loop 1 after the preparation phase. The loop was kept as broad as possible to gain maximum information. This loop also housed to first interviews with the users.

4.2.1 Interviews

Main aim behind the interviews was to learn as much as possible from the users. The interviews were conducted both as plain and contextual. Interviewees were mainly based on company premises. Some of the interviews were conducted at customer site, to gain more understanding and be in the same context with the user. Six plain interviews were conducted in total, 2 being with pre-stating and rest with professional services. All these interviews were conducted in Stockholm, Sweden. One contextual interview was conducted at the customer site. For this interview, the closest project selected from the calendar. The project site was located in Karlsruhe, Germany. The trip was arranged together with the responsible field technician. The contextual inquiry was conducted at the work site.

4.2.2 Experience Map

The experience maps were created with interviewees during the interviews. This method helped to create a perspective from first person. An example map could be found in the appendix I. Additional maps were created for analysis of the all interviews. The maps point out the main areas where the technicians had more negative experiences. The whole process from getting the purchase order to finalizing the project was divided into main three categories. Before is from

the beginning to the start of the field work. During is between the start of the field work and until the end of the work. After is the duration between the end of the field work to the start of a new project (Appendix IV).

An additional experience map was created stating the activities, behaviors and needs of the pre-staging technicians (Appendix II).

4.2.3 Insights

Interviews were documented by voice recordings with the permission of the interviewees. These recordings were listened back to get insights from the users. Following are lists of insights that were gathered from the conducted interviews. These lists are grouped in the different stages where they occur. These interviews were conducted both in-house and on project site. These insights represent different stages in the process.

Pre-staging

- Fiber management assembly is the most time consuming.
- Repetitive work is dissatisfying.
- Layer 2 is considered as the hardest part of the work flow.
- Accomplishment feeling is a fundamental motivation alongside with appreciation.
- Pre-stating does not get any direct information from RND.
- Documentation is considered as a problem.
- Whilst configuration is ongoing, it is problematic to change between different screens.
- When there are similar nodes which requires same configurations, it takes longer time as the information could not be copied. This condition lead to time waste.
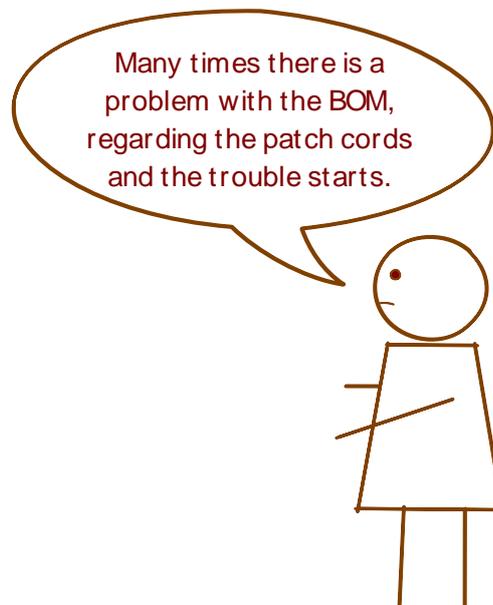

Figure 11. Insight from user from Professional Services

Professional services

- It is dissatisfying when there is no incoming work.
- Layer 2 is considered difficult because of various configurations.
- Node acceptance reports are time consuming as they have to be manually written.
- When extra help is needed from TAC, it is quite hard to get in touch with someone.
- Problems with documentation affects the work flow. Missing information causes loops between sales and professional services.
- There is sometimes bottlenecks throughout the planning of the network due to communication problems.
- Physical equipment is always the priority. Commissioning follows installation.
- Physical installation consists of building and operating. Operational part requires the RnD work mostly.
- Operational phase is the most important part for the customer.
- Time is proportional with the money.
- Attenuated fiber patches, in other words "patch cords", is one of the crucial problems.
- Sales to Professional Services handovers are generally missing;
  - BOM
  - Layer 2 information
  - Point-to-point link calculations
- Email chains are generally left without answers as there is no lead.
- When the project involves pre-staging, configuration is done remotely (in-house). Field technicians administrate the work from the company premises. In such cases, installation is done by subcontractors in the designated site.
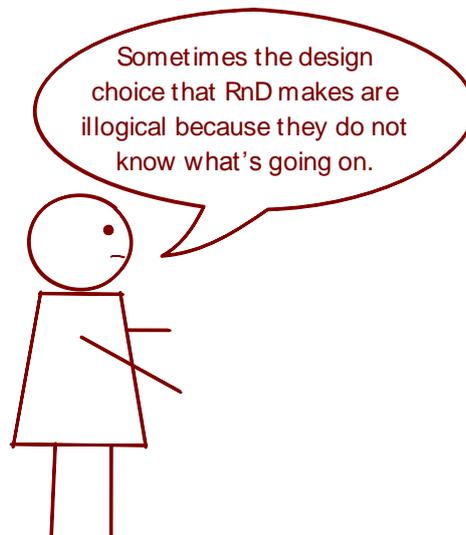

Figure 12. Insight from user

Workflow of a project

Sales manager works with pre-sales who also referred as sales engineer. Sales manager works with the customer to get the expectations and needs for the project. Sales engineer, who works parallel with the sales engineer, turn these into technical data. These technical data can be broken into; calculations, simulations, solution description, network overview, drawings and node-per-node drawings. This process loops until the customer is satisfied with the offer. After this, customer sends in a purchase order from Infinera's incoming system. Within 24 hours of the purchase order a delivery date is determined and send to the customer. Estimated delivery date is calculated by pre-staging technicians. Four fundamental factors are taken into account when determining the delivery date. These factors are hardware (when all the equipment will be in house), pre-stage (how long is it going to take to configure), packing and shipment. Shipment could be categorized into two. Delivery duty paid is the choice where shipment is delivered to the doorstep of the customer. The other option is where customer takes care of the designated shipment. Purchase order includes all the detailed information related to the project. If it is a new installation project, Infinera has the rights to decide whether to conduct pre-staging or not. Turnkey project is assigned with a project manager. Whereas, smaller projects such as point-to-point links or lighter turnkeys are administered by the field technicians.

4.2.4 Customer Journey Maps

To gather all the information customer journey maps were created (Appendix I). Customer journey maps reflected the journeys that were taken successively at pre-staging and professional services. These journeys focused on highlighting the negative experiences in the work period such as: Layer 2 configuration, communication with Sales, documentation (BOM etc.), node acceptance reports. The highlights and the downlight are reflected by emotion faces throughout the maps. The customer journey maps showed that the problems were experienced by the whole team.

Description of the problems

It was found out that there were 5 main problems by analyzing the journey maps as shown in the figure 14 below. Three of these problems were categorized as process problems. Rest of the problems were categorized as UX as they were fairly technical problems. For this project, it was decided to focus on the process problems.

First of process problems was loops between sales and services. The description of this problem was that if anything was missing from the information that sales delivered to field technicians, this caused field technicians to go back and forth to complete the needed information. The main reason of this problem was that there is no official handover of for these documentation. The information usually delivered by e-mail to the responsible technician of the specific project. Also, service delivery manager who is the head of field technicians was not involved in this process which led to some issues.
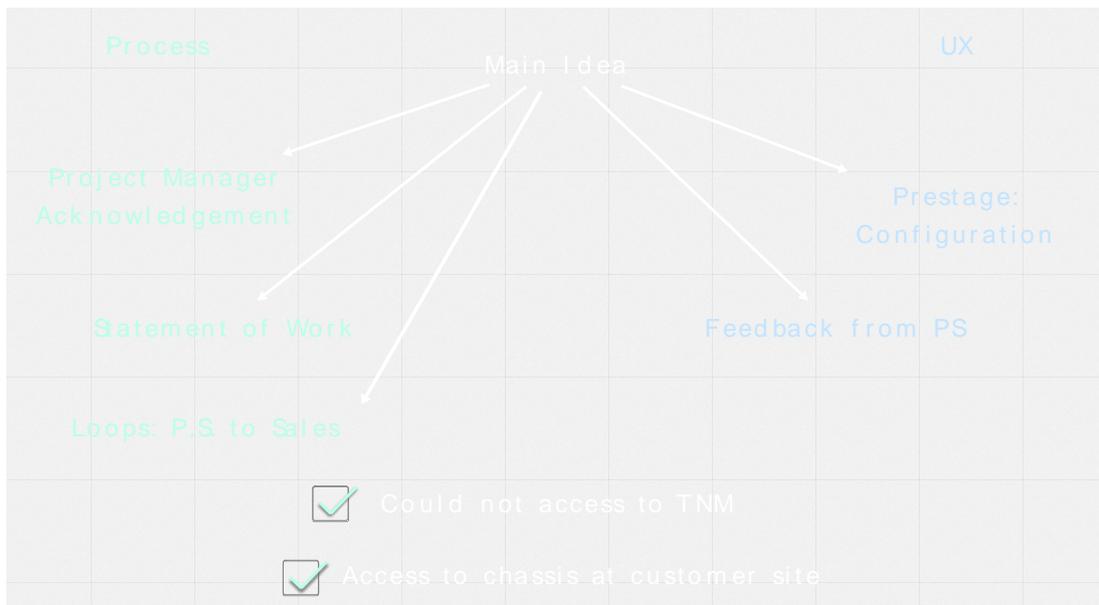
Figure 13. Problem List

Another problem was that there was no statement of work between the participants of the project. The lack of the agreement caused misunderstandings between the customer and the company. For example, for the first project that was conducted in Karlsruhe, customer requested something just a day before which was not in the agenda. The time was limited and the request required additional working time. As this request came at the last minute the responsible technician couldn't executed the requested work. Also, due to the same reason customer did not have the right preparation for the project work. This caused unfortunate delays at the beginning of the work. The foundation of the problem was that the participants were not on the same page for the agenda of the project. Similar problems happened throughout the period of the thesis project. (Appendix I)

The pictures below were taken in one of the project site. For the project, responsible technician needed to have access to the cables. However, as the pictures shows, the access was restricted because of the panels located at the two sides of the chassis. The removal of the panels caused time delay at the start of the project. This problem was an example that was caused by the lack of statement of work. Due to this reason, site was not prepared prior to the project work which affected the time period.

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Figure 14. Pictures from Project Sites

Project manager acknowledgement was another problem. Project manager was assigned to larger sized projects such as new installations or projects with new customers. Smaller projects such as upgrades were directly assigned to the responsible technician. However, the criteria that differed the larger and smaller projects was not defined. So the handover of the needed information was done quite informally. Due to these informal transfer, many obstacles came out throughout the projects.

There were two user experience problems. One of these was configuration problem at the pre-stage. Using different programs and user interfaces made the process harder for the technicians. The other one was that there was no feedback service for field technicians. Lacking of the feedback mechanism disabled the possibility for improvement. These problems would be further developed by Infinera after the thesis project if desired.

4.2.5 Stakeholder Workshop & Ideation

After gathering all information and insights, several visual aids were created (Appendix I). These reflected the journeys followed throughout the project. One workshop was conducted between the main stakeholders: Project manager, head of sales team and Research and Development engineer. These stakeholders were crucial because their input was fundamental for the path of the project.

The aim of the workshop was to present the insights that had been collected throughout the first loop. The customer journey maps and insights were presented for the workshop. After the presentation of the findings, a brainstorming session was held to set direction for the project. In

order to, ease the session and completely have the focus of stakeholders a problem list was created. This list was consisted of 5 main problems. These problems were categorized into two: UX and Process. The problems regarding the UX are configuration the Pre-staging area and feedback from the Professional Services. For the process there are three areas. These are Project Manager acknowledgement, Statement of work and the handover between the Sales department to Professional Services. Out of all, sales to service handover was selected for the next step.

The reason behind selection of this problem was the priority compared to other problems. It was found out that a new system will be integrated. Some of the problems that were found out through the process would be covered with the help of the new system. It was found out that the project management acknowledgement will be solved through new system. System will assign the project manager if needed according to the requirements of the project. Statement of work was considered as a part of the handover between sales and service departments. Therefore, this problem was integrated under the loops between departments problem. UX problems were left for Infinera to further work on later.

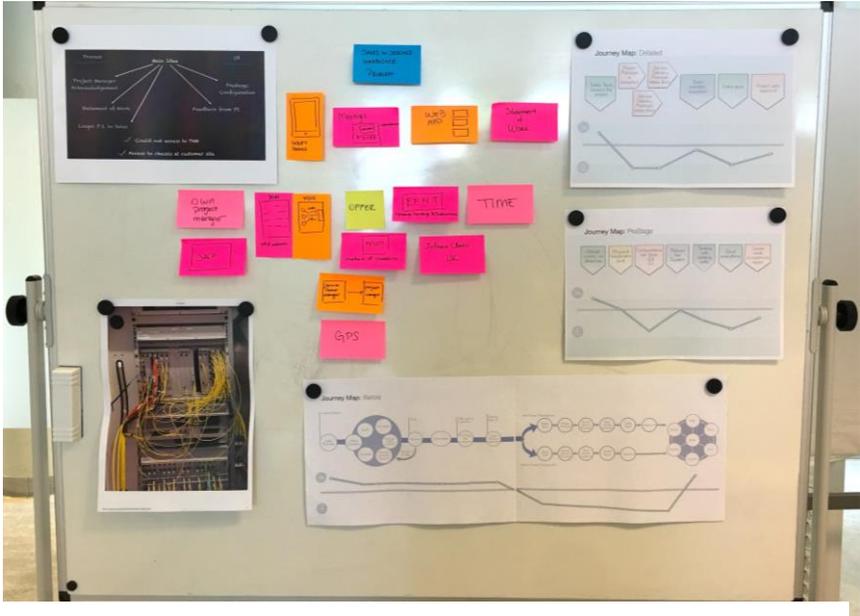*Figure 15. Picture from Stakeholder Workshop*

Figure 16. Picture from Stakeholder Workshop

35

After the selection of the main topic, a brainstorming session was held to find different ideas to handle this problem during the workshop. The figure 14 and 15 shows layout for the workshop and material used for the workshop respectively. In this session, developments regarding the new operating system were also discussed. The ideas that were already included in the new update were eliminated from the brainstorming session. As a final idea web applications were selected to continue with.

The reason behind the selection of the web applications based on research questions that stated earlier in the project. The aim of the project was to improve everyday lives of technicians. Web apps have the possibility to be used in mobile devices. This property is especially important as mobility would ease technicians work activities. They are already using mobile devices for their personal and professional use. Integrating the required handover through a web system would ease the work of both technicians and sales personnel. This would make the process official and any missing data could be searched by means of the app. The app could also be used by other users depending on their connection with the project.

4.3 Loop 2

Loop 2 started at the end of the stakeholders' workshop. After the workshop, the selected idea was deeply analyzed. Previous examples were looked into.

After creating a general understanding, a very rough prototype was designed to gather more insights regarding the concept (Appendix VI). As web apps were selected for final concept, this idea was tested on tablet form. In order to test this idea, tablet shaped foams were cut and a tablet design was added on as seen in figure 16. These rough prototypes were used to get insights from field engineers. The reason that the prototypes were kept rough was to increase the engagement of the technicians as much as possible. As the idea was not finalized, it was easier for them to share their ideas about the prototype (Brown, 2008).

This rough prototype was tested in two different ways. First, it was tested on a contextual inquiry. A project was selected to test this concept. The closest project was selected for this testing. The project was conducted in Zurich, Switzerland. After the first testing, additional interviews were conducted inside the company with the future users. It was crucial to have this step as the concept was to be designed for the users.

After the interviews, information was gathered. This information was used for the next step where the selected concept was more shaped. For this step, user story mapping was used in order to break down the ideas into functions, needs and requirements. The rough concept was presented as a final for the thesis project.

Gathered Information

Below was information that was gathered from the interviews regarding web app concept;

- USB connection for checking connectors
- MOP
- Contact information of the people related to project
- Function to access all the documents related to the project
  - Tickets for the journey
  - Site address & contact numbers
  - Site pictures (which will be added by the customer)
  - Visio & BOM documents (Detailed and overviewed)
  - Layer 2 information (which will be added by the customer)
- Statement of work
  - Information about the project
  - Which tests needed to be done, period for the tests and type of the tests
  - Day or night work
  - Service time period
  - The specification needed to work to be finished
- GPS function
- Status on the technicians: stating the address, time of the job, duration of the work period and updates on the project
- Function to create meetings with sales department
- Feedback function with a template
  - Drag & drop function to make it easier for the users
  - Photo saving property
  - Notes section

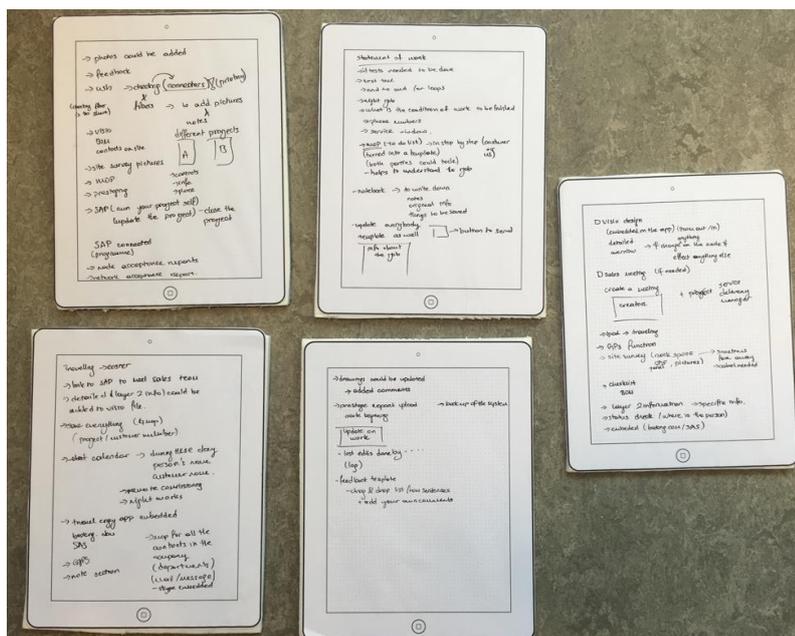The information consists of desired functionalities and needs.

Figure 17. Rough Prototypes

Practice of User Story Mapping

This sub-chapter shows the developed concept regarding web applications. For the development of web application, a common method was used. This method was referred as User Story Mapping. This method practices identifying activities, tasks and features to build an application. The project was finalized with the use of the method. The further work would include software developer to create a rough prototype to test this application.

The gathered information then sorted through by using user story mapping techniques. All insights were grouped according to their activities. These activities were: collect data, check documents, check that equipment is available and ready to go, travel arrangements, site, work on the site and additional activity. Then these activities were sub-grouped according to user tasks. These tasks were respectively; collection of all the documents that was needed for the installation work, checking the collected documents to see if there was anything missing, equipment from pre-staging, personal equipment (such as traffic testers and USB connectors), collection of documents related to the travel, site survey documents and access.
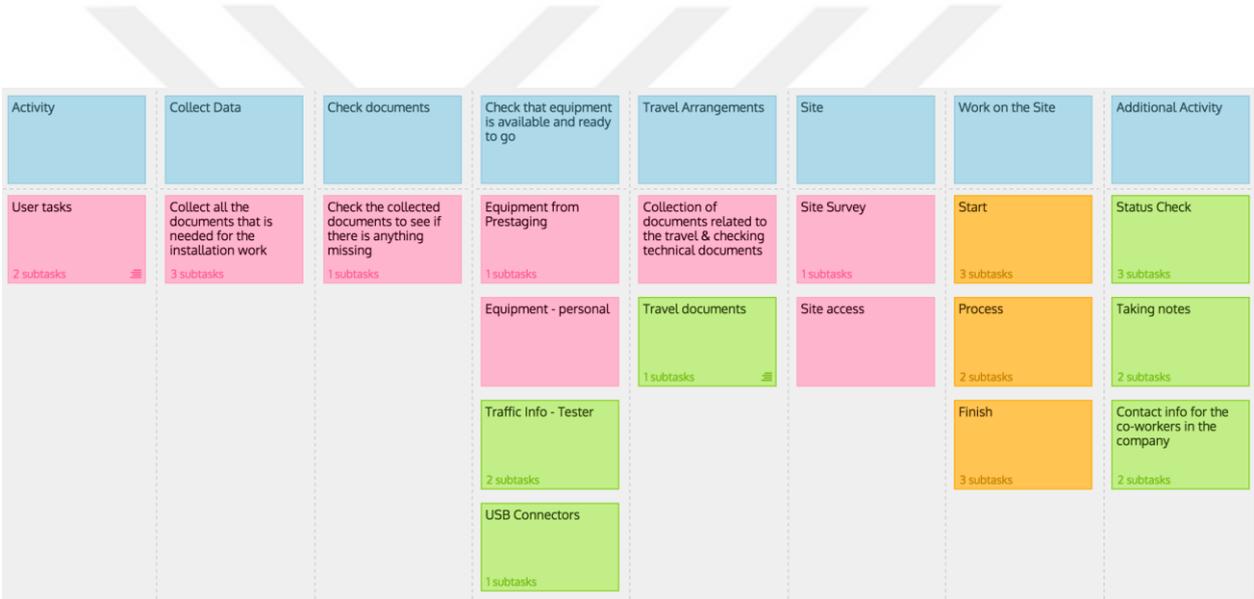

Figure 18. Collapsed User Story Map

Work on the site was divided on three periods: start, process and finish, as shown in figure 18 above. User tasks that were listed for start periods were calling in responsible personal to check if it was okay to start, making site ready to work and access to fiber optic equipment and save the original data. This period was continued with process period. The user tasks in this period were following the work list and checking fibers and connectors. As for the finish period, there were 3 main user tasks. This list started with calling in responsible authorizes to check the system was running, finalizing the work and entering the feedback. The last section was for additional activity for this 3 user tasks were added. These were status check, notes function and contact information for all the project members.
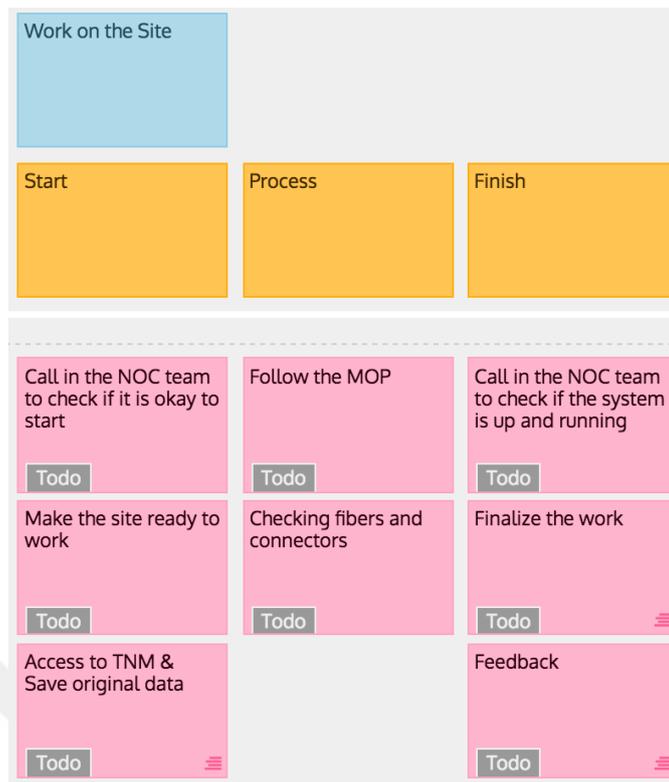
Figure 19. Detailed view of Work on Site

After the sub-grouping of user tasks were added, these were broken into features. For example; for collection of data specific features was statement of work, BOM (bill of materials), limitations, testing criteria, testing type and client boards. Statement of work would include information about details of the project work such as service period, time of the project and agreement on the project work from both customer and company. An additional sub-group was added to define features further. For example; questions were stated to define the necessary requirements for features.

Figure 20. User Story Map

39

The thesis project was finalized with the practice of user story mapping method. This method broke down the concept into a tasks, activities and features. The next step for Infinera would be to create a rough prototype to be tested with the users. This s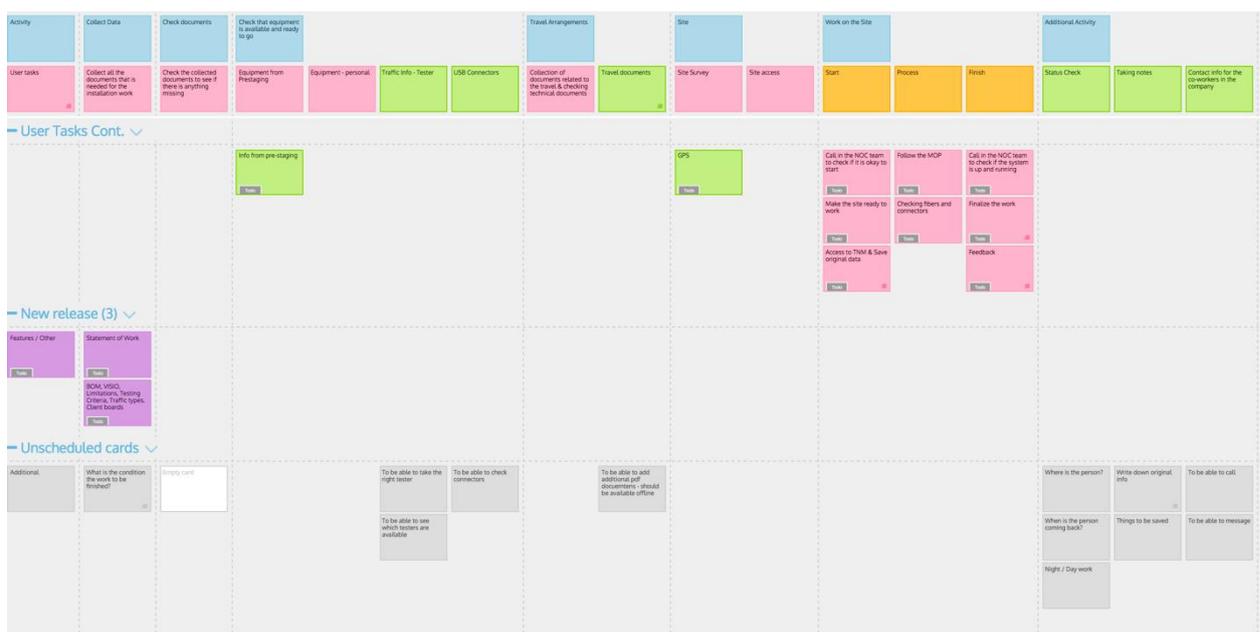oftware developed prototype would reveal the features that would be useful and eliminate the ones that were not used by the users. The scope of the project was to improve everyday work lives of the technician, suggest improvements to adjust the process to be more user-centered and learn daily activities of technicians. Throughout the process, the daily activities of the technicians were analyzed. This analysis revealed the problems of the process that affected the daily activities of the technicians. In order to make this process user-centered, new improvements were suggested. It was found out that a new system will be integrated that would solve project manager acknowledgement. User experience problems were kept for later work which would be conducted by Infinera. This conclusion led the the focus on handover between sales and service departments. Statement of work was also covered in the developed concept. The brainstorming session that was conducted during the stakeholder workshop, led to web applications as a concept solution. The importance of web applications was the mobility to ease the use and shape the application to be user-centered.

4.4 Recommendations

Throughout the project period, several points were noted to be improved. It was found out that the lack of connection between departments were causing many of the problems. Infinera could solve this problem by adding reoccurring meeting sessions between departments. These could be arranged according to the updates for the equipments and software.

It was also found out that having an in-house service designer, created an overview of the project in an objective way. This helped to discuss obstacles in the workflow in a more professional way. Infinera could test this further more by creating an in-house design department which focusses on service deliverables.

This study also showed that it is highly important to keep the users in the creative loop. This could also further be extended by having feedback systems for all the departments. These systems should be kept simple and easy to use and incentives could be added. The employee participant should be encouraged to improve the efficiency of the work in the company environment. This idea could also be turned into a project which would be led by a service designer.

5. Discussion

This chapter presents the discussion the project work. The chapter follows the timeline of the project work. An additional chapter was added to discuss the further work for this project.

5.1 Project Goals

Project goals were kept as the originals throughout the project. Insights were gathered to have a deeper understanding of the installation process. The concept that was generated at the end of loop 1 was fitting to the research questions that was generated at the beginning of the project.

5.2 Limitations

The main obstacle of this project was the project times that Infinera was conducting for their customers. These visits were crucial for the contextual inquiries but unfortunately the dates did not work out as thought at the beginning of the project. Due to this condition, the scheduled time for the project was delayed a bit further. Also, due to the lack of projects only two visits could be arranged for the testing and analysis.

Another important constraint was the few number of participants. Generally, it is more efficient when service design methods are used on larger crowds. However, the project was based on field technicians and although there are very few numbers of technicians, all of them were participated in the project.

5.3 Final Result

The project shaped with the input of the users, in this case, the field technicians. Interviewing them helped to gather lots of input and insights regarding both their day to day activities and field work. The usage of service design and user-centered principles were fundamental.

The project started with the learning phase which then continued with loop 1. Throughout the project the scope and research questions were kept as an internal guideline. First interviews were bit clumsier but as the process continued both parties get used to it. Service design methods were proven most useful for loop 1. It was hard for the technicians to engage with the service design perspective at first. However, informing them about the process helped to gain interest. In my opinion, most useful methods were customer journey maps, a day in life and shadowing. Most of the insights were gained by spending the time with the technicians both in-house and outside. Most hard part of the project was to learn basics of fiber optic networks.

Stakeholders workshop was quite successful. The identified problems were discussed. Gaining insights for these problems from stakeholders confirmed the results that was gathered. The fundamental reason behind all these problems was intercommunication problems between the departments in the company. There should definitely be a guide for defining projects as big or

small. As the process is not defined successfully, this leads problems throughout many projects. Dues to this problem, many times sales and service departments have conflicts. Moreover, as there is no handover between these two departments, if any data is missing from the documents this causes loops between the departments. As responsibilities are not fully completed such as data about attenuated fiber patches and the fact that there is no handover causes a vague process. Due to this vagueness, this problem is marked prior by the stakeholders. In order to achieve a common platform web app concept is selected. This concept is competitive as it can be usable remotely and all the participants can take part. Sales department can add all the necessary documents to the app and technicians can access these all the time.

Due to the restrictions for the thesis one topic needed to be selected to further development. Also during the stakeholder workshop, it is found out that a new system will be integrated. Some of the problems that were found out will be solved with the usage of the new integrated system. Therefore, these problems were eliminated whilst the ideas were discussed.

Web applications were selected for the continuity of the thesis project as a solution concept. The rest of the problems were left to Infinera to work further. Web applications had a significant importance as they support the research questions that stated earlier in the project. The scope of this project was to learn daily activities of technicians as well aa adjusting the process to be more user-centered. By having users in the learning and defining process reinforced the problems that were found. To have a user-centered process, the users kept in the loop while working on solution concepts. The selected idea, which was web application, fitted the profile that was set at the beginning of the project. The mobility of the concept is fundamental as the users is always on the move. Also, the concept can easily be developed with the focus on the users. For the development of the concept, user story mapping is used for the methodology. The methodology is used with information that is gathered from interviews and other methods that was conducted with the user. The collected information gathered and sorted as activities, tasks and features to be integrated in the application. The thesis project was finalized at this point. The further work for Infinera would be to develop an application by using software applications. This software prototype then should be tested on users to see which functions should be kept and developed further and which ones should be eliminated.

This project is a great example that service design methods could be applied to any field where there is a customer interaction with a service. The involvement of users showed the hidden problems and how they could be solved efficiently. By using service design, experiences do not just happen. On the contrary, they are designed to serve the best for the user/customer.

5.4 Work Procedure

At the start of the project, a lot of time was spent in the company with the supervisor. This phase helped to gain knowledge regarding the selected area of work and fiber optics. There have been lot of times where various meetings were held that at the time seemed to be not relevant to the scope of the project. However, as the project developed more and more all this knowledge were used.

The project started with the planning of time. Initially, three loops were considered. However, due to the lack of projects and their timings these loops were dropped to two. Additional time added due to the special condition with the projects.

With the help of the people at Infinera, alongside with the installation process, process flow was also examined. This helped to see through the problems before the installation process but effected it.

5.5 Further Work

For the further development of this project, more insights should be gathered regarding the selected concept. Also, more stakeholder workshops could be held in order get insights from different departments.

After gathering all the information, prototype testing becomes crucial. This step enlightens the parts that should be further improved and the parts that should be eliminated. Also, as the created product involves software development a team of developers and designers should be working together.

6. Conclusion

The scope of this was enlighten the installation process of field technicians that work at Infinera. The results of the project showed that there are few areas that could be improved further regarding the installation process and communication between the departments at Infinera. This project also has an emphasis on service design and user-centered design. These two principles are crucial when designing a new experience for the customers or users. With the use of methods of these principles, the customer/user satisfaction is ensured.

The service design methods were used for the first time at Infinera with this thesis project. It is proven that having a service designer in-house affects the process on a positive note. For Infinera that was their first experience. Infinera would definitely benefit having an in-house service design department. This would help them to shape the processes to be more user-centered which would improve the efficiency. This thesis is an exemplary project for Infinera to see how service design and user-centered design is useful for the company.

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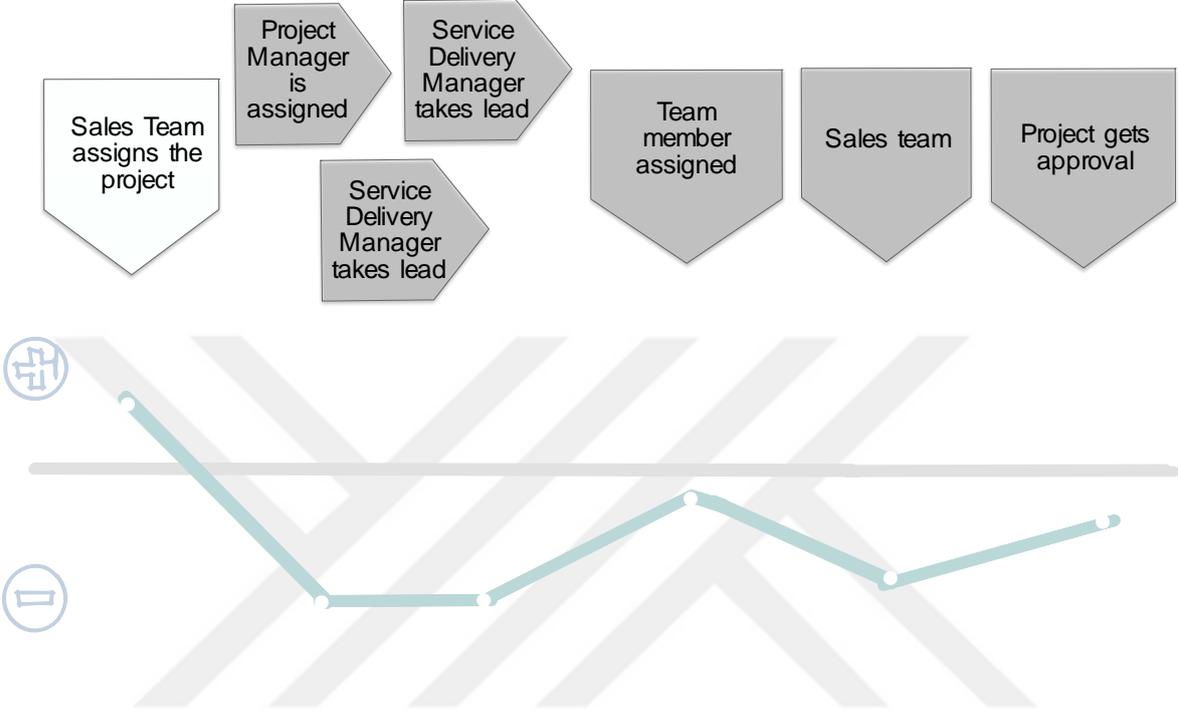
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Appendix I - Workshop

Journey Map: Detailed

| Sales Team assigns the project | Project Manager is assigned | Service Delivery Manager takes lead | | Team member assigned | Sales team | Project gets approval |

Service Delivery Manager takes lead

Journey Map: PreStage

| Design comes via drawings | Physical equipment built | Configurations are done - GUI - CLI | Reboot the System | Testing with adding traffic | Save everything | Create node acceptance report |

Journey Map: During

Take the flight / Getting the rental car

Site visit — Meeting with the customer / Go over workload, try to be on the same page

Midnight — Settle down [Hotel] / Leave the hotel / Arrival to the site / Try to get some sleep and energy / Calling the site guide to let us in

Set-up space for work / Get equipment ready / Collect original data & save / Check access to the chassis / Analysts Check drawings and compare with the site / Try to get access to TNM

Call to check for the start / Following the given documents to ease the work flow / Careful removal of the fibers / Recording descriptive information

Replace the amplifier board / Patching the cables / Accessing to the node / ROADM is set up as a spare part / New control groups are created

ROADM upgrade / Value check and Patching accordingly / Manual info is put / Checking and fixing the problems / ROADM to ROADM connection is done

Save all the changes / Call to check to leave the site / Cleaning the site / Mail sent to relevant parties

Journey Map: Before

48

Appendix II – Experience Map (Pre-staging)

Installation Process

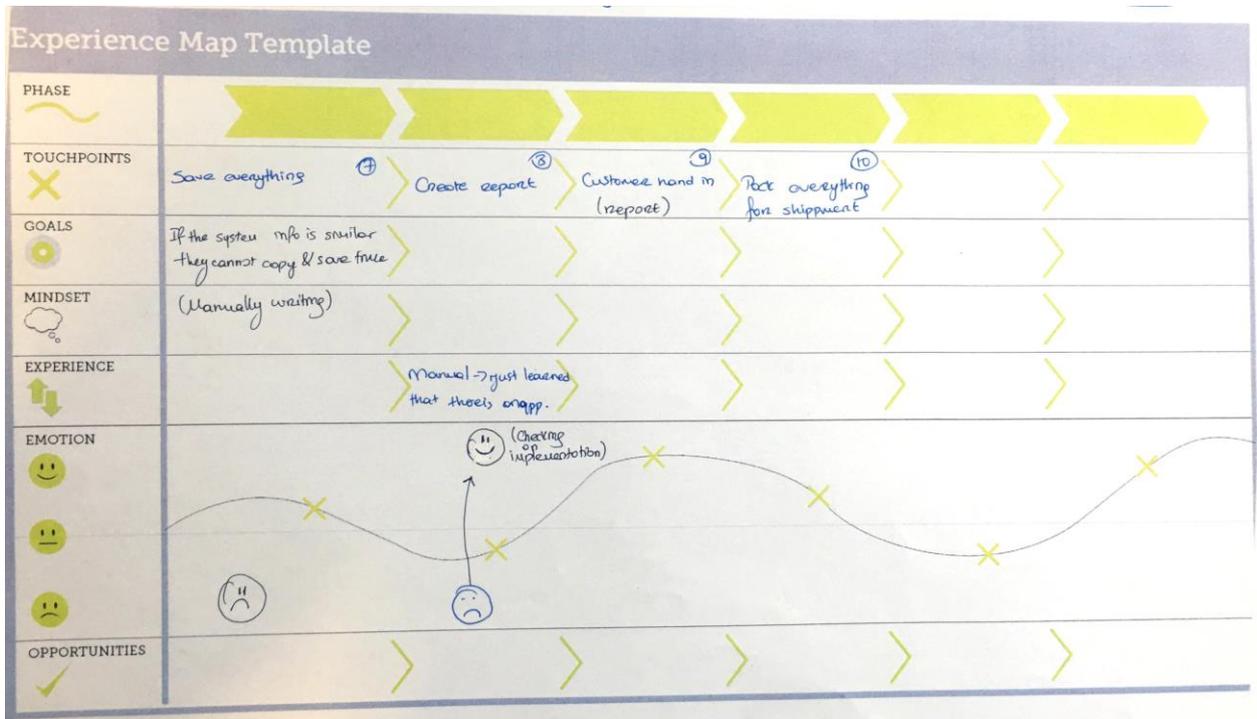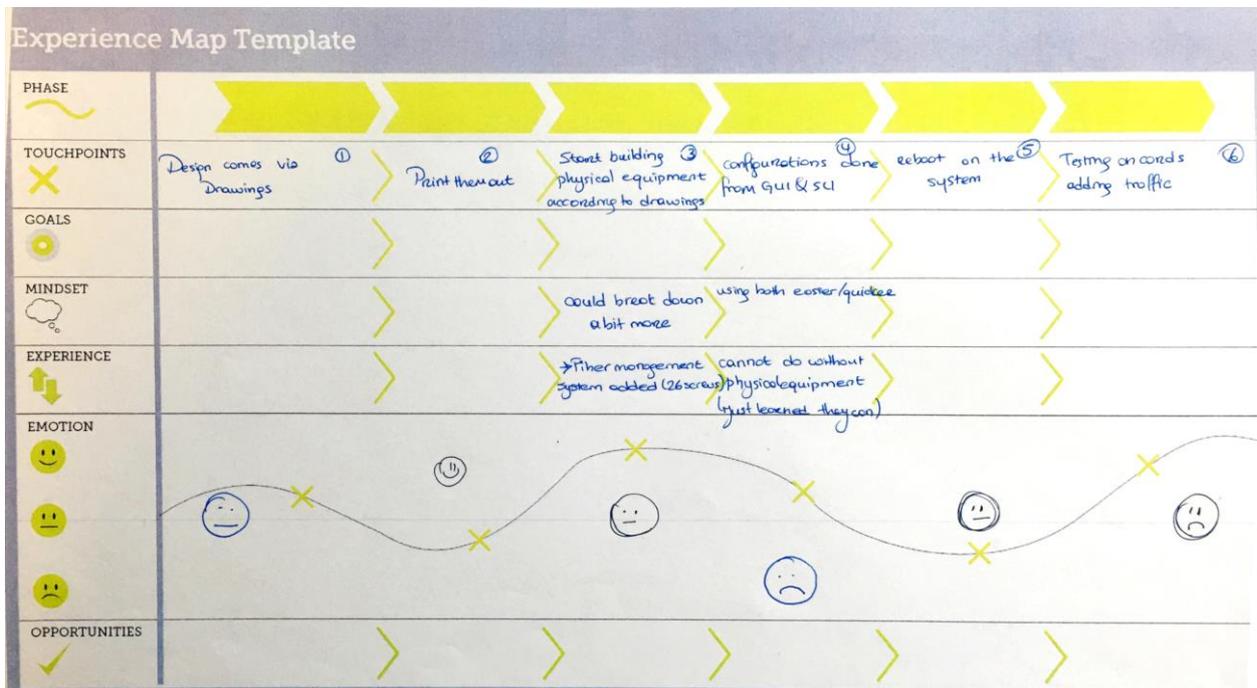|								
Activity	Printing out the design	Building the equipment	Configuring the system	Rebooting the system	Testing with Traffic	Saving all the data	Creating node acceptance report	Packaging the shipment
Experience	Neutral	Not so ambitious, adding external systems take too much time	Between neutral and down, Changing between the systems and pages complicates the process	Neutral	Neutral	Neutral	Negative Manually created	Between Neutral and down
Need	Printer Drawings (Design)	Necessary equipment Design drawings	GUI CLI Equipment	Necessary equipment	Necessary equipment	Necessary equipment	Necessary equipment Automatic creation with serial number and barcode system	Necessary equipment

APPENDIX III – Interview Guide

Interview Guide

- What do you like most about your job?

- What are your strengths?

- What is the most rewarding thing in your work?

- Is there any responsibilities that you do not like regarding your job?
- {If so what are these and why?}

- What do you find difficult in your job?

- What is the most time consuming responsibility / job?

- You can find different problems and obstacles. Could you describe conditions, assignments or tasks that have been dissatisfying?

- Often, there is multiple tasks to complete in one day. How would you prioritize your tasks?
- {Have you ever experienced it? Could you please share?}

- What areas do you think should / could be further developed in your everyday work?

- What aspects of your job that you most like / enjoy?

- What are your motivations when you come across with an obstacle?

APPENDIX IV – Experience Map

The experience map below is created together with the interviewee.

APPENDIX V - Clusters

Appendix VI – Trigger Material