Aalto University - Department of Communications and Networking

ELEC-E7830 Value Network Design for Internet

Case Intelligent Locking in Packet Delivery / Assa Abloy "Last Mile"

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Abstract

In this report, we study the Last Mile case for company Assa Abloy to use the intelligent locking system in package delivery. We used three main methods in this case study to analyse our case. First, we used the Scenario Planning to study the environment, in which the company offers its services, and made a scan for the possible alternative future scenarios, by identifying the key uncertainties and trends. Second, we created three Value Network Configurations (VNC) that describe the flexibility of the company towards different factors in the environment and the different value networks that might emerge around the business model. Finally, we used the STOF method to explore the service by going through the four business model domains (Service, Technology, Organization, Finance). The STOF model considers important factors in regards of constructing viable business models, such as customer needs, costs and risks that could affect this case.

Table of Contents

1. Introduction

Due to the increasing trend of online shopping in recent years, after turning to the era of Internet, package deliveries to individual people have also massively increased. Increased deliveries have introduced the rising problem in the so-called Last Mile of the delivery process, that customer might not be available to receive the package personally at the time of delivery. This results in the failure of the package delivery. This is especially expensive for the delivery company, but also inconvenient and frustrating for the customer. What if there would be a solution to improve the success rates of deliveries? And how would that possibly be implemented in regards of the possibilities with the help of digitalization and current technologies?

The case company Assa Abloy has acknowledged the problem and has started business case analysis in collaboration with a few companies working in the industries alike. Assa Abloy has a strong, even dominant, position in the locking manufacturing and service industry in Finland, which is the target region for this case analysis.

The following report will introduce the used analysis methods and provide further information for understanding the case and context for having the means to an effective solution. After the analysis with each of the methods the report will design a business case and test its validity with also providing recommendations for further research.

2. Methods

In following chapters the report introduces the methodology used in the case. The reader will be provided an understanding of the theory in each method and the relevant terminology. This acts as a basis for diving deeper into the problem and the process of constructing the business case. Scenario Planning (Schoemaker, 1995) aims to construct scenarios to help decision making. Value Network Configurations analysis (Casey et al., 2010) is a tool for constructing value network models with the use of recognizing relevant actors, roles and technical components connecting them together with interfaces on technical and business level. The STOF Model in the end (Bouwman et al., 2008) dives into the case service on four domains focusing on most important details that form the basis for viable business model.

2.1. Scenario Planning

Scenario Planning is a tool for strategic thinking. It identifies trends and uncertainties and it helps to construct a series of scenarios. These scenarios help to compensate the most common mistakes, such as tunnel vision and overconfidence, in decision making. The constructed scenarios make the decision makers to challenge the prevailing mind-set. (Schoemaker, 1995)

Scenario planning consists of three steps: first, the scene and scope are set. This means defining the time frame, scope, and decision variables. Also, the major stakeholders are identified. Secondly, the key trends and uncertainties are identified. Key trends are important forces whose consequences have not yet unfolded while key uncertainties are forces whose outcomes are not predictable. Thirdly, the scenarios are constructed with the help of the two first steps. Two most important key uncertainties are chosen to be the scenario matrix axes. The internal consistency and plausibility are assessed as well as the stakeholder behaviour. Also, the impact of key trends are added into the constructed scenarios. Even though it's impossible to know the future and it's very hard to even guess the future, the scenario planning method helps to understand the different future scenarios.
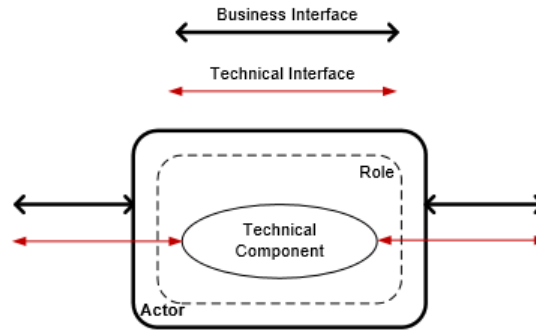
2.2. Value Network Configurations

In globally used business models and the overall literature related to the terms of value and value network teem around describing the relation of products, companies

and customers. Value is defined according to Merriam-Webster dictionary (2017) as "A fair return or equivalent in goods, services, or money for something exchanged", "The monetary worth of something" and "Relative worth, utility, or importance". A value network is composed, according to Casey et al (2010), of interlinked business actors and technical resources, that produce economically recognized value through products and services. Value Network Analysis is a study aiming to understand, visualize and optimize both internal and external value networks from the whole perspective describing the value from financial and non-financial assets.

Value networks are initially built upon the use of certain technologies, which define the underlying network for the value network structure itself. The technology or technical architecture is structured from various technical components located in a platform or a set of multiple platforms. The components are connected by technical interfaces, which are marked using red arrows in the Casey's VNC notation (figure 1). Each technical component are located under a certain role. A role is distinguished by a separate unique responsibility, which can't be divided between separate actors. Those responsibilities are defined by activities and technical components needed to utilize the unique role. In the broad picture, the technical components and roles are held by a certain actor. An actor can take several roles and yet be in control of multitude of technical components. An actor can easily be compared to a company or community, even an individual or so. In the case of this report, examples of actors are Internet Service Provider, Delivery Company, Locking Company and Condominium (a set of residents). (Casey et al., 2010).

As the business actors take on roles and establish both technical and business interfaces with each other, the graph notation is called a Value Network Configuration (VNC), which concisely yet informatively reflect the relations of actors in the value network. The business interfaces are marked with bolded black arrows connecting actors (figure 1). The complete VNC describes in addition to the technical architecture and business contracts, both the tangible and intangible value distributed along the value network. (Casey et al., 2010). Figures of value network configurations are provided in chapter 5.
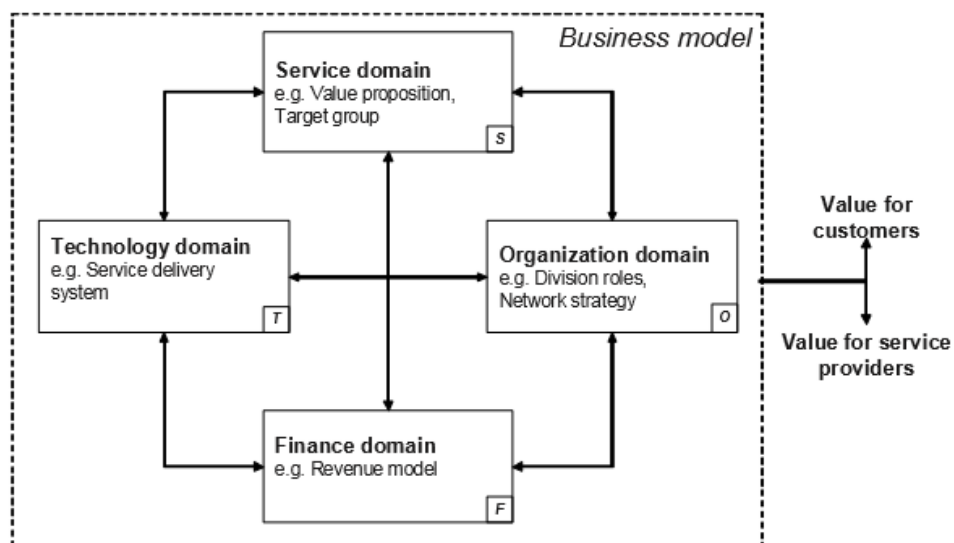
Figure 1. VNC object in the Casey et al's (2010) notation. (Casey et al., 2010)

As we have defined the VNC method, a value network analysis is done to recognize and place the actors, roles, technical components and their connecting (technical and business) interfaces to the value network configuration. Usually the analysis reveals that multiple differing value network configurations emerge on the same case, as there are several outcomes by varying the objects on each of the levels (actor, role and technological components) in the VNC. The various VNC's are often called after the dominating actor controlling the value network (e.g ISP driven VNC).

2.3. The STOF Method

The STOF model is a tool that defines the main idea and design variables for the four business model domains that include service, technology, organization and finance. Within these domains different components play a role. The figure 2. illustrates the four business model domains. (Bouwman et al., 2008)

Figure 2. The STOF business model domains. (Bouwman et al., p36, 2008)

4

It has been found that the design decisions that are made in these domains need to be balanced to achieve applicability and functionality. To support a balanced design, Critical Design Issues (CDIs) and Critical Success Factors (CSFs) have been introduced in addition to the specific problems that are related to the business models of mobile services. (Bouwman et al., 2008)

The idea of the STOF method is to help designers in designing a solid, practical and feasible business model that creates significant value for both customers and providers. Furthermore, this method is helpful and effective in the very early phase of service invention when new ideas are brainstormed and explored. That is to say, service and technology domains could be adjusted and set to fulfill the business requirements and needs and to rise the market potential at a later stage. (Bouwman et al., 2008)

Service domain is the first step to start building the business model. There are some concerns that play an important role in the concept of the service, such as customer value and the functionality of the service, communication between service provider and customer. The domain examines and determines the value proposition of the service and consider analyzing other approaches, such as pricing, customer targeting, and framework. (Bouwman et al., 2008)

Technology domain describes the technological architecture, applications, devices, connections and infrastructure that are used to build the business model to ease continuing the process that is affected by the demands of the service domain. (Bouwman et al., 2008)

In Organization domain, the issues are usually resolved around the resources and capabilities that are associated to technology, marketing and finance that are used to enable the service. Although the service could be offered by a single organization, but the collaboration between organizations would be more valuable to offer a better service for involved actors in the market. (Bouwman et al., 2008)

Finance domain describes the financial arrangements and agreements between parties that are involved in the value network by considering several aspects, such as efforts that have been made, revenues, risks and costs. (Bouwman et al., 2008)

The STOF method includes four steps. The Quick Scan, which is the first step, a basic sketch of the business model is made. This simply means a description of the service and the intended value suggestion, a value network, a technical architecture and a financial model. Evaluation with CSFs is the second step where the viability of the Quick Scan result is assessed. In the third step, the initial business model is clarified by specifying the CDIs. A robustness check is done in step four. (Bouwman et al., 2008)

The STOF method can be used in different ways. For example, designers can use it to structure their work and guide them in the design and design process. The creative and productive way of using the STOF method is through a design session, such as workshops where all participants can discuss their business model problems and try to fix them by outlining these issues and formulating the design options. (Bouwman et al., 2008)

3. Case description

The case was briefly introduced in the abstract and introduction, but is now given more accurate context and limitation. Also, the initializing the scope and time frame are presented, which are needed for determining the work with the methods and the case in reality. Chapter 3.1 will describe the case in general and chapter 3.2 provides information on the state of competition in the close proximity of industries in the business case area.

3.1. General description

Starting point for the work in this report was the introduced problem from Assa Abloy Oy with the key fact that on average only 33 percent (%) of package deliveries to success to reach their intended recipient at the first try. The problem is caused by various facts, most of them being of quite practical in nature, e.g. the recipient is not at home at the moment, when the delivery is carried out or that the recipient can't be reached by contacting by phone or text message for some reason. This results to additional effort for both the delivery company and the recipient, which consumes resources, money and time without mentioning all the facts of inconvenience.
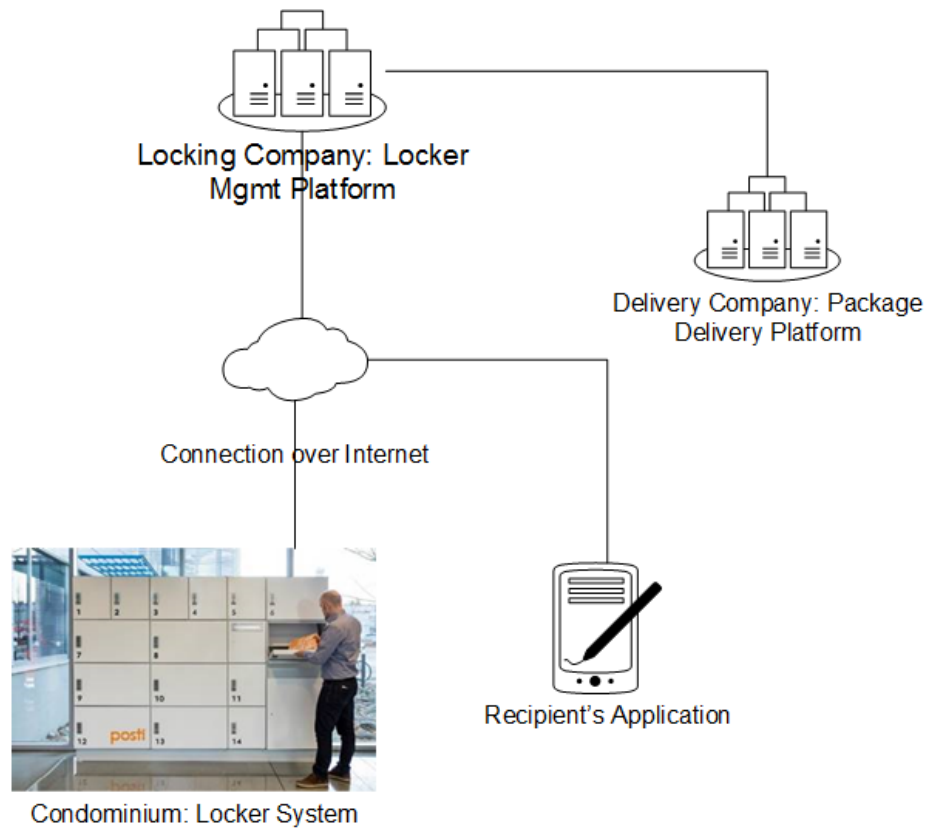
The case analysed in this report called as "Last Mile" problem was brought in by the Finnish department of Swedish Assa Abloy AB Group, which is the world's largest lock manufacturer by sales volume. In Finland, the brand Abloy stands also very strong in the minds of customers as generally their products are very well-known. Later, in this report Assa Abloy is also referenced with the name Abloy for convenience.

As holding a strong position in the locking industry and recently also entering the area of security solutions, it stands as an interesting opportunity for Assa Abloy to scan and study the business opportunities in last mile packet deliveries for increasing the delivery rates and improving the customer perceived value. In this context Abloy might have various set of roles, as there are competing parties thinking of the same ideas, especially in package delivery business. But as Abloy holds a strong professional experience in both traditional and more interestingly in electric locking regarding current era of digitalization, they might have a good opportunity to possess a key role in intelligent packet delivery systems and service business.

So how could the delivery rate be increased, possibly with the use of the expertise and products that Abloy has? This is the fundamental question that is analyzed and solved in this report by utilizing the three methods and scanning the opportunities in the business case. The most certain and important note to keep in mind, is that 33 percent delivery success rate is very low, possessing a significant opportunity to improve the delivery process, and in the end resulting as an economical benefit to be shared within the actors involved in the business.

The shortened term locker system is used through the report for describing the Intelligent Locker System to be installed into the building lobbies. According to discussion with Abloy the set of lockers would consist of an amount of approximately ten lockers having possibly different sizes. The main size is seen to be around 50 cm * 50 cm * 50 cm, to have enough space in each locker for storing most of the parcel that are delivered straight to recipient. The general architecture, which stands for basis of the case analysis can be seen from the figure 3. The architecture consists of the Intelligent Locker System, which has preferably wired internet connection allowing all the locker systems to be monitored remotely via the Locker Management System, which stores the information of all the locker systems in the country. The recipient would have a mobile application for getting notices of packet delivery status and information about the status of the lockers. This software also has a connection to the locker management system and to the delivery company's parcel information system. The lockers would be accessible using the central panel in the locker system with a pin code or using the mobile application.

The scenario analysis scope is done with time frame of five years in Finland. The target segment for the final service are condominiums, which holds the decision power of common issues regarding to each individual apartment building in Finland, and in that sense would make the joint purchase decision of the service and locker system for the use of the building community. As a starting point, as it has seen to happen with the services alike (Posti's Pakettiautomaatti and SmartPost), a more central location (e.g. a shopping centre or a grocery store) for the locker systems could be chosen to test the early life of the service making it less risky for the accompanying companies.

Figure 3: Technical architecture of the Intelligent Locker System

The intended service is beneficial for both the recipient and delivery companies increasing the effectiveness and convenience of the delivery process, as it removes the need for the recipient being available at the time of packet delivery to the destination. The locker system would be accessible for both the delivery personnel for storing the package as the ending of delivery process and for the recipient for collecting the package whenever wanted. Making package receiving and storing a digital service allows for building additional services, as an example advertising and enabling further development of according to the needs of users in the future. It is notable that the service could also integrate into some other services or use cases which are out of the package delivery scope, for example food or medicine deliveries in health care or integration towards smart home solutions.

3.2. Competition

We used Porter's five forces framework (figure 4) to identify the competition, as it helps to identify the attractiveness of an industry. (Johnson et al., 2009)

Bargaining Power of Suppliers

The suppliers are the companies that provide the parts for the boxes and lock parts. Also Abloy has collaboration with Verisure (a supplier).

Bargaining Power of Buyers

For Abloy, the buyers are mostly end-customers as in condominiums and public storage places. This force isn't very strong as the buyers aren't huge companies who would have a big bargaining power and could lower the prices with big orders.

Threat of Substitutes

The current substitute for this service is the old package delivery systems with non-intelligent stand-alone boxes. Another possible candidate could be that people would accept their neighbour as a real recipient for their package. This of course would need a great attitude change in Finland. Otherwise we predict an emergence of smart home related solution but this is not applicable within the 5-year-scope. The threat of substitutes isn't seen as the strongest force in this case.

Threat of New Entrants

The threat of new entrants is a fairly big concern as big delivery companies such as DHL might expand their Packstation service, which are delivery lockers at the moment functioning in Germany, to Finland. Other big delivery companies such as DB Schenker, UPS and TNT might also expand their services in Finland and become a competitor.

Industry Rivalry

The straight competitive rival for the intelligent locker service is Posti, as they offer nowadays their Smartpost service. Also, other locking companies such as

Allegion (USA), Stanley Black & Decker (USA), Dorma (Germany), Kaba Group (Switzerland) and Hörmann (Germany) are the rivals for Abloy, but they don't offer such delivery service. (Assa Abloy: Business & Market, 2017).

Bargaining Power of *Suppliers*

Threat
of *New Entrants*

Industry
Rivalry

Threat
of *Substitutes*

Bargaining Power of *Buyers*

Figure 4. Porter's Five Forces Framework (Wikipedia, 2017)

4. Scenario Planning

In this chapter we are going to introduce the scenario planning method for our case, Last Mile. We will discuss about the key trends and key uncertainties, as well as introduce the scenario matrix, that is based on the two most important key uncertainties. The scope in this scenario planning is set for five years and the piloting would happen in Finland.

4.1. Key Trends

T1. Home Deliveries are increasing because of online shopping

People are ordering more and more from online stores and their packages need to be delivered. The amount of online order has grown steadily and it's very likely to continue growing. (Tilastokeskus, 2014).

T2. Everything is becoming digital the amount of digital services is increasing

The amount of digital services is increasing and digital services are more common. Such as smart homes, online food orders, mobile applications, electric locks... (TNS Connected Life, 2017).

T3. Urbanization. People are moving into cities

As people are moving into cities there would be more customers for the intelligent locking box service. Also, the implementation of the service is easier in the cities as the set of boxes can serve more people. (Vuori, 2015)

T4. Life cycle businesses and rapid service development are more common than before

Companies tend to bring their products faster to the market and pull them out from the market faster. The life period of a sold product has become shorter.

4.2. Key Uncertainties

We identified following key uncertainties for the case:

U1. Will the demand be in key role affecting the scale of the business?

The U1 describes that if the demand is high enough, the people accept the service better and won't mind about the locker systems taking space for example on their condominium lobby.

U2. Are the lock manufacturers and delivery companies going to co-operate to form the service?

The uncertainty U2 is affecting the decision of how to form the service, as the co-operation between locking company and delivery company will be the main actors to form the service.

U3. Will social interactions become (e.g. neighbors) a part of receiving parcel?

In Germany it's a common custom that the neighbor receives the package if the real receiver isn't at home. At the moment in Finland, according to Abloy's study, only 1 out of 1000 would like to give a permission for the neighbor the receive the package. As the attitudes might change in the future and people might allow the neighbor to receive the package, this remains still as an uncertainty.

U4. Are the users going to accept the new service?

There is always a risk that the users might not accept the service, as people need to adapt to use the service. It might be difficult for some users to use the technology or accept that the lockers take space in the lobbies.

U5. Will the people find the intelligent locking secure enough?

New technology always raises questions about the security. Some people might find traditional locks more secure than intelligent locks. The security issues rise as a concern in many new technological innovations.
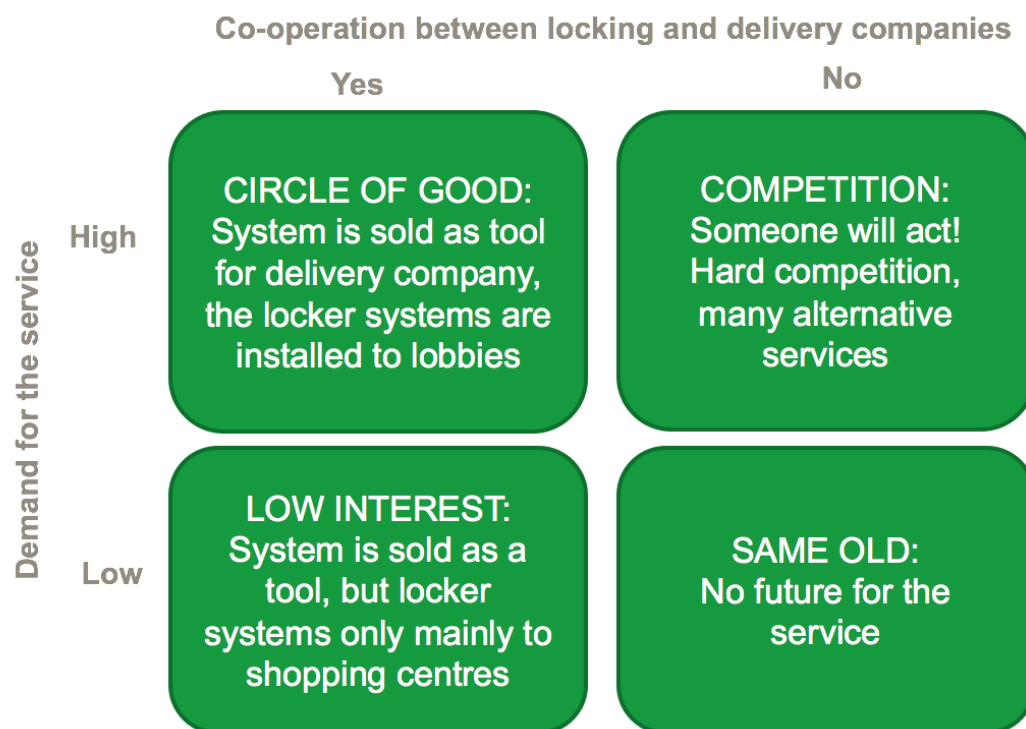
U6. Will the intelligent locking be a part of smart home or against it?

It might be possible that smart home services would bring another solution for packet deliveries and start competing with intelligent locker systems. It could be also possible that the intelligent locking is adapted into smart homes.

The two most important uncertainties are U1 and U2, of which are used to form the axis to the scenario matrix (figure 5).

4.3. Scenario Matrix

In the Scenario Matrix (figure 5) the uncertainties U2 and U1 are used as the axis x and y, respectively. The matrix describes four different scenarios, depending on the level of demand and if the locking company and delivery company are going to co-operate to form the business.

Co-operation between locking and delivery companies

	Yes	**No**
High	**CIRCLE OF GOOD:** System is sold as tool for delivery company, the locker systems are installed to lobbies	**COMPETITION:** Someone will act! Hard competition, many alternative services
Low	**LOW INTEREST:** System is sold as a tool, but locker systems only mainly to shopping centres	**SAME OLD:** No future for the service

(Demand for the service — vertical axis label)

Figure 5. Scenario Matrix

The scenario "Circle of Good" is the best-case scenario. Here the demand for the service is high and the co-operation between the companies is established. The locking company sells the API access for the delivery companies and the intelligent locker systems are sold for condominiums.

14

The second scenario, called "Competition" is formed from high demand for the service and no co-operation between the locking and delivery company. In this scenario different companies are interested in forming a new generation delivery service. There will be many and different competing services and products.

"Low Interest" is a scenario where the demand is low but the locking and delivery companies are co-operating. The intelligent locker systems can be installed to shopping centres and the API access for the delivery company.

Lastly, the "Same old" scenario describes how there wouldn't be demand for the service nor co-operation between the companies. In this scenario, there isn't a future for the service as it is difficult to form and the customers aren't interested in the service. The customers aren't interested in the development and prefer the system as it is.

5. Value Network Configurations

After scanning the future possibilities with the Scenario Planning method, we took the Value Network Configurations method in use and started with sketching the initial version of VNC's by recognizing and evaluating the roles, actors, and technical components in the value network. We repeated the process with several iterations to construct the final three alternative Value Network Configurations, as it was seen that technical components and their connections needed to be defined as clearly as possible, which again affected the placing of roles and actors. In the end we got into the center of the problem and chose one most likely VNC for further analysis of the case in business model thinking with the STOF-model. The different VNC's represent the possible evolution path that have been partially exposed in Scenario Planning process.
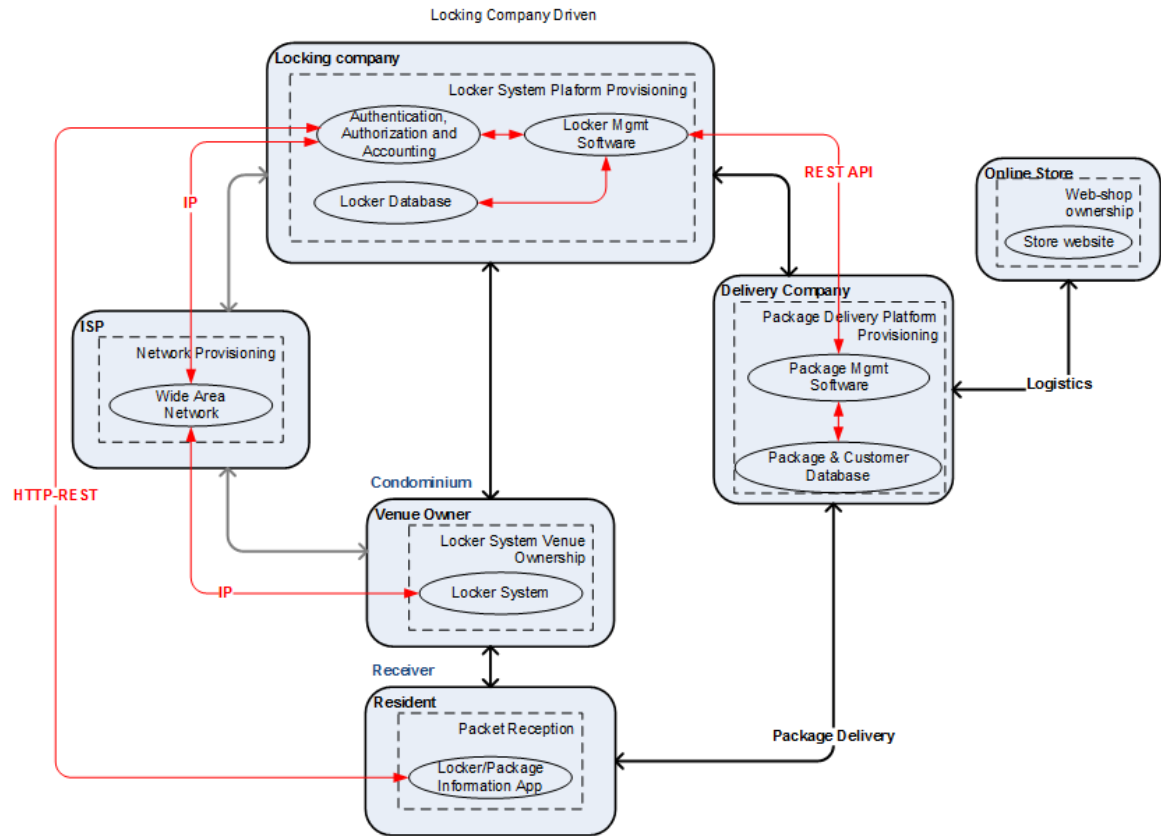
The main changing issue in each of the VNC is how the technical components form the whole technical architecture and thereby defining which actor possess a certain component and role. This key aspect that was seen to be important in the case can be called as platform thinking, meaning the structuring of interconnected systems and value of information is crucial in forming the business model. Each VNC result in different business interfaces and flow of value as well.

The main VNC called "Locking company driven" can be seen in the figure 6. It is formed around the idea that Locking Company, say Abloy in this case, would hold the management and information of all the locker systems around the country, thereby possessing relatively large amount of control in the value network. First it should be noted that the roles ISP (Internet Service Provider) and Online Store are not in the centre of the business case, but are included in the VNC as they are mandatory for the whole case and the system to work. Thereby this report does not focus on those roles and their business interfaces. In each of the VNC's there are also red arrows indicating the technical interfaces with most important technical communication protocol, if possible, that acts as a basis of the business contracts between the actors. Internet Protocol (IP) is the protocol connecting each locker system to the locker system platform over the Internet and on the other hand HTTP-REST is the most likely applicable application layer protocol used for communication from the locker

system platform to the recipient's mobile application and also to the delivery company's package delivery systems.

In the main VNC, the role "Locking System Platform Provisioning" under the actor Locking Company, involves the most relevant technical components needed in implementing the system for managing the individual locker systems connected over Internet. First component is authentication, authorization and accounting server with complemented with a firewall (not in picture) which takes in and forwards user requests and status information from the locker systems. The processed information is managed with the locker management software, which is the key component bringing all the parts together and providing an interface for management and monitoring. Locker database collects the information of all the locker systems, their users and provides linking information for the delivery company systems.

The second key role in all the VNC's is the Package Delivery Platform Provisioning, which in the main VNC is under the actor Delivery Company. The importance of the role comes from another main source of information, that are the technical components forming the Package Delivery System. This system is used for the delivery company in their processes of handling the packet delivery processes. Main components that are included in this platform are the main command centre Package Management Software, which is the equal to Box Management Software under Locking System Platform and Package and Customer Database, which is for storing the package delivery status and customer information, with also providing the linkage information to the Locker Database. This linkage allows for all the parties to know which package is stored in which locker and providing valuable real time information to the user via the mobile application, and also increasing the effectiveness of package delivery process for the great benefit of delivery company.
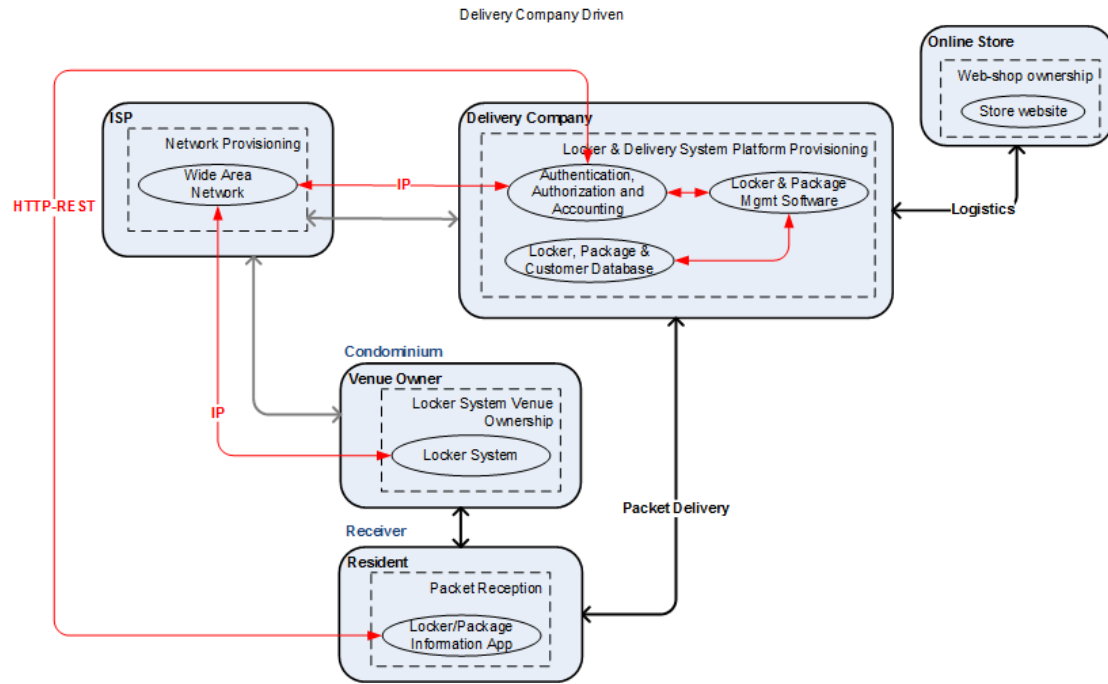
Figure 6: Main VNC, Locking Company Driven

Third main set of roles locate under the actors Venue Owner (Condominium is used for clarifying the target group with blue color) and Resident (receiver or the package living in the apartment building). As explained, the Condominium is the main target group for acquiring the locker system for the use of the building community, and individual people are the ones to be receiving packets with the use of the lockers. The Residents would be in paying to the Venue Owner for having an individual own locker or a permission to use a part of the locker system, as a monthly fee or then by per use payment. The pricing methods would be wise to be decided in the Condominium's administration, as there are likely multiple types of user profiles using the same locker system.

The role of ISP is to provide the needed Internet connection for the locker systems to be remotely accessible and able to communicate across the locations. In that sense the ISP doesn't possess key role in the case service itself and the regarding business interfaces are greyed out as they partially already exist in providing general Internet access to buildings and the case companies. In a same way, the Online Store is not in the centre of the service, but acts as the starting point of the packet delivery process,

18

so being an entity that is beneficial to be included in the VNC for understanding the whole business ecosystem and main parties taking part into the value network. In recent years, some Online Stores have gotten a strong position in the markets of Internet, who might have a special effect on how the deliveries are arranged and where the boundaries of packet, customer and delivery information are placed. Still in the general case and assumption for the study in this report, each online store uses outsourced delivery services instead of providing their own delivery with the purchase transaction.
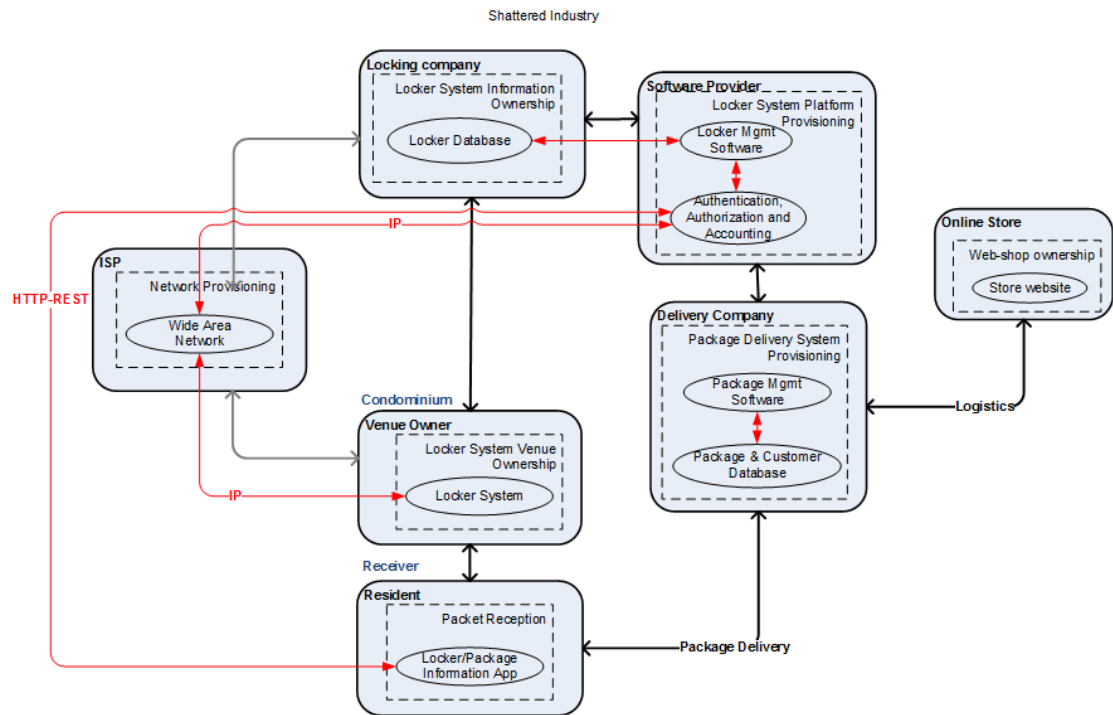
The second constructed VNC "Delivery Company Driven" (figure 7) is a modification of the raised platform thinking thereby resulting in changes in the technical architecture and business logic. It combines the control of the platforms and information under one individual actor instead of two like in the main VNC. This would diminish the importance of the actor Locking Company to be involved in the value network, as it would only be needed in providing materials and manufacturing the locker systems. The likelihood of the second VNC is due to that in fact it would mean the different delivery companies being represented as one actor in the figure 7, and resulting in competing delivery companies each providing their own platform for managing the information of lockers and packet deliveries. Although what is needed to be noted, that the locker systems are likely to be manufactured and designed by a third party, but the software platforms are in central role running the business, thereby being the main ingredient visible in the VNC and business case model. This architecture also makes it easier for one company to handle the information flow between lockers, packages and customers, as they likely reside under the same infrastructure system.

Figure 7: Second VNC, Delivery Company Driven

The third VNC "Shattered Industry" describes (figure 8) the possible value network where each of the technical components are separated in a most meaningful way possible, having each sub-part of the whole technical architecture located under different role, thereby making the value network more shattered. In this case it brings the Locking Company back to the picture for being in control of the information about the sparsely located locker systems over the country, and providing that information to a third party, the Software Provider, who is in responsibility of implementing the Locker System Platform and running it under their premises / control. It remains reasonable for the delivery company's Package Delivery System to remain under the hold of the delivery company as each of them already have such system in their use. The API to Locker System Platform served by the Service Provider still allows the delivery company to use the information provided by Locker System Platform to increase the effectiveness of the delivery process in a same way that was seen in the main VNC. The Shattered Industry model describes the entrance of software development focused parties to provide their deep expertise on system implementations giving the other actors more space on focusing on their own areas of expertise and to sidestep the risk of a failure in expensive software development project. This logic opens a wide space for competition on the software development and provider side, and also naturally putting the centre of the VNC on their role.

20

Figure 8: Second VNC, Delivery Company Driven

6. STOF Model

In this section, we discuss the Last Mile problem in the light of STOF model going through the four business domains in more details analyzing the critical design issues and critical success factors. STOF model helps to design a feasible business model that describes how to create deliver and capture value and visualizes an image about how the company fits in within a network of partners.

6.1 Service Domain

The origin of the low successful rate in package deliveries is due to lack of communication between delivery company and the customer. With our service, we wanted to improve the success rate of deliveries. We designed the service with two main goals in mind; reliable package delivery system and smart locking mailboxes. The main challenges were how the service could be designed to solve the problem efficiently and how to create demand for the newly designed service. Answering the first question we developed an idea of database system that would be run on the cloud for all smart lockers and their users, keeping users buying records and preferences. We also designed a monitoring and tracking system that would track packages from the sources untill end user. This way we can make sure that package deliveries won't fail, and in a case a failure would occur, it would be possible to see whether the failure happened in the lockers or in the delivery. We designed a penalty system punishing the party responsible for misdelivery (locking or delivery company) to ensure a high quality of the service. To create a demand for our new service we decided to narrow down our scope and focus upon higher demand areas and found condominiums to fit best. Before going out to public, condominiums are good candidates to trial the the intelligent boxes for several reasons: we can ensure a good number of users in a controlled environment, we don't have to pay additional cost for the place hosting the boxes, we minimize security issues from strangers trying to access the locker and maximize the locker safety (inside the hall of the condominium). We also designed adjustable locker sizes according to end user needs (dynamic lockers), while also allowing flexible ownership methods as owning a locker or renting an access to a dynamic locker for a period of time.

This is all done by considering the customer added value, because we are targeting the end users mainly. So we defined our target group to be online shoppers and designed

our service to fit perfectly with their life style. We designed a portal (application/website) for end users to keep track of their packages and to avoid the issue of unattended delivery. Users can also keep record of their online purchases and get promos and advertisements specifically to their needs, this all creates interaction and traffic on the portal adding value to our service and making a room for selling ads which is another possibility to make profit. In addition, security is one of the critical aspects that must be considered in Last Mile to earn the customer trust. This is done by providing a locked package storage that is secured with digital authentication. Moreover, we implemented the idea of expiry codes which can be used only once. These codes can be given to deliverers to ensure more security also can be given by locker users/owners to third parties to give them permission to open the locker in case they are not available.

6.2 Technology Domain

The technical architecture of the service is essential to support the intended value. Our service is mainly depending on connectivity as a technological prime factor. Standalone lockers are becoming history in nowadays technology and so our design mainly focused on connected locker system where Abloy could be connected to all of its lockers. This gives Abloy the upper hand in the value network configuration where it could sell the access to the locker systems to different delivery companies creating competition between companies and increasing profit. Abloy can also keep its relationship close with its customers and not to lose them to the delivery companies. This could be accomplished by utilizing Cloud system implementation, from cloud service providers such as Amazon and Akamai. The locker system may also include management platform, monitoring software, locker database and the Authentication, Authorization and Accounting as explained above in the Value Network Configuration. we proposed that the authentication and access to locker system should be a software extension to the already existing package management software and user database that exists in most delivery companies. This would make it more light weighted and simple while being robust and rich in features. HTTP-REST protocols are used for the connection between Abloy and delivery companies. End-users have their own Information application to track their package and could be secure using HTTPS (SSL). Next important technological aspect is system integration, since there are many parties involved in the package delivery the system must be well

synchronized and so we proposed a near real time synchronized system between Abloy and the delivery companies so not to lose track of the package. This feature is accompanied with user software application where the user can also keep track of the anticipated package.

Last and most critical aspect in the technology domain is security, as security can be achieved on many levels. Staring from securing the physical lockers inside the buildings as mentioned in the service domain. Added to that, securing access to the lockers which is mainly provided by Abloy as it would only give temporary or real-time permission to delivery companies to deliver the package but not long access capabilities. Expiry codes can be given by Abloy to third parties for occasional access as maintenance or by the locker owner if he/she wish for someone else to access the locker in case of unviability or absence. Online security is to be provided to user application.

6.3 Organization Domain

Organization domain is not of less importance if not more than previous domains. Since it is a newly designed service which has different key players with different player's roles the selection of partners and division of roles is the first riddle to solve. Our long-term goal is a standard-based agreement between Abloy and delivery companies in which specific standards of delivery and service level is agreed upon. All companies whom can provide such standards are encouraged to join so we can raise competition and increase quality of service level. On the time being starting with this step is not practical as the service is still new to the market so rather we planned to start with only one delivery company. Making clear agreements on division of roles and profitability of each partner. Also, service level agreements and arrangements must be issued at the early beginning to protect partners right and as we mentioned above in the service domain there would be penalty on the undegraded service from any of the partners. As we are planning to move into a more complex network as more delivery companies are to join, our plan is to make simple and modifiable platform that allow ease of access with minimum complexity in which we can build on for later stages.

6.4 Finance Domain

Finance domain best described as a coin which has two sides cost and profit, but this is not the whole story as we must carefully balance our cost and profit on the shoulders of the price the customer pays and the value he/she perceives. Starting from the organization point of view, we planned short to medium partnership contracts time-range to decrease any losses in case of bad partnership. Moreover, we planned division of costs and revenues between partners same as in organization domain. This is achieved by agreed contracts to secure profitability of each partner based on role and investment. We have narrowed down and listed revenue sources, these revenues come from selling software interface access with API's (Application Programming Interface) to delivery companies, selling and installing lockers and locker systems, fees that come from delivering the package. Finally, the advertisement space where more revenue could be added by tracking the end-user's orders and checking out the most interesting shopping places for the user. Selling online user activity to advertisements is a growing business in today's cyber world.

From the customer point of view, we planned an acceptable price for the user by creating an option of bundled prices for both delivery and box systems. In addition customer are free to choose between different offers of buying or renting the locker system with different prices for different time ranges. We introduced the idea of the dynamic boxes which gives the user plenty of room to increase or decrease his locker size according to its needs and not permanently but dynamically. We also added the standby lockers in case of urgent needs or rare usage.

7. Conclusions

The solution we proposed to the Last Mile problem case can be simplified into three main steps. Starting with the urge for change in package delivery systems to be able to cope with the fast-growing people needs in 21 century. we developed a connected package delivery system to eliminate any loss of communication throughout the delivery journey. We introduced a more flexible solution than the older system through expiry codes, adjustable boxes and new ways for owning/renting. We connected the box systems to the outer world through internet application which opens a new market for shopping and advertisement.

With the help of Intelligent Locking and Package Delivery Service, the delivery success rate can be improved dramatically, from 33% to almost 100%, and also the customer experience is much better as the customer will receive the packet at once, easily and conveniently. The delivery companies will have more time to deliver as they don't need to return for the same customer several times and they are not forced to plan the delivery routes according to any limitations from user availability side.

The hardest issues lie in taking the risk on first investing to all the technical parts needed for implementing the service and then finding the right way of bringing it out to the public. It can be seen safe to start focusing to the condominiums as the main target group and finding the most suitable pricing models for the bundled or separate services of intelligent locker systems and ensured package deliveries. What is certain, that there is a space and coming need of the service in future, which can be currently seen also in Finland as a set of new developing solution trying to fill this business area. Still those actions have remained careful as we are living the early stages of the case service.

Assa Abloy has consciously taken the challenge on entering the smart package delivery business and will likely be facing a hard competition on this region.

Our solution approach especially "Locking company driven VNC" was a surprise to the Abloy company as they never imagined a way for their company to take the leading role in this business rather imagined themselves as third parties.

The most important fact is that there are multiple roles filling the overall value network, making it essential to stay up-to date on the progress of rivals and collaborating parties in the industry, and trying to find strong position most suitable to their expertise and secure their need in future as well. It seems some parties are already ahead of depending on the region globally, but starting a collaboration on the business with their strong background focusing more on the technical parts of the locker systems would seem as a logical direction for Abloy to investigate on.

7.1 Recommendations

The mobile application working as a part of the service will be in key role for the customer satisfactory with also naturally having a working locker system solution. This is what user cares the most after the succeeded package delivery, how is the usability in receiving packets and using the locker system. The more valuable information it provides, the more important it is perceived and customer base will start growing.

We recommend on making a research on the industry on global scope as well as in Finland. This probably has already been done, but scanning the key players in this domain is essential on being able to acknowledge the possibilities with or against each party. In addition to the players, also the solution alike should be analysed thoroughly for seeing which methods are effective and how those could be brought into this case.

From the locker system side, the good level of usability consists of easy and modern access methods (expiry pin code, digital authentication through the application). These methods will and should provide means in ensuring the access for right persons and ensure a level of security which is felt safe for the user.

The service should be open for taking more parties in from the locking company side on the case of the main VNC, as it tries to acquire the dominant position in providing the locker systems.

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Feedback for the course

The workload in the course was very well aligned to the amount of credits (5). Both in general the amount of load in project work was comfortable, no need to be changed, and the material which needed to be provided as results was also reasonably. At first starting with the idea of having just introductory and concise lectures discussing the theory with also being prepared with reading the material was a solid basis for starting the work with methods and used just enough time resources not taking it away from actual project work.

The course schedule was good, it was nice that there was enough time between the presentation sessions, but on the other hand the schedule wasn't too loose. The presentation sessions were sometimes very long and tiring. It would have been good to have a bit longer break in between of the presentations. It was also good that there was the exam in the beginning of the course so that the team members knew all the important methods that were used on the course.

The methods used were perfectly fitting, starting from the theoretical part that clarify what are the methods and how they are used. Second practically implementing those methods was not as easy as we imagined, it took long time to adjust. The thing that was challenging is that there was no right or wrong answer and whenever we asked questions thinking we will get straight answer we were getting back a further deeper question. Only after a several weeks it was understood that the process is iterative even when moving from one method to another, so it would be valuable to emphasize on trying to keep this in mind from the very beginning.

If the course had more money, maybe it would be more beneficial for students inviting more companies to present their business view, ideas about the current business and how it should be developed from their point of view.